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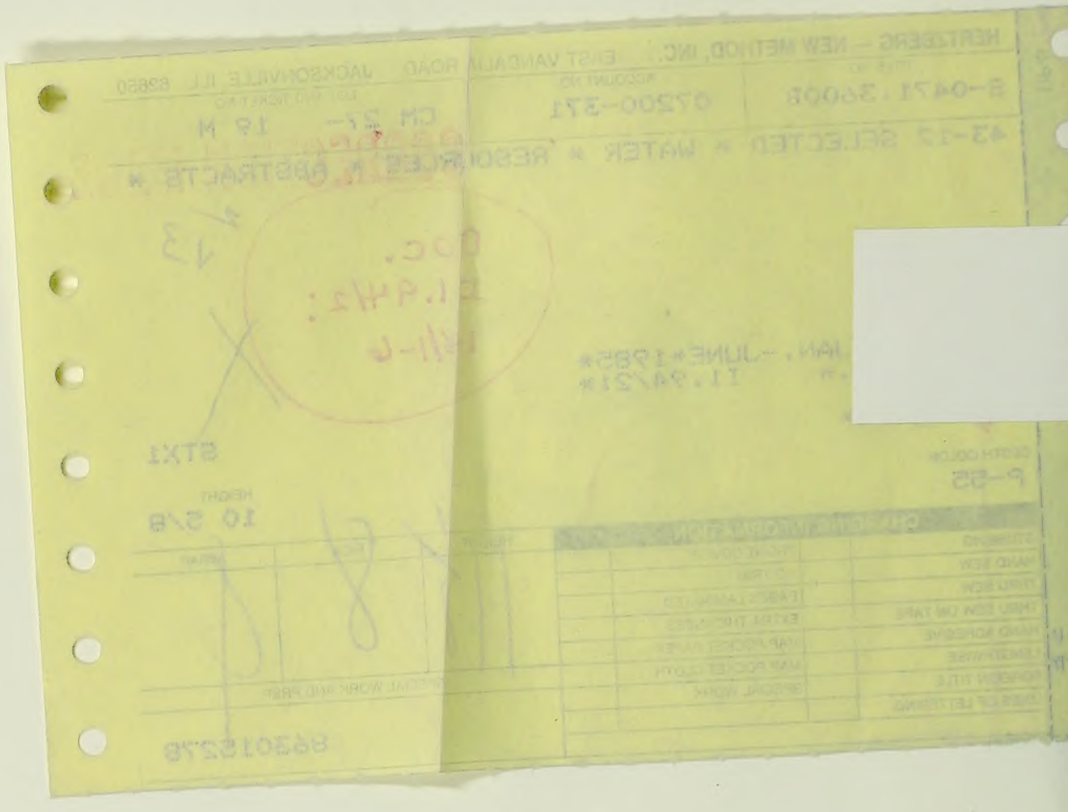

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SELECTED WATER RESOURCES ABSTRACTS

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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 18, NUMBER 1
JANUARY 1985

W85-00001 -- W85-00507

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1985.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

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01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

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10 SCIENTIFIC AND TECHNICAL INFORMATION

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

ANALYSIS OF CILIATA FROM POLLUTED SECTOR OF THE RIVER DRWINKA ON THE BASIS OF BINARY DATA,
Jagiellonian Univ., Krakow (Poland). Dept. of Hydrobiology.
K. Wiakowski.
Acta Hydrobiologica, Vol. 23, No. 4, p 319-329, 1981. 6 Fig, 2 Tab, 10 Ref.

Descriptors: *River Drwinka, *Poland, *Water pollution effects, *Protozoa, Population dynamics, Species diversity, Water quality, Bioindicators.

In the course of two seasons (1978 and 1979) 68 samples were collected in the polluted sector of the river Drwinka. The Ciliata fauna was distinctly differentiated in a linear way, in agreement with the pollution gradient. The food spectrum of Ciliata also changes at particular sampling stations in a linear way. A gradually decreasing participation of bacteriophagous forms at a concomitant increase in participation of species feeding on algae. Among the species characteristic of the most polluted station, 1, were: Metopus es, M. contortus, Plagiopyla nasuta, Caenomorphia medusula, and Colpidium campylum, C. colpoda, Paramecium aurelia. The species composition was similar at station 2, but new species included Loxocephalus luridus, Stentor coeruleus, and Litonotus lamella. The next two stations, 3 and 4, are characterized by the highest diversity of Ciliata in the given sector of the river. The last two stations, 5 and 6, are characterized by a smaller number of species. On the basis of the differentiation, three zones of river purity were distinguished: a highly polluted zone from Niepolomice to station 3, a zone of transitory character at station 4, and a relatively clean zone at 5 and 6. An attempt has been made to determine quantitatively the pollution degree based on the indicator values of Ciliata. Differentiation in the species composition of Ciliata was closely correlated with the self-purification process ocurring at the sampling site. (Baker-IVI)
W85-00223

2A. General

APPLICATION OF LANDSAT IMAGERY TO FLOOD STUDIES IN THE REMOTE NAHANNI KARST, NORTHWEST TERRITORIES, CANADA,
Georgia Univ., Athens. Dept. of Geography.
G. A. Brook.
Journal of Hydrology, Vol. 61, No. 1-3, p 305-324, February, 1983. 5 Fig, 4 Tab, 8 Ref. NASA grant NSG 7539.

Descriptors: *Northwest Territories, *LANDSAT, *Nahanni karst, *Karst hydrology, Remote sensing, Satellite technology, Infrared imagery, Subarctic zone, Groundwater movement, Hydrology, Snowmelt, Poljes, Flooding, Ponors, Freezing.

LANDSAT imagery has provided important new data about the spectacular hydrology of the Nahanni north karst, one of the most complex subarctic karst landscapes known. Near-infrared band-6 (700-800 nm) and band-7 (800-1100 nm) LANDSAT images are the most suitable for hydrologic investigations. Images have revealed that prior to spring snowmelt the three poljes and other depressions in the north karst are dry. This suggests that water remaining in depressions in October, when lakes freeze over, drains underground before the following spring. When snow and ice melts in May, several depressions flood because their ponor systems are blocked by ice. Spring snowmelt is not a major hydrologic event of the year; the most intense hydrologic activity results from heavy rainfall in the months June-August. Nahanni depressions flood when there is above-average rainfall in one of these months. In years with no unusually high monthly precipitation, depressions may remain dry or suffer only minor inundation. Continuation of the LANDSAT program of earth resource data acquisition provides a means of monitoring hydrologic conditions in the north karst in the future. (Collier-IVI)
W84-00024

KARST HYDROGEOLOGY WITHIN A SUBARCTIC PEATLAND: ATTAWAPISKAT RIVER, HUDSON BAY LOWLAND, CANADA,
Canada Centre for Inland Waters, Burlington (Ontario).
D. W. Cowell.
Journal of Hydrology, Vol. 61, No. 1-3, p 169-175, February, 1983. 3 Fig, 3 Ref.

Descriptors: *Attawapiskat River, *Ontario, *Geohydrology, *Groundwater movement, *Karstification, *Peatlands, Bogs, Wetlands, Dolines, Intermittent lakes, Sinks.

The Attawapiskat River cut through 30 m of mid-Silurian limestone approximately 90 km west of James Bay in the Hudson Bay Lowland. Limestone cliffs of 12-15 m provide local relief along the river but inland the terrain is flat, covered by 1.5 m or more of peat. The area emerged from the Tyrrell Sea approximately 4400 yr. B.P. Since that time two karst hydrogeological zones have become established: a vadose fluvio-karst zone in the exposed limestone along the river represented by disappearing lakes and streams; and an organo-karst zone represented by sinkholes on or next to limestone bioherms within the peat mantle. They occupy 16% and 13% of the study area, respectively. Organo-karst features are expected to expand at the expense of the peatland. Three karst morphologies have evolved. The first morphology occurs where the top of the knoll is higher than the surrounding bog; dolines, often with intermittent ponds or small lakes form at the edge of the reef. The second morphology occurs where the reef surface is at the same elevation as the surrounding peatland; the bog may encroach onto the reef. The third morphology develops where the reef surface is lower than the surrounding peatland; the bog may drain into the reef. (Collier-IVI)
W85-00012

EVALUATION AND DESIGN OF A STREAMFLOW-DATA NETWORK FOR CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 7A.
W85-00052

GEOMORPHIC APPROACH TO HYDROGRAPH SYNTHESIS, WITH POTENTIAL FOR APPLICATION TO UNGAGED WATERSHEDS,
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
V. P. Singh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 190115, Price codes: A06 in paper copy, A01 in microfiche. Completion Report, June, 1983. 97 p, 27 Fig, 5 Tab, 32 Ref. OWRT Project No. A-058-LA (1), Contract/Grant No. 14-34-0001-2120.

Descriptors: Hydrologic modelling, Stream flow synthesis, Ungaged basins, *Hydrographs, *Ungaged watersheds, Watersheds.

A conceptual approach, based on the work of Gupta, Waymire and Wang (1980), is developed for synthesis of the instantaneous unit hydrograph (IUH) by employing basin geomorphology. This IUH is then employed in convolution for synthesis of the direct runoff due to a rainfall event. Because the approach contains parameters which can be determined from geomorphology, it is potentially applicable to ungaged basins. A computer model, designated as GMHS, is developed using this approach for hydrograph synthesis. The model is verified on five small agricultural watersheds. The model results compare as well with observations in light of accuracy of the parameters and data.
W85-00069

VARIATION OF MODEL PARAMETER VALUES AND SENSITIVITY WITH TYPE OF OBJECTIVE FUNCTION,
Nigeria Univ., Nsukka. Dept. of Geography.
F. T. Sefe, and W. C. Boughton.
Journal of Hydrology, Vol. 21, No. 2, p 117-132, 1982. 3 Fig, 6 Tab, 16 Ref.

Descriptors: *Optimization, *Model studies, Catchments, Boughton Model, Australia, Sensitivity, Lumped parameter model.

A comparative study was made of ten objective functions used in optimizing an updated version of the Boughton Model (Boughton and Simpson, 1978: An Index Model for Catchment Hydrology. AES Working Paper 1/78, Griffith Univ., Nathan, Queensland) so as to determine how the optimized parameter values varied with type of objective function. Optimum parameter sets obtained for a lumped-parameter model were shown to vary with type of objective function used in the optimization. Moreover, all the parameters need not vary. Owing to interdependence and compensatory nature of the model parameters, only a few parameters need vary to produce a distinct optimum parameter set. Similarly, parameter sensitivity varied with type of objective function if the parameters were considered individually. When the parameters were considered in groups according to type of objective functions, the variation in sensitivity values proved insignificant. (Baker-IVI)
W85-00180

DRAINAGE DENSITY VARIABILITY AND DRAINAGE BASIN OUTPUTS,
Australian National Univ., Canberra. Centre for Resource and Environmental Studies.
D. G. Day.
Journal of Hydrology, Vol. 22, No. 1, p 3-17, 1983. 6 Fig, 4 Tab, 33 Ref.

Descriptors: *Drainage basins, *Drainage density, *New South Wales, *Australia, Suspended sediments, Dissolved solids, Rainfall, Rainfall-runoff relationship, Catchment areas, Prediction.

Relationships between the drainage density of channelled flow and stream discharge, suspended sediment, and total dissolved solids were examined during rainfall events for two New England (NSW, Australia) catchments on granite and greywacke. Detailed observations were made on the two catchments. The drainage density of flow was measured as it fluctuated over rainfall events in a 16 month period. Such network changes were related to variability in stream discharge and dissolved solid concentrations for all storms, with higher correlations between these hydrologic variables for individual storms. For the catchments, drainage density can be used as a predictor of discharge. Data pooled for each catchment revealed that there are major differences in the runoff response which can be partly attributed to distinctive morphological differences between the catchments, specifically by contrasting densities of channel networks due to basic lithological and pedological differences. Rapid expansion and contraction of the flowing stream network exerts a dominant control on drainage basin outputs. (Baker-IVI)
W85-00183

LUMPED PARAMETER MODEL OF A CHALK AQUIFER-STREAM SYSTEM IN HAMPSHIRE, UNITED KINGDOM,
Southern Water Authority, Eastleigh (England).
T. Keating.
Ground Water, Vol. 20, No. 4, p 430-436, July-August, 1982. 4 Fig, 13 Ref.

Descriptors: *Hampshire, *England, *Surface-groundwater relationships, *Chalk aquifers, Mathematical models, Transmissivity, Storativity, Aquifers, Stream discharge.

The Chalk aquifer in the Candover area of the Hampshire Downs in southern England has a thin, highly transmissive and storative zone in the vicinity of the water table. Attempts to model the aquifer-stream system in the Candover catchment using a conventional two-dimensional mathematical model with discrete parameters at each grid inter-

section failed because values of storativity in excess of 5% were required to reproduce the observed low groundwater fluctuations while values of 1% were required to simulate stream flows. A lumped parameter model of the aquifer-stream system incorporating a variable transmissivity and storativity distribution has been developed to explain the unusual hydrogeological features of the catchment. The model represents the aquifer as a two-layer system, with the upper layer representing the zone of fluctuation of the water table and consequently having a relatively high storativity (5%) and transmissivity (100,000 sq m/d) and a lower layer representing the main zone of the aquifer with parameters typical of those observed in test pumpings (storativity of 1% and transmissivity of 1,000 sq m/d). The model predicts both observed spring flows and groundwater levels simultaneously, and the decline of computed net gains following the onset of recharge. In practice, the variation of parameters between the upper and lower zones of the aquifer must be continuous. (Moore-IVI)
W85-00323

2B. Precipitation

RESOURCES OF THE TUG HILL REGION,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
For primary bibliographic entry see Field 6D.
W85-00044

PROBABLE MAXIMUM PRECIPITATION AND SNOWMELT CRITERIA FOR SOUTHEAST ALASKA,
National Weather Service, Silver Spring, MD. Office of Hydrology.
For primary bibliographic entry see Field 2C.
W85-00056

MOVING AVERAGES AND CYCLIC PATTERNS,
Oregon State Univ., Corvallis. School of Forestry.
R. L. Beschta.
Journal of Hydrology, Vol. 2l, No.2, p 148-151, 1982. 3 Fig, 6 Ref.

Descriptors: *Hydrologic models, *Precipitation, *Time series analysis, Correlation analysis, Autocorrelation, Mathematical studies.

An example is provided using annual precipitation data to illustrate how the combination of moving averages and autocorrelation techniques can be used to identify possible periodicities for hydrological time series problems. The annual precipitation averages 1032 mm at the Mt. Torlesse rainfall station with a standard deviation of 175 mm. Coefficients of skewness and kurtosis for annual totals are -0.2 and 2.9 respectively. Regressing annual precipitation with time (in years) indicates no long term trend in the data. Thus the time series appears to be stationary and normally distributed. There is a high degree of variability throughout the 73 year record period. Even with the smoothing time series method the occurrence of a definite periodic component remains somewhat obscure. Autocorrelation of the annual precipitation data indicates that little dependency and periodicity apparently exist in this time series and suggests annual precipitation amounts are almost entirely independent from one year to the next. Correlograms developed from the 3, 5, 7, and 9 year moving averages provide a somewhat different result. Several cyclic components are found in the annual precipitation records at the station, with an 18 year cycle being the most pronounced. (Baker-IVI)
W85-00182

IMPACT OF THE DROUGHT IN NATAL/KWAZULU,
Natal Univ., Pietermaritzburg (South Africa). Inst. of Natural Resources.
J. M. Erskine.
South African Journal of Science, Vol. 79, No. 11, p 439-440, December, 1983.

Descriptors: *Drought, *Natal, *KwaZulu, *South Africa, Planning, Water resources development, Groundwater, Seasonal variation, Grazing, Crop production.

An agricultural drought has two variations. Firstly, a seasonal drought is a regular and predictable event which is limited to a single growing season during which poor rainfall distribution or low total rainfall results in reduced grazing and crop production. Secondly, a disaster drought, in agricultural terms, is a farming situation where, owing to subnormal rainfall, there is a very substantial loss of crops and grazing over one or more growing seasons. While the rainfall over much of Natal/KwaZulu during the 1982-83 normal rainy season was more than 35% below the average, and was in itself enough to create a disaster drought situation, the real problem was that this very dry season was preceded by very dry seasons in the three previous years. The coincidental occurrence of both an agricultural drought and a water resources drought had serious repercussions on the people and resources. The consequence this last season was a total failure of all crops in many areas and many livestock deaths due to poor grazing. The water resources drought has caused many springs and some bore holes that normally provide water right through the dry winter months to dry up due to the drop in the underground water table. It is not possible to predict when good rains can be expected. The planning and preparation for the expected dry season was probably adequate regarding the surface water reserves. Where the inadequacy arose was on the part of the plans for the development of groundwater resources. There has been no coordinated planning of groundwater use in South Africa similar to that carried out in many other parts of the world. (Baker-IVI)
W85-00214

DROUGHT STRESS AND THE DEMISE OF ACACIA ALBIDA ALONG THE LOWER KUISEB RIVER, CENTRAL NAMIB DESERT: PRELIMINARY FINDINGS,
Natal Univ., Durban (South Africa). Dept. of Botany.
J. D. Ward, and C. M. Breen.
South African Journal of Science, Vol. 79, No. 11, p 444-447, December, 1983. 8 Fig, 1 Tab, 20 Ref.

Descriptors: *Drought stress, *Kuiseb River, *Namib Desert, *South-West Africa, *Acacia, Flooding, Water table, Groundwater recharge.

The Kuiseb River flooded annually past the Namib Desert Research Station at Gobabeb between 1961/62 and 1978/79. Since then, however, it has not flooded into the lower reaches and the Kuiseb water table in the Harubes-Scout River sector has dropped by more than 3 m. During this dry period a considerable number of large mature A. albida trees have collapsed and died. Daily changes in xylem pressure potential of A. albida and A. erioloba, collected near Gobabeb before and after the 1975-76 Kuiseb flood were investigated. It is probable that the prolonged Juiseb river flood of 1976, together with the unusually heavy rains that summer, had recharged the groundwater reserves in the river bed, at least in the vicinity of Gobabeb. It is also likely that those favorable soil moisture conditions persisted several months after the cessation in April of surface flow in the study site area. Localized stands of juvenile A. albida tress, mainly established after the prolonged flood of 1974 and good rains of 1976 have continued to grow and appear to be fluorishing. It is suggested that the roots of these quick-growing juvenile A. albida trees are able to follow the dropping water table, whereas those of the mature trees are not because of a relatively shallow rooting system established when the water table was relatively high. (Baker-IVI)
W85-00215

PRELIMINARY CALCULATIONS OF AVERAGE STORM DURATION AND SEASONAL PRECIPITATION RATES FOR THE NORTHEAST SECTOR OF THE UNITED STATES,
Battelle Pacific Northwest Labs., Richland, WA.
J. M. Thorp, and B. C. Scott.
Atmospheric Environment, Vol. 16, No. 7, p 1763-1774, 1982. 3 Fig, 9 Tab, 6 Ref. DOE contract DE-AC06-76RLO-1830.

Descriptors: *Precipitation rate, *Storm duration, *Seasonal variation, Storms, Temporal distribution, Rainfall rates.

Regional and seasonal averages of storm duration and precipitation rates are needed as input variables in models aimed at describing precipitation processes relating to acid rain and other problems. Hourly precipitation data for 77 first order weather stations were used to calculate the summer and winter regional average storm duration and average precipitation rates over the northeastern United States. Average storm duration for summer (June-July-August), and winter (December-January-February) seasons considered periods of up to three dry hours in summer storms, and up to 6 dry hours in winter storms to be part of the same storm. Thus, each storm consisted of one or more precipitation periods. The average precipitation event rates for summer and winter storms were calculated. By considering storm durations on an hourly basis, the 3-h summer storm was found to contribute the greatest fraction to total summer precipitation. Similarly, the 26-h winter storm was found to contribute the greatest fraction to winter precipitation. The summer storms typically consisted of one rain event lasting about three hours with rain rates averaging about 2.5 mm/h. The 25-h winter storm averaged about 3 precipitation periods (or rain bands). Each period lasted about seven hours and had an average precipitation of rate of 1.0 mm/h. (Author's abstract)
W85-00242

DIRECT ACQUISITION OF RAINFALL DATA ON SITE (SAISIE DIRECTE SUR LE SITE DE L'INFORMATION PLUVIOGRAPHIQUE),
Centre National de Machinisme Agricole du Genie Rural, des Eaux et des Forets, Paris (France).
For primary bibliographic entry see Field 7B.
W85-00388

DYNAMICS OF INTENSE RAINY SPELLS OVER THE SOUTH-EAST OF THE MASSIF CENTRAL - METEOROLOGICAL ASPECTS AND HYDROLOGICAL APPLICATIONS (DYNAMIQUE DES EPISODES PLUVIEUX INTENSES SUR LE SUD-EST DU MASSIF CENTRAL; ASPECTS METEOROLOGIQUES ET APPLICATIONS HYDROLOGIQUES),
Centre National de la Recherche Scientifique, Grenoble (France). Inst. de Mecanique de Grenoble.
P. Tourasse, and Ch. Obled.
Houille Blanche, Vol. 36, No. 7/8, p 559-568, 1981. 4 Fig, 1 Tab, 7 Ref.

Descriptors: *Masif Central, *France, *Rainfall distribution, Rainfall area, Rainstorms, Floods, Flood flow, Meteorological data collections, Hydrometeorology.

The whole south-eastern side of the Masif Central (in south-east France) is regularly subject, especially in August, to periods of intense rainfall which can cause violent and sometimes catastrophic floods in some basins. Data on all intense rainfall periods (approximately thirty different episodes) from 1970 to 1979 were compiled and analyzed, in hourly steps, using a network of 58 rainfall recording stations. Systematic plotting of the most interesting episodes revealed that during phases of high activity, rainfall had the very specific shape of a narrow rainy strip a few km wide and parallel to the topographic crest but located 20 km in front of it. The strip contains very intense nuclei within which rain frequently exceeds 50 mm an hour. These nuclei can cover a few dozen to a few hundred sq km. Joint analysis of hourly rainfall graphs and the concominant meteorological fields has allowed for better understanding of the phenomenon, as well as the relationships which can exist between the main synoptic factors (intensity of flow, position of the front, etc.) and the organization of the rainfall field. The rainfall drip developing over the mountainside did not usually move systematically in a single direction, but the rainfall system, once organized, remained quite stable. Sharp variations in local intensity can be observed, associated with the magnitude of convective activ-

ity, making the phenomenon one of intermittent character. (Collier-IVI)
W85-00391

PRECIPITATION IN 6 MINUTES. FIRST EXAMINATION OF SEVERAL MONTHS OF RECORDINGS ON MAGNETIC CASSETTES (LES PRECIPITATIONS EN 6 MINUTES. PREMIER EXAMEN DE QUELQUES MOIS D'ENREGISTREMENT SUR CASSETTE MAGNETIQUE),
Electricite de France, Paris. Direction de la Production et du Transport.
P. Guillot, and D. Duband.
Houille Blanche, Vol. 36, No. 7/8, p 569-576, 1981. 5 Fig, 1 Tab.

Descriptors: *Automation, *France, *Rainfall distribution, Meteorological data collections, On-site data collections, Rainfall intensity, Computers.

The progressive installation of a cassette tape recorder in the 150 unit EDF network of rainfall recorders solves the problem of recording over a one to two month period in remote places. This also allows for the automation of computerized files on rainfall in six minute time steps. The knowledge of rainfall in such small time units permits: more thorough analysis of the Gradex hypothesis adopted for extreme rainfall conditions over a few hours or for a whole day; analysis of the influence of the chronological irregularity of showers on the instantaneous flow coefficient in the rainfall/flow relation; and measurement quality improvement by allowing for an intensity-linked adjustment to offset the inherent loss of the recorder. The information collected has possible application to the correlation diagram and the calculation of statistical distribution parameters. (Collier-IVI)
W85-00392

CLASSIFICATION OF DAILY, MONTHLY AND SEASONAL RAINFALL OVER FRANCE (TYPOLOGIE DES PRECIPITATIONS QUOTIDIENNES, MENSUELLES ET SAISONNIERES SUR LA FRANCE),
Meteorologie Nationale, Paris (France).
G. Der Megreditchian, A. De Billy, R. Foka, J. Y. Grosse, and M. C. Rulliere.
Houille Blanche, Vol. 36, No. 7/8, p 589-596, 1981. 5 Fig, 2 Tab, 6 Ref.

Descriptors: *France, *Rainfall distribution, Rainfall intensity, Precipitation rate, Meteorological data collections, Areal precipitation, Climate.

The Water Service of the National Meterological Agency has compiled a record of daily average precipitation by county covering approximately twenty years. A climatic description has been drawn up corresponding to the various scales. This climatic description has been used to produce sets of maps of the traditional parameters of a descriptive statistical analysis and a supplementary study of types of spatial distribution of precipitation. The types of map portraying the spatial distribution of rainfall have been studied over time. Homogeneous climatic zones as regards rainfall (regionalization) were then defined. (Author's abstract)
W85-00393

STATISTICAL REPRESENTATION OF THE ALTERNATION OF DRY AND RAINY SPELLS USING RAINFALL SERIES. APPLICATIONS AT MONTPELLIER-BEL AIR (1920-1971) AND PARIS-MONTSOURIS (1949-1978) (REPRESENTATION STATISTIQUE DES ALTERNANCES PLUIE-NON PLUIE A PARTIR DES SERIES PLUVIOGRAPHIQUES APPLICATIONS A MONTPELLIER-BELL AIR (1920-1971) ET PARIS-MONTSOURIS (1949-1978)),
Montpellier-2 Univ. (France).
J. M. Masson.
Houille Blanche, Vol. 36, No. 7/8, p 597-604, 1981. 6 Fig, 1 Tab, 6 Ref.

Descriptors: *France, *Montpellier, *Bel Air, *Paris, *Montsouris, *Statistical analysis, *Rainfall distribution, Simulation, Mathematical models, Temporal distribution, Rainstorms.

A succession of showers at individual stations were portrayed statistically using the shortest possible time interval. Two long rainfall series, Montpellier-Bel Air and Paris-Montsouris, were used. Rainfall series for discrete intervals of one-thousandth of a day and a tenth of a millimeter are represented by an alternating series of dry spells (Ds) and rainy spells (Rs), the latter being also characterized by continuous rainfall amount. The marginal distribution of rainfall amount is characterized by a high frequency of measurements lower than, or equal to a threshold (0.4 mm at Montpellier and 0.2 mm at Paris). The frequency distribution of dry spells is bimodal. The first mode corresponds to short dry spells between successive showers, and the second to much longer spells of true good weather. Rainfall amounts have been added over 24 consecutive hours to obtain results similar to a rainfall series in which successive rainy days have been accumulated. The observed and the simulated series can then be compared at the level of the first two moments of the variables characterizing a daily rainfall model: length in days of dry and rainy spells and the corresponding amount of the latter. The comparison can also be made using monthly totals. The first simulation shows reasonably satisfactory results, except for the standard deviation of length of dry spells (over-estimated) and heights during rainy spells (under-estimated). (Collier-IVI)
W85-00394

2C. Snow, Ice, and Frost

NISQUALLY GLACIER, MOUNT RAINIER, WASHINGTON, 1857-1979: A SUMMARY OF THE LONG-TERM OBSERVATIONS AND A COMPREHENSIVE BIBLIOGRAPHY,
Geological Survey, Tacoma, WA. Water Resources Div.
C. C. Heliker, A. Johnson, and S. M. Hodge.
USGS Open-file Report 83-541, 1984. 20 p, 4 Fig, 5 Tab, 84 Ref.

Descriptors: Glacier fluctuation, *Nisqually Glacier, *Washington, *Mount Ranier, *Bibliography, *Data collection.

Nisqually Glacier on Mount Ranier, Washington has a long record of terminus position observations and ice-surface altitude measurements along specific profiles, and has been the topic of numerous scientific studies. From the earliest observations in 1857 to the present many individuals and several different organizations have been involved in data collection at Nisqually Glacier. In order to preserve the long-term data, it was assembled and reduced to a standard format for this report. A comprehensive bibliography of scientific publications relating to the glacier is included. Between 1857 and 1979, Nisqually Glacier receded a total of 1,945 meters and advanced a total of 294 meters. Advances occurred from 1963-68 and from 1974-79. Ice-surface altitude changes of as much as 25 meters occurred between 1944 and 1955. (USGS)
W85-00039

PROBABLE MAXIMUM PRECIPITATION AND SNOWMELT CRITERIA FOR SOUTHEAST ALASKA,
National Weather Service, Silver Spring, MD. Office of Hydrology.
F. K. Schwartz, and J. F. Miller.
Hydrometeorological Report, No. 54, September 1983. 114 p, 43 Fig, 23 Tab, 26 Ref, 1 Append.

Descriptors: *Probable maximum precipitation, *Orographic precipitation, *Snowmelt, *Rainstorms, *Thaw, *Precipitation, Stream discharge, Streamflow, Data collection, Hydrologic data collection, Dewpoint, *Alaska.

Over a considerable span of time, numerous estimates of probable maximum precipitation (PMP) for Alaska have been made for individual basins. Generalized all-seasons PMP values were developed, and Spring and early Summer PMP estimates were given. Two factors to be considered were the complicated topography of the region, and the sparsity of daily or hourly precipitation measurements. Data are nearly nonexistent for the 70% of the basins which is above 500 feet. Annual streamflow data were combined with available precipitation data to develop a mean annual precipitation (MAP) chart. This along with analysis of small glaciers and snowpack-accumulation season was used as guidance to delineation of generalized PMP estimates. An approximation of generalized PMP was developed first from the relations between storm precipitation and PMP in the Northwest States region, and then adjusted by a variety of techniques to provide the basic 24-hour, 10-square-mile PMP map. In general, uniform distribution of PMP is suggested for PMP over basins in Southeast Alaska. However, where fixed significant control of orography exists, it is recommended that the user distribute the PMP in line with such orographic control. A summary of maximum daily rains of record for 49 stations is given, and generalized estimates of snowpack and other snowmelt criteria including temperatures, dew points, and winds is provided. (Garrison-Omniplan)
W85-00056

CHARACTERISTICS OF SNOWFALLS, SNOW METAMORPHISM, AND SNOWPACK STRUCTURE WITH IMPLICATIONS FOR AVALANCHING, CRAIGIEBURN RANGE, NEW ZEALAND,
National Hydrology Research Inst., Ottawa (Ontario).
T. D. Prowse, and I. F. Owens.
Arctic and Alpine Research, Vol. 16, No. 1, p 107-118, February, 1984. 6 Fig, 4 Tab, 53 Ref.

Descriptors: *Climates, *Snowfall, *Snowpack, *Craigieburn Range, *New Zealand, *Avalanches, Maritime climates, Temperature gradient, Storms, Snowmelt, Freezing.

Many of the characteristics of snowfall and snowpack structure in the Craigieburn Range are typical of both maritime and continental climates. While most snowfalls are generally low intensity, small magnitude events as found in continental regions, there is on the average one storm per year which produces snow at such a rate and amount as to pose a direct action avalanche hazard. Strong windspeeds are also a common feature of the area and may create both soft and hard slab avalanches. While both storm and long term air temperatures are relatively warm, typical of maritime climates, temperature gradient metamorphism, a process commonly associated with but not restricted to cold continental areas, was shown to be prevalent in the basal layers of the snowpack. Ice crusts produced by mid-winter warming and rain events appear to play an important role in temperature gradient metamorphism and the production of depth hoar crystals. Equitemperature metamorphism is the dominant process in the Craigieburn snowpack but temperature gradient and melt freeze metamorphism are also important, the latter resulting from mid-winter rain and melt events. In general, maritime climates are characterized by direct action avalanching resulting from large inputs of snow while in continental climates, where snowfalls are relatively small, structural weaknesses create a considerable potential for climax avalanching. The findings of this study are particular to the primarily leeward locations of the Craigieburn Range. Because of the strong regional variations in alpine climate, which although not accurately quantified, are known to exist in New Zealand, any inter-regional extrapolation of these results must be conducted extremely circumspectly. (Baker-IVI)
W85-00113

INFLUENCE OF NON-UNIFORM TEMPERATURE DISTRIBUTION ON THE STEADY MOTION OF ICE SHEETS,
University of East Anglia, Norwich (England). School of Mathematics and Physics.
L. W. Morland, and G. D. Smith.
Journal of Fluid Mechanics, Vol. 140, p 113-133, March, 1984. 7 Fig, 1 Tab, 14 Ref. NERC grant GR3/4114.

Descriptors: *Ice sheets, *Glaciers, *Temperature gradient, Ice properties, Ablation, Ice temperature,

Plane steady flow, Viscous rate factor, Mathematical equations.

Large ice sheets have significant temperature variation with depth, with melting or near-melting temperatures in some basal regions to colder temperatures at the surface but more modest temperature gradients over their much greater spans. The plane steady flow of a grounded ice sheet is analyzed under the assumption that the ice behaves as a nonlinearly viscous fluid with a strongly temperature-dependent rate factor. The accumulation/ablation distribution on the (unknown) free surface is prescribed, and there is a given basal sliding condition connecting the tangential velocity, tangential traction and normal pressure. The basal boundary is the smooth contour which describes the mean topography viewed on the ice-sheet lengthscale, and is assumed to have small slope. Perturbation analysis is extended to the non-isothermal problem when the temperature distribution is prescribed. The thermomechanically coupled energy balance is not solved, but families of temperature distributions qualitatively compatible with observed patterns are adopted to exhibit the effects of significant creep-rate variation with temperature. There is no optimum mean temperature for which the isothermal solution approximates satisfactorily to solutions for even simple temperature patterns varying only with depth. (Collier-IVI)
W85-00173

ENERGY BALANCE OVER MELTING SNOW, CRAIGIEBURN RANGE, NEW ZEALAND,
National Hydrology Research Inst., Ottawa (Ontario).
T. D. Prowse, and I. F. Owens.
Journal of Hydrology, Vol. 21, No. 2, p 133-147, 1982. 5 Fig, 5 Tab, 44 Ref.

Descriptors: *Energy balance, *Snowmelt, *New Zealand, *Craigieburn Range, Heat flow, Net radiation, Humidity, Wind, Rainfall.

The energy balance method was applied to periods of spring snowmelt in the Craigieburn Range, New Zealand to assess the relative importance of the individual heat flow components during both long-term and intense periods of seasonal snowmelt. During spring snowmelt, sensible heat is the major source of energy to the snowpack, contributing approximately sixty percent of the total heat supply. Above average air temperatures and windspeeds, typical of northwesterly airstreams, are primarily responsible for the dominating influence of the sensible heat flux. Over the long term, daily inputs of sensible heat under such north-westerly conditions are similar in magnitude to those reported for Chinooks in Canada. Net radiation is the second most important heat flux, reaching maximum levels during calm, clear periods late in spring. Under heavy cloud, high humidity and strong wind, radiation heat flow is less than latent heat flow. The greatest total heat flux to the snowpack occurs on days with rain, although the precipitation heat flow is relatively unimportant, less than eight percent of the total heat supply. Sensible and latent heat are the most important heat supply during rain. Future studies of snowmelt should concentrate upon obtaining more data on the size and relative importance of heat flows during specific weather systems and especially during wet north-westerly airflows. (Baker-IVI)
W85-00181

EFFECTS OF INCREASING SNOWPACK ON A SUBALPINE MEADOW IN THE UINTA MOUNTAINS, UTAH, U.S.A.,
Native Plants, Inc., Salt Lake City, UT.
W. K. Ostler, K. T. Harper, K. B. McKnight, and D. C. Anderson.
Arctic and Alpine Research, Vol. 14, No. 3, p 203-214, August, 1982. 4 Fig, 8 Tab, 28 Ref. Water and Power Resources Service contract 6-07-DR-20060.

Descriptors: *Snowpack, *Subalpine zone, *Uinta Mountains, *Utah, *Meadows, Cloud seeding, Weather modification, Environmental effects, Vegetation, Soil depth, Water stress, Plant cover.

The Uinta Mountains of Utah are a target area for possible winter cloud seeding for the augmentation of precipitation. Sampling sites were established along naturally occurring snowdrifts in order to assess the long-term impacts of increased snowpack on a subalpine meadow. The area was divided into three zones (light, moderate, and heavy snowpack) based on snow depths measured on 1 April. Sites were sampled from 1976 through 1979. Slope, exposure, soil texture, and pH did not differ significantly between snowpack zones in the study area. The variables sampled which decrease with increasing snowpack are soil depth, organic matter, plant moisture stress, total plant cover, and plant production. Snow release date, number of species per macroplot, exposed rock, and total flowering period increase with increasing depth of the snowpack. A relative decline in plant cover and plant production is predicted for additional increases in snowpack. Individual plant species responses show that 14 species achieve maximum cover in the heavy snowpack zone while only six reach maximum cover in the light snowpack zone. Ten species show no preference for snowpack zones. Production data for the 4 yr of study show considerable variation between years. Differences in the yearly production figures are primarily due to the response of the graminoids which increase with increased growing season precipitation and decrease with greater snowpack. Forb production did not change significantly among the 4 yr of study. (Moore-IVI)
W85-00236

BASAL ICE IN HIGH ARCTIC SNOWPACKS,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
M.-K. Woo, R. Heron, and P. Marsh.
Arctic and Alpine Research, Vol. 14, No. 3, p 251-260, August, 1982. 10 Fig, 16 Ref.

Descriptors: *Basal ice, *Arctic, *Snowpack, *Snowmelt, Sublimation, Ice erosion, Melting, Freezing, Sediment transport, Channel erosion, Ice breakup, Runoff.

In late May or June, meltwater percolating through cold arctic snowpacks often refreezes as ice layers. In the presence of a cold substrate, such layers form at the base of the snowpack. This basal ice continues to grow so long as meltwater supply is sustained and the substrate remains below 0 degrees C. Upon exposure, the ice is destroyed by sublimation and surface melting or by thermal and mechanical erosion by water which runs on, in or under the ice. Multiyear ice is preserved when the incompletely melted basal ice is buried by subsequent snowfall or by a layer of earth materials. Multiple freezing and melting of water in basal ice layers complicate the snowmelt-runoff relationship in three principal ways. Where basal ice is abundant, the melt is prolonged and contributes to streamflow during the drier summer months. During breakup, the basal ice in stream beds tends to increase flow velocity and, consequently, the capacity for sediment transport. However, a basal ice layer in the channel will reduce opportunities for erosion. (Author's abstract)
W85-00237

2D. Evaporation and Transpiration

TEMPERATURE AND EVAPOTRANSPIRATION GRADIENTS OF THE WHITE MOUNTAINS, NEW HAMPSHIRE, U.S.A.,
Dartmouth Coll., Hanover, NH. Dept. of Biological Sciences.
W. A. Reiners, D. Y. Hollinger, and G. E. Lang.
Arctic and Alpine Research, Vol. 16, No. 1, p 31-36, February, 1984. 2 Fig, 2 Tab, 27 Ref.

Descriptors: *Evapotranspiration, *Temperature gradient, *White Mountains, *New Hampshire, Air temperature, Soil water, Forests, Canopy, Mountains, Degree days.

Air temperatures and soil moisture percentages were measured below forest canopies along an environmental gradient in the White Mountains of New Hampshire. The following gradients of decline with altitude were estimated from these data: within forest air temperature, growing degree days, and potential and actual evapotranspiration. These gradients provide a basis for the development of predictors for rates of ecologically significant phenomena such as water balance, net primary production, and decomposition rates. Such data are important for the development of predictive models for several ecological processes the most obvious being the annual hydrological water balance of mountain watersheds. Degree days is a very useful parameter for estimating metabolic rates and distributional limits of pollutants. Actual evapotranspiration is useful for estimating primary productivity of mature ecosystems, detrital decomposition rates, and litter decomposition. (Baker-IVI)
W85-00111

INTERCEPTION OF PRECIPITATION BY FOREST PLANTATIONS (L'INTERCEPTION DES PRECIPITATIONS PAR LES PEUPLEMENTS FORESTIERS),
Centre National de Recherches Forestieres, Seichamps (France). Station de Sylviculture et de Production.
G. Aussenac.
Houille Blanche, Vol. 36, No. 7/8, p 531-536, 1981. 6 Fig, 3 Tab, 15 Ref.

Descriptors: *Interception loss, *Forest hydrology, *Evapotranspiration, Transpiration, Evaporation, Meadows, Rainfall intensity, Trees.

Interception is substantial in forest plantations; it represents 25 to 45% of annual precipitation for resinous trees and 15 to 30% for leafy varieties. Interception varies with the characteristics of the tree population (density, age). It also depends on rain intensity, its permanent or intermittent character, and the evaporating capacity of the air. Most of the water intercepted evaporates. Evaporation is two or three times faster than the speed at which transpiration occurs. As a result, the tree loses 80 to 85% of the intercepted water, with no offsetting compensation. According to the frequency of rainy spells, the real and potential evapo-transpiration of the forest population will be higher or lower than the potential evapo-transpiration of meadows. (Author's abstract)
W85-00390

2E. Streamflow and Runoff

EFFECTS OF GLACIATIONS UPON KARST AQUIFERS IN CANADA,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
D. C. Ford.
Journal of Hydrology, Vol. 61, No. 1-3, p 149-158, February, 1983. 1 Fig, 2 Tab, 21 Ref.

Descriptors: *Karst hydrology, *Glaciation, *Canada, Limestone, Glacial drift, Aquifers, Carbonates, Rocky Mountains.

In Canada there are 570,000 sq km of limestone and marble outcrop, 600,000 sq km of dolomite and 80,000 sq km of sulfate rocks. In addition, halite subcrops beneath 500,000 sq km of the central Prairie region and interacts with modern groundwater circulation to a varying extent. More than 90% of the total outcrop-subcrop has been repeatedly glaciated. The most recent time terminated 13,000-5000 yr B.P. in certain areas. Carbonate terrains still partly buried by glacier ice may be inspected in the Rocky Mountains. Nine distinct effects of glacial action on the propagation and efficiency of karst aquifers are recognized. Destructive effects include erasure, dissection, infilling and injection. Bedrock solution may be inhibited during non-glacial periods by a cover of glacial drift rich in carbonate clasts. Glacial burial may also preserve an aquifer and enhance its storage characteristics. Raising the hydrostatic head or steepening hydraulic gradients may stimulate aquifer expansion. (Baker-IVI)
W85-00009

RESPONSE OF FISHES TO PERIODIC SPRING FLOODS IN A SOUTHEASTERN STREAM,
University of Southern Mississippi, Hattiesburg. Dept. of Biology.
For primary bibliographic entry see Field 2H.
W85-00130

RESPONSE OF BRAIDED RIVERS TO CHANGING DISCHARGE,
Ministry of Works and Development, Christchurch (New Zealand).Water and Soil Science Centre.
M. P. Mosley.
Journal of Hydrology, Vol. 22, No. 1, p 18-67, 1983. 26 Fig, 4 Tab, 27 Ref.

Descriptors: *Braided streams, *Discharge measurement, *Ashley River, *Hurunui River, *Rakaia River, *Ahuriri River, *New Zealand, Flow discharge, Water surface area, Riffles, Pools, Runs, Channels.

Data to describe the physical characteristics of selected reaches were collected on the Ashley, Hurunui, Rakaia and Ahuriri Rivers to search for the existence of common relationships between the braided river environment and discharge. Water surface width, mean and maximum depth, mean and maximum velocity and cross sectional area of transects across individual branch channels and of cross sections across all channels increased with discharge. Simple power functions fitted to these relationships are similar to those of braided channels flowing over non-cohesive bed material. Cumulative plots of depth and velocity demonstrate regularities in the form of the study rivers. No significant relationships were found between discharge and the number of branch channels and the proportion of flow in each. The areas of riffle, pool and run subenvironment all increase with increasing discharge. Water surface area in pools increases more slowly than does total water surface area, in riffles more rapidly, and in runs at approximately the same rate. Hence the relative proportions of these subenvironments change with discharge. The areas of smooth, wavy and broken water expand as discharge increases but at different rates. Bed sediment size distributions in a given channel do not appear to change as discharge and lateral channel extent increase, until discharge increases to a point where sediment movement occurs, caused for example by the introduction of fine sediment from upstream. Although general qualitative relationships exist between discharge and channel characteristics, variability is so great that the relationships have little predictive value. Changing discharge is only one source of variation in channel characteristics. Other sources include differences between rivers, between reaches, between cross-sections, between branch channels, between transects on a given branch channel, and due to the effect of floods. The effect of changing discharge is no greater than any one of these taken individually, and their aggregated effects mask the effects of changing discharge. (Baker-IVI)
W85-00184

STORMFLOW GENERATION IN A HEADWATER BASIN IN THE TAMA HILLS (IN JAPANESE),
Tsukuba Univ. (Japan). Inst. of Geoscience.
M. Yasuhara, S. Takayama, and Y. Suzuki.
Japanese Journal of Limnology, Vol. 45, No. 1, p 44-50, January 1984. 11 Fig, 12 Ref.

Descriptors: *Headwaters, *Storm runoff, *Tama Hills, *Japan, Rainstorms, Storm seepage, Subsurface water, A-horizon.

Research was conducted in a small headwater basin of 0.56 ha in size in the Tama Hills to clarify the mechanism of stormflow generation. Observations were made in the field during and after a 130.5 mm rainstorm occurred on Oct. 7-8, 1979. At each stage of the rainstorm the relationship between subsurface water behavior and stormflow generation was established by using 56 observation wells and 40 tensiometers. Three contributors to stormflow generation were recognized: subsurface stormflow in the A-horizon, saturation overland flow, and flow from the shallow groundwater body. A quantitative analysis of the observed results revealed that the subsurface stormflow in the A-horizon was the most important contributor to stormflow generation in the experimental basin. In regions such as Japan where rainstorms with a total rainfall of more than 100 mm often occur, much more attention should be concentrated on the role of the A-horizon in stormflow generation. (Baker-IVI)
W85-00190

DETERMINATION OF THE HYDRAULIC ROUGHNESS OF A VEGETATED FLOODPLAIN,
Yu. N. Sokolov.
Hydrotechnical Construction, Vol. 16, No. 2, p 96-100, February, 1982. 2 Fig, 1 Tab, 6 Ref. Translated from Gidrotekhnickeskoe Stroitel'stvo, No. 2, p 33-36, February, 1982.

Descriptors: *Flood plains, *Hydraulic roughness, *Vegetation, Design criteria, Hydraulic engineering.

The designing of hydraulic structures on rivers with floodplains is associated with a determination of the water conveying capacity of the floodplains. To determine the capacity of a floodplain requires not simply a representative depiction of the floodplain relief, but understanding its characterization so that it would be correlated with the velocity regime of the flow measured at the stream-gauging station. The next step after determining the statistical parameters of the floodplain relief is the establishment of the relation between these parameters and the coefficient describing the roughness of the floodplain stretches. The hydrometric data obtained in field studies are used in this study. The method proposed for characterizing the roughness of the relief and vegetation permits, without conducting costly hydrometric works in the flood period, a differentiated estimation of the change in the roughness coefficient of a floodplain in time and space on the basis of serial photogrammetric or ground topographic and geobotanic surveys in the low water period. (Baker-IVI)
W85-00437

SOME ASPECTS OF PRACTICAL CALCULATIONS OF UNSTEADY FLOW IN OPEN CHANNELS,
M. S. Grushevskii.
Hydrotechnical Construction, Vol. 16, No. 4, p 220-225, April, 1982. 14 Ref. Translated from Gidrotekhnichenkoe Stroitel'stvo, No. 4, p 25-28, April, 1982.

Descriptors: *Unsteady flow, *Water resources management, *Open channels, Mathematical equations, Flow, Lakes, Reservoirs, Overland runoff.

In calculations of unsteady flow in natural bodies of water one must deal with situations where the one-dimensional model is insufficient and it is necessary to to solve the two-dimensional problem. Calculations of unsteady flow play an important part in the case of water resources management. Such aspects as direct coordination with water management calculations, operative planning and management in the automated control system of river basins, and the hydraulic calculation of interbasin water transfer routes are areas of interest. Use of the calculation of unsteady flow in the case of traditional hydrological investigations is also described. Practical aspects of calculating unsteady flow in rivers are noted briefly. (Baker-IVI)
W85-00453

REFLECTION OF A SURGE FROM A VERTICAL WALL,
A. V. Mishuev, and M. S. Sladkevich.
Hydrotechnical Construction, Vol. 16, No. 4, p 225-228, April, 1982. 4 Fig, 3 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 28-30, April, 1982.

Descriptors: *Surges, *Hydraulic structures, Vertical distribution, Rivers, Flow, Channels, Reservoirs.

Cases of the interaction of a surge with a vertical wall are possible in the operation of hydraulic structures. Such a situation can occur when a surge propagating along the channel of a river, canal, or a reservoir encounters a hydraulic structure. When investigating the force of the surge on structures and problems of flooding of a territory it is important to have a correct determination of the parameters of the reflected wave. When the surge approaches the wall an impact lasting several fractions of a second occurs at the instant of first contact. The wall is passed around by the flow, which can be considered quasisteady and equations of hydraulics describing steady flows can be used. Measurements of the reflection of a surge from a vertical wall were taken by motion picture filming and wire type wave recorders operating on the principle of measuring the resistance between wires which changes depending on the depth of water. The theoretically obtained relations of the depths in the reflected wave with consideration of overflow for all values of the relative wall height satisfactorily agree with the experimental data and also with data obtained in a study of the uprush of a solitary wave on a vertical wall. These findings can be used in preliminary estimations of flood zones and forces in the case of uprush of long wave on hydraulic structures. (Baker-IVI)
W85-00454

CONSTRUCTION OF THE FLOOD (FRESHET) HYDROGRAPH OF A GIVEN PROBABILITY WITH CONSIDERATION OF ITS UNFAVORABLE SHAPE,
N. S. Kashinov.
Hydrotechnical Construction, Vol. 17, No. 9, p 429-439, September, 1983. 8 Fig, 4 Tab, 6 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 8-15, September, 1983.

Descriptors: *Flood hydrographs, *Freshet, *Probabilities, Storage reservoir, Reservoirs, Runoff, Powerplants, Prism storage.

The main purpose of flood (freshet) hydrographs is to determine the most rational combination of the discharge capacity and prism storage of a reservoir for storing the runoff in the period when the inflow to the reservoir exceeds the discharge capacity of the hydrostation. A method is presented for constructing the design hydrograph taking into account for the first time the probability of the distribution of the high runoff between the rising and falling limbs (rise and recession, respectively) during storage. The design hydrograph with given probabilities of maximum runoff and its distribution relative to the maximum after introducing the correction factors is exhibited. (Baker-IVI)
W85-00489

2F. Groundwater

POINT-RECHARGE OF LIMESTONE AQUIFERS - A MODEL FROM NEW ZEALAND KARST,
Manchester Polytechnic (England). Dept. of Environmental and Geographical Studies.
J. Gunn.
Journal of Hydrology, Vol. 61, No. 1-3, p 19-29, February, 1983. 3 Fig, 2 Tab, 24 Ref.

Descriptors: *Karst hydrology, *Groundwater recharge, *New Zealand, Model studies, Sinkholes, Pits, Limestone, Aquifer recharge, Hydrologic models.

Closed depressions of moderate dimensions (solution dolines, sinkholes, cockpits) are a widely described feature of limestone terrains, but very little attention has been paid to their contemporary hydrological function. The mechanisms by which depressions concentrate near-surface waters and transmit them to underlying aquifers has been investigated through the use of a depression hydrology model. The area of study was located 7 km west of the Waitomo Caves in the King Country of west-central North Island. The karst is developed on the Oligocene Te Kuiti Group of limestones, the most widely outcropping carbonate rocks in New Zealand. Water transmitted by each flow

mechanism in the depression hydrology model was sampled to test the hypothesis that their existence may be justified by the differences in their chemical and physical characteristics. Overland flow occurs infrequently following intense and/or prolonged rainfall and it is regarded as relatively unimportant. Throughflow may tentatively be divided into two sub-components: flow in the upper soil horizons which responds rapidly to rainfall; and slower sustained flow. Subcutaneous flow shows a rapid increase in discharge following storm rainfall, due to the transmission of infiltrating pulse waves, but storm water has a flow-through time of 2-10 weeks. Shaft flow is chemically indistinguishable from subcutaneous flow but has a greater annual temperature range. Two subsets of vadose flows were identified: flows which travel through open joints and fissures to the underlying conduit; and flows which travel through soil-filled fissures. Vadose seeps in the four study caves have similar solute concentrations and their mean calcium ion concentrations are significantly lower than those of the other transmission mechanisms and those of subcutaneous flows. (Baker-IVI)
W85-00002

LINEAR UNIT-RESPONSE FUNCTIONS AS INDICATORS OF RECHARGE AREAS FOR LARGE KARST SPRINGS,
California Univ., Santa Cruz. Dept. of Earth Sciences.
S. J. Dreiss.
Journal of Hydrology, Vol. 61, No. 3, p 31-44, February, 1983. 6 Fig, 1 Tab, 14 Ref.

Descriptors: *Precipitation, *Karst hydrology, *Groundwater recharge, Springs, Aquifer recharge, Groundwater recharge, Surface-groundwater relations, Precipitation.

Linear kernel functions derived from the spring-flow response of large karst springs to intense, isolated storms are most physically realistic and have the greatest predictive accuracy when the assumed spring recharge area is consistent with tracer study results. This observation implies that, if sufficient precipitation spring discharge data are available, such derived kernel functions could be useful for identifying or validating assumed spring recharge areas. For example, in the absence of detailed tracing data a researcher might propose a number of feasible recharge areas for a spring and derive kernel functions, using the average precipitation for each of these proposed areas. The shape and predictive accuracy of the derived kernels would reflect the accuracy of the location of the assumed recharge areas. The effectiveness of these kernel function properties in delineating recharge boundaries would depend on the size of the spring relative to the areal extent of the monitor storm, the homogeneity of soil and vegetation conditions, and the areal distribution of the precipitation stations. (Baker-IVI)
W85-00003

ROLE OF THE SUBCUTANEOUS ZONE IN KARST HYDROLOGY,
Auckland Univ. (New Zealand). Dept. of Geography.
P. W. Williams.
Journal of Hydrology, Vol. 61, No. 1-3, p 45-67, February, 1983. 11 Fig, 52 Ref.

Descriptors: *Karst hydrology, Groundwater, Subcutaneous zone, Saturation zone, Vadose water, Permeability, Chemical reactions.

The subcutaneous zone is the upper weathered layer of rock beneath the soil, but above the permanently saturated (phreatic) zone. It is of particular hydrological importance in karst because of its high secondary permeability, arising from the considerable chemical solution in this zone. The importance of subcutaneous storage in sustaining baseflow discharge at some sites must be recognized, as must the contribution of subcutaneous water to flood hydrographs. Methods of estimating the volumes of subcutaneous and phreatic components of karst spring flood hydrographs are presented. A discussion is included of the significance of subcutaneous hydrologic processes for an understanding of karst geomorphology. The desirability of explaining karst landform evolution in terms of hydrologic processes is stressed. (Baker-IVI)
W85-00004

KARST LANDFORMS AND DRAINAGE BASIN EVOLUTION IN THE OBEY RIVER BASIN, NORTH-CENTRAL TENNESSEE, U.S.A.,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
E. L. White, and W. B. White.
Journal of Hydrology, Vol. 61, No. 1-3, p 69-82, February, 1983. 7 Fig, 1 Tab, 14 Ref.

Descriptors: *Karst hydrology, *Obey River Basin, *Tennessee, Cumberland Plateau, Limestone, Permeability, Warsaw Formation, Wolf River, Obey River, Roaring River, Subsurface drainage, Catchment areas.

An extensive karst landscape is developed on the Mississippian limestones of the dissected western margin of the Cumberland Plateau. The internal drainage from the dolines and from the sinking streams is perched on the impermeable Warsaw Formation and emerges as contact springs on the inner gorges of the rivers which have cut deep narrow valleys below the level of the upland surface. Tributary streams to the Wolf, Obey and Roaring rivers (tributaries of the Cumberland River in north-central Tennessee) were analyzed by fitting their longitudinal profiles to exponential and logarithmic functions. Linear segments of semilogarithmic plots permitted extrapolating both active streams and under drained stream channels through the doline karst. Active stream systems maintain, on the average, the profiles and gradients that they would have had if they had been flowing in normal surface channels. Streams emerge from the karst at elevations appropriate to the hydraulic characteristics of the drainage basin that fed the system. The dry under drained channels in fluviokarst can be related to river terraces and erosion surfaces in the same way that dry upper level cave passages can be so related. The tributary stream channels examined here relate the Highland Rim surface, the band of doline karst that borders the Cumberland Escarpment, and the flood plains of the principal rivers. The maintenance of the hydraulic profile of the tributary streams through their under drained reaches suggests that the development of subsurface drainage and the excavation of conduits by dissolution of the limestone is a more rapid process than is the adjustment of the surface channels. The sub-surface conduit systems seem to keep pace with the surface channel without difficulty. (Baker-IVI)
W85-00005

HYDROLOGY AND HYDROCHEMISTRY OF THE CAVES BRANCH KARST, BELIZE,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
T. Miller.
Journal of Hydrology, Vol. 61, No. 1-3, p 83-88, February, 1983. 2 Fig, 7 Ref.

Descriptors: *Aquifers, *Karst hydrology, *Water storage, Chemical reactions, Calcium carbonate, Belize, Central America, Solute transport, Caves.

A large conduit spring issuing from Cretaceous limestones in Belize, Central America, displays a positive relation of discharge to solute concentration. Beneath a maturely dissected cockpit karst, the hydrologic system combines allogenic surface water from an invasion polje with authigenic karst water. Dynamic mixing produces three climatically induced discharge phases: baseflow, normal, and high stage flow. Comparisons of aquifer storage with the total amount of discharge recorded during the summer showed the latter was insufficient to entirely replace the storage and that the mean residence time was on the order of several months, even during the wet season. Zuhuyhas were only the visible part of extensive networks within the karst that collect diffuse flows into conduit-type passages. Runoff enters the karst through many openings, rapidly passes to the phreatic zone, then percolates slowly for several months, achieving high saturation before resurgence at many discrete resurgences. The influx of high hardness karst aquifer water into the trunk channel can be considered a type of flushing event, then, but on a much grander scale than that common nearly everywhere else. The mean total hardness of hundreds of samples collected from diffuse springs indicates higher concentrations than expected. Discharge weighted total hardness was about 215 mg/l calcium carbonate, giving a denudation rate of about 100 mm per 1000 yr. (Baker-IVI)
W85-00006

HYDROSTRATIGRAPHIC SUBDIVISIONS AND FAULT BARRIERS OF THE EDWARDS AQUIFER, SOUTH-CENTRAL TEXAS, U.S.A.,
Geological Survey, San Antonio, TX.
R. W. Maclay, and T. A. Small.
Journal of Hydrology, Vol. 61, No. 1-3, p 127-146, February, 1983. 11 Fig, 1 Tab, 9 Ref.

Descriptors: *Karst hydrology, *Geologic fractures, *Texas, *Edwards Aquifer, Aquifers, Groundwater, Stratigraphy.

The karstic Edwards Limestone within the Balcones Fault Zone of south-central Texas forms a productive confined aquifer that consists predominantly of dense carbonate rocks and contains several layers of highly permeable and porous honeycombed rocks that have been produced by the leaching of evaporitic, tidal flat or reefal deposits. The Edwards aquifer not only supplies the water requirements for a population of more than one million people, but it also supplies the water needed for extensive irrigation. Fractures have hydraulically interconnected these layers at some places. Faults, however, commonly place rocks of very high permeability opposite rocks of very low permeability, thus creating a lateral discontinuity and a flow barrier. At places, fault barriers probably cause partial to almost complete blockage of groundwater flow normal to the fault. This kind of discontinuity is very common in the aquifer, and it may exert a major control on the direction of groundwater flow within it. (Baker-IVI)
W85-00008

UPPER SALMON RIVER KARST, ANTICOSTI ISLAND, QUEBEC, CANADA,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
J. Roberge, and D. C. Ford.
Journal of Hydrology, Vol. 61, No. 1-3, p 159-162, February, 1983. 1 Fig, 3 Ref.

Descriptors: *Karst hydrology, *Anticosti Island, *Quebec, Carbonates, Glacial sediments, Groundwater, Groundwater movement.

Anticosti Island is composed of medium- to thin-bedded carbonates of low dip and low relief. The island was glaciated during the Late Wisconsin but drift cover is thin because of marine overwash. The principal karst extends along the joint set with 38 sq km holokarst area and 105 sq km allogenic catchment. No evidence for karst features older than the postglacial period was found in this area, or of glacial interference with the groundwater circulation system. The system and landforms are most probably of postglacial age. (Baker-IVI)
W85-00010

KARST HYDROLOGY OF THE BRUCE PENINSULA, ONTARIO, CANADA,
Canada Centre for Inland Waters, Burlington (Ontario).
D. W. Cowell, and D. C. Ford.
Journal of Hydrology, Vol. 61, No. 1-3, p 163-168, February, 1983. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Karst hydrology, *Drainage, *Bruce Peninsula, *Ontario, Niagara Escarpment, Scouring, Groundwater movement, Sinkholes.

The Niagara Escarpment forms the eastern boundary of the deeply scoured dolomite plain of the Bruce Peninsula. The Bruce Peninsula represents

an early karstification of a cuesta-bounded dolomite plain. Normal surficial channel drainage on the backslope competes with groundwater drainage to the scarp foot. This results in the progressive karstification of the carbonate mass. Nearest the scarp is a zone of holokarst dominated by vertical drainage and lacking normal surface channels. Westward of this zone are at least five small fluvio-karst basins which have regular surface flow but are drained entirely by sinkholes. Most of the remaining drainage is normal surface flow draining westward away from the escarpment. Three drainage conditions found on the Bruce Peninsula are described. (Baker-IVI)
W85-00011

KARSTIC INTERPRETATION OF THE WINNIPEG AQUIFER (MANITOBA, CANADA),
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
D. C. Ford.
Journal of Hydrology, Vol. 61, No. 1-3, p 177-180, February, 1983. 1 Fig, 4 Ref.

Descriptors: *Aquifers, *Winnipeg, *Manitoba, *Transmissibility, *Permeability, *Karst hydrology, Carbonate aquifers, Sandstone aquifers, Groundwater pollution, Wells, Water pollution sources, Glacial tills.

At Winnipeg, the Upper Carbonate Aquifer lies 10 to 15 m below an erosion surface that bevels dolomites, limestones, and minor shales. The aquifer extends over more than 3400 sq km and is confined by overlying glacial tills and lake clays. This preglacial limestone pavement karst was preserved intact because glacial ice was frozen at the base and could neither scour nor infill it. Karst aquifer capability was greatly enhanced by glacial action. The Upper Carbonate Aquifer displays high storage and transmissibilty: transmissibility ranges from 25 to 2500 cu m/day. Two hundred commercial and industrial wells and thousands of commercial wells have been drilled in this aquifer over a period of at least 130 years. Overlying lake clays function as an aquiclude, shielding the aquifer from pollution by surficial sources. A 20 to 22 m thick Lower Carbonate Aquifer is confined to basal dolomitic limestones: transmissibility nowhere exceeds 60 cu m per day. Two underlying sandstone aquifers are confined by shales at the base of the sedimentary rock section: they contain highly saline water (TDS = 30,000 to 80,000 mg/l). The Upper Carbonate aquifier is probably not being expanded by further solution. High dissolved solids recorded in the aquifer are attributed to contamination from wells drilled into the sandstone aquifers. (Collier-IVI)
W85-00013

GOOSE ARM KARST, NEWFOUNDLAND, CANADA,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
M. S. Karolyi, and D. C. Ford.
Journal of Hydrology, Vol. 61, No. 1-3, p 181-185, February, 1983. 1 Fig, 4 Ref.

Descriptors: *Goose Arm, *Newfoundland, *Karst hydrology, *Groundwater movement, *Subsurface drainage, *Geohydrology, *Surface-groundwater relations, Hardness, Springs, Water temperature.

Karst landforms located at the head of Goose Arm, a major fjord, comprise 200 sq km of deformed carbonates with relief of 60-350 m, blanketed with carbonate-rich till of the Last Glaciation. Karst development is mature and well integrated: landforms include small ponors, small collapse, subsidence and suffosion dolines in till, and littoral karren at lake margins. Groundwater drainage is extremely disordered; there appear to be as many springs as there are sinkholes and the flowpaths are very short (200-2800 m). Gradient and orientation of the flowpaths display no systematic relationships to geologic structure. The anomaly is explained by injection of glacial till into a paleoaquifer, clogging it. Karstic depressions are present over 70% of the 200 sq km area but only 13% of it is drained underground at all times. A further 40% is also drained underground, but with surface overflow during wet periods. Glacial till has effectively buffered postglacial runoff to inhibit the renewal of solutional attack upon the bedrock and the introduction of ordered drainage within it. Mean hardness of samples taken from surface water equals 98 mg/l (CaCO3 + MgCO3, expressed as CaCO3); distribution is ideally normal. The karst springs may be grouped into two principal classes by temperature. Springs grouped into the principal class of approximately 8 C are interpreted as circulating deeply and so attaining the ambient temperature of the rock. Springs of the principal class of 15-18 C are interpreted as flowing rapidly at very shallow depth. (Collier-IVI)
W85-00014

ALPINE KARST SYSTEMS AT CROWSNEST PASS, ALBERTA-BRITISH COLUMBIA, CANADA,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
D. C. Ford.
Journal of Hydrology, Vol. 61, No. 1-3, p 187-192, February, 1983. 2 Fig, 5 Ref.

Descriptors: *Crowsnest Pass, *Alberta, *British Columbia, *Karst hydrology, *Geohydrology, *Groundwater movement, Caves, Aquicludes, Vadose water, Springs.

Crowsnest Pass is a deep E-W breach through a westerly dipping thrust plate of massive platform limestones that contains one major aquiclude stratum. Preglacial drainage was karstic, strike-oriented to the Pass in separate systems above and below the aquiclude. Alpine glacial cirque and trough valley entrenchment has disordered the aquifers. In different catchments there is now karst drainage down dip, against dip, aslant strike, or surface drainage. Karstic strike drainage survives where hydraulic gradients exceed 1:15. The aquiclude is breached at one side. Caves and other karst features are abundant at all elevations between the mountain crests and the floor of Crowsnest Pass. Passage fragments close to crest elevations rarely retain more than 100 m of gallery length. Larger fragmented cave systems at intermediate elevations may attain an aggregate gallery length of 5 km and a depth in excess of 300 m; these are fossil phreatic loop complexes which may channel small quantities of vadose invasion water today. Modern active cave systems, which are largely inaccessible, are known by their springs or function as flood overspill channels. Regional prediction of karstic flow in alpine terrains is problematic; simple model predictions are unlikely to apply. (Collier-IVI)
W85-00015

CASTLEGUARD KARST, MAIN RANGES, CANADIAN ROCKY MOUNTAINS,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
C. C. Smart, and D. C. Ford.
Journal of Hydrology, Vol. 61, No. 1-3, p 193-197, February, 1983. 2 Fig, 4 Ref.

Descriptors: *Castleguard karst, *Columbia Icefield, *Rocky Mountains, *Glacial springs, *Karst hydrology, Geohydrology, Groundwater movement, Springs, Aquifer systems, Glaciers.

A major portion of the drainage from the Columbia Icefield is discharged through the bed of the subglacial Castleguard karst into well integrated cave conduits. The subglacial water is drained through the karst to constricted springs in the Castleguard Valley. Spring discharge measurements reveal few discharges in excess of 1 cu m/s. Output at Big Spring (6.5 cu m/s maximum) showed diurnal oscillations in the discharge peaks which lagged 5-7 hours behind the diurnal peaks in the conventional glacial-melt rivers. During its peak flow periods, Big Spring displayed constant discharge and the periodic springs commenced flowing in diurnal pulses. Fluorescent dye injections confirmed a groundwater link between the cave springs and Big Spring; the linkage is not a simple distributary relationship. Measurements of flowthrough time to Big Spring from a site 4.5 km distant and 750 m higher yielded minimum mean velocities of 200 m/hr and 640 m/hr. These results suggest that the phreas has very limited volume. There is little storage in the aquifer and its rapid response and recession indicate a sparse but well-integrated network of conduits. The springs are the principal drain of the central ice field. Karst flow systems may be maintained beneath temperate ice. The apparent immaturity of the springs is contradicted by their rapid response and recession, and by rapid groundwater velocities. The inferred age of 700,000 yr is also sufficient for conduit development. Recent glaciation has blocked a pre-existing conduit, throwing the aquifer into temporary disorder. (Collier-IVI)
W85-00016

LINCOLNSHIRE LIMESTONE - HYDROGEOCHEMICAL EVOLUTION OVER A TEN-YEAR PERIOD,
Institute of Hydrology, Wallingford (England).
W. M. Edmunds, and N. R. G. Walton.
Journal of Hydrology, Vol. 61, No. 1-3, p 201-211, February, 1983. 2 Fig, 1 Tab, 13 Ref.

Descriptors: *England, *Geochemistry, *Groundwater pollution, *Groundwater movement, *Chemical properties, Nitrates, Sulfates, Calcium, Chlorides, Hydrogen ion concentration, Carbonates, Fluorides, Magnesium, Strontium, Hydrogen sulfide, Groundwater withdrawal, Agricultural chemicals.

In the Lincolnshire (Jurassic) Limestone of eastern England a sequence of hydrogeochemical processes along a 28-km flow line was defined in 1969. These processes include solution, redox and ion-exchange reactions, sulfate reduction, and mixing with saline formation water. Resampling in 1979 showed an almost exact replication of the hydrochemical profiles for pH, O2, HCO3(-), Na(+), Mg(2+), Sr(2+), F(-), and total mineralization. The NO3(-), SO4(2-), Cl(-), and Ca(2+) levels have all increased significantly downgradient, while the redox boundary has become less distinct, and an easterly shift of several kilometers for the first appearance of HS(-) is noticeable. Groundwater abstraction has stressed the natural system, and there now exists a dynamic equilibrium between the development induced recharge and the much older formation water. The principle changes in the hydrogeochemical controls can be attributed to over-development of the aquifer. A front of recent groundwater, contaminated by agrichemicals, has migrated eastwards giving rise to an increased concentration of Ca(2+), SO4(2-), NO3(-), and Cl(-). The aquifer has a significant capacity for in situ nitrate reduction. (Collier-IVI)
W85-00017

TRACE-ELEMENT PARTITION COEFFICIENTS IN THE CALCITE-WATER SYSTEM AND THEIR PALEOCLIMATIC SIGNIFICANCE IN CAVE STUDIES,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
M. Gascoyne.
Journal of Hydrology, Vol. 61, No. 1-3, p 213-222, February, 1983. 4 Fig, 2 Tab, 18 Ref.

Descriptors: *Caves, *Magnesium, *Geochemistry, *Calcite, *Paleoclimate, *Stalactites, *Groundwater, Ion exchange, Trace metals, Calcium, Deposition, Speleothems, Limestone, Air temperature, Seep water.

Timing and intensity of past climates may be inferred from the mineral content of calcium carbonate precipitates formed in caves. These deposits, called speleothems, include stalactites and stalagmites. The incorporation of certain trace elements (e.g., Mg, Mn and Zn) in calcite is known to be temperature-dependent. Apparatus for collecting water and preconcentrating trace-metal cations was used for sampling drip-water from stalactites. Using specially developed ion-exchange sampling techniques, analysis of trace-metal content of seepage water and associated fresh calcite deposits in caves in Vancouver Island and Jamaica shows that Mg is distributed between phases in a consistent manner within the temperature regimes of the caves (7 degrees and 23 degrees C, respectively).

Average values of the distribution coefficient for Mg are respectively 0.017 and 0.045 at these temperatures. These results indicate that the Mg content of calcite varies directly with temperature and in a sufficiently pronounced manner that a 1 degree C rise in depositional temperature of a speleothem containing 500 ppm Mg, at approximately 10 degrees C, would be seen as an increase of approximately 35 ppm Mg - a readily determinable shift. Variations in trace-metal content of fossil speleothems is useful as an alternative paleotemperature indicator. (Collier-IVI)
W85-00018

EFFECTS OF GEOMORPHOLOGY AND SEASONALITY ON THE CHEMISTRY OF CARBONATE GROUNDWATER,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
J. J. Drake.
Journal of Hydrology, Vol. 61, No. 1-3, p 223-236, February, 1983. 5 Fig, 1 Tab, 12 Ref.

Descriptors: *Geochemistry, *Geomorphology, *Calcium, *Carbonates, *Carbon dioxide, *Seasonal variation, Groundwater chemistry, Soil gases, Temperature, Gases, Soil temperature, Groundwater recharge, Climates.

The equilibrium chemistry of carbonate groundwater at the regional and long-term scales of aggregation is affected by geomorphic factors and by the seasonality of temperature and recharge regimes. The general trend of Ca concentration differences between regions is governed by annual mean air or groundwater temperature and by the nature of the solution system. Higher Ca concentrations result from the coincident system where carbonate material, soil air and water are all present together and lower Ca concentrations from the sequential system where carbonate material occurs downstream of the soil air. Coincident systems occur in areas where carbonate material is present in the regolith (either by natural or human activity), where a porous or friable bedrock lies at shallow depth or where soils are shallow. Sequential systems occur where there is a deep noncarbonate regolith, where there is a non-carbonate cap to the carbonate bedrock or where there is a high water table. The assumptions of a fixed soil-air CO2 production contained in a simple model of the chemistry of saturated groundwater in carbonate terrains is invalid where recharge occurs through soils with a small relative air volume, at low temperatures, and where solution occurs under coincident-system conditions. This model does explain the general patterns of variations between regions worldwide. Reductions in equilibrium Ca concentration can be caused by low soil-air volumes relative to percolation volume. This may be particularly significant in cool regions, where soils are shallow and clayey, and where recharge occurs in short high-intensity events. (Collier-IVI)
W85-00019

SALTWATER-FRESHWATER INTERFACE IN THE TERTIARY LIMESTONE AQUIFER, SOUTHEAST ATLANTIC OUTER-CONTINENTAL SHELF OF THE U.S.A.,
Geological Survey, Albany, NY.
R. H. Johnston.
Journal of Hydrology, Vol. 61, No. 1-3, p 239-249, February, 1983. 5 Fig, 13 Ref.

Descriptors: *Floridan aquifer, *Florida, *Georgia, *Saline-freshwater interfaces, Saline aquifers, Groundwater potential, Carbonate aquifers, Aquifers, Coastal aquifers, Offshore, Groundwater reservoirs, Saline water intrusion, Chloride, Water resources development.

The tertiary limestone aquifer of southeastern USA is a sequence of carbonate rocks from which more than 3 billion gal (approximately 11,400,000 cu m) of water are pumped daily. This aquifer system is the principal source of municipal, industrial, and agricultural water in south Georgia and most of Florida. Hydrologic testing in an offshore oil well determined the position of the saltwater-freshwater interface in Tertiary limestones underlying the Florida-Georgia continental shelf. At the offshore well 55 mi (approximately 88 km) east of Fernandina Beach, Florida, drill-stem tests made in the interval 1050-1070 ft (320-326 m) below sea level in the Ocala Limestone recovered a sample with a chloride concentration of 7000 mg/l. Formation water probably is slightly fresher. Pressure-head measurements indicated equivalent freshwater heads of 24-29 ft (7.3-8.8 m) above sea level. At the coast (Fernandina Beach), a relatively thin transition zone separating freshwater and saltwater occurs at a depth of 2100 ft (640 m) below sea level. Fifty-five miles (approximately 88 km) offshore the base of freshwater is approximately 1100 ft (approximately 35 m) below sea level. The differences in depth to the freshwater-saltwater transition at these two locations suggests an interface with a very slight landward slope. Assuming the Hubbert interface equation applies here (because the interface and therefore freshwater flow lines are nearly horizontal) the equilibrium depth to the interface should be 40 times the freshwater head above sea level. Using present-day freshwater heads along the coast in the Hubbert equation results in depths to the interface of less than the observed 2100 ft (640 m). Substituting predevelopment heads in the equation yields depths greater than 2100 ft (640m). The interface is in a transient position between the position that would be compatible with present-day head and the position that would be compatible with predevelopment heads. Some movement of the interface from the predevelopment position has occurred during the past hundred years. The implied movement is incompatible with the hypothesis that the freshwater occurring far offshore in this area is trapped water remaining since the Pleistocene Epoch. (Collier-IVI)
W85-00020

RELATION OF CONCEALED FAULTS TO WATER QUALITY AND THE FORMATION OF SOLUTION FEATURES IN THE FLORIDAN AQUIFER, NORTHEASTERN FLORIDA, U.S.A.,
Geological Survey, Jacksonville, FL.
G. W. Leve.
Journal of Hydrology, Vol. 61, No. 1-3, p 251-264, February, 1983. 7 Fig, 1 Tab, 15 Ref.

Descriptors: *Floridan aquifer, *Florida, *Chlorides, *Geologic fractures, *Solution features, *Saline water intrusion, Saline-freshwater interfaces, Demineralization, Carbonate aquifer, Artesian pressure, Calcite, Dolomite, Mineralization, Aquifers, Dissolution, Geochemistry, Groundwater movement, Water quality.

Geological and hydrological information on the Floridan aquifer in northeastern Florida indicates that isolated occurrences of water having relatively high chloride concentration in the upper part of the aquifer may be associated with buried faults. Water having chloride concentrations of more than 7000 mg/l occurs in the deeper zone of the aquifer at depths below approximately 600 m below sea level in the coastal and east-central part of the study area. This deep salty water is under higher artesian pressure than water in the shallower, generally freshwater zones, but it is restricted from moving upward by relatively impermeable dolomite beds. Two buried faults with vertical displacements of 30-45 m are in areas where relatively high concentrations of chloride have been detected in water in the upper part of the aquifer. Geochemical, artesian pressure, and water temperature data show that the source of the relatively high concentrations of chloride in water in the upper part of the aquifer is from the deeper zone; the faults may have breached the dolomite confining beds and allowed the upward movement of salty water from the deeper zone. The upward movement of mineralized water along the faults may also have formed some of the solution features found in the aquifer near the faults. In this area, freshwater in the upper part of the aquifer is normally saturated with respect to calcite and dolomite. Water from wells tapping the upper part of the aquifer near the faults is not fully saturated suggesting that the mixing of deep mineralized water with shallower freshwater produces a mixture that is not saturated with respect to these minerals and allows for the dissolution of limestone in the aquifer near the faults. Dissolution of limestone may also be occurring at the freshwater-saltwater interface in the deeper zones of the aquifer. (Author's abstract)
W85-00021

SULFUR ISOTOPES AND HYDROCHEMICAL VARIATIONS IN SPRING WATERS OF SOUTHERN INDIANA, U.S.A.,
Indiana Univ. at Bloomington. Dept. of Geology.
N. C. Krothe, and R. D. Libra.
Journal of Hydrology, Vol. 61, No. 1-3, p 267-283, February, 1983. 6 Fig, 4 Tab, 14 Ref.

Descriptors: *Indiana, *Geochemistry, *Groundwater movement, *Sulfur isotopes, *Spring water, Carbonates, Karst hydrology, Sulfates, Gypsum, Conduit flow, Diffuse flow, Sulfur bacteria, Hydrogen sulfide.

Sulfur isotope data can be combined with hydrological and geochemical techniques to determine the sources of sulfate dissolved in a carbonate terrain. Water chemistry and delta S-34(SO4) studies suggest two flow systems in the karst terrain of southern Indiana: a conduit (shallow) flow system, dominated by surface water entering the ground through fractures; and a deeper regional groundwater flow system recharged by diffuse flow. The chemistry of the water in the regional system may be dominated by the solution of gypsum in the Lower St. Louis Limestone. Water chemistry and sulfur isotopes in the springs studied vary with flow type and discharge. The high SO4(2-) concentrations in local waters may result from solution of gypsum. Reported delta S-34(SO4) for Upper Mississippian evaporates and fresh water range from +14 to +19 to +8 to +12 0/00, respectively. Isotope analysis of gypsum cores from the Lower St. Louis Limestone evaporite unit shows delta S-34 values between +14.10 and +15.13 0/00 in the study area. Groundwater chemistry studies show a direct linear relationship between SO4(-2) concentrations and delta S-34 values. Groundwater varies in SO4(-2) concentrations between 20 and 1970 mg/l. The delta S-34 values range from +10.61 0/00 for a conduit spring to +18.57 0/00 for a diffuse spring. The waters with high SO4(2-) concentrations have delta S-34(SO4)-values higher than the local gypsum deposits analyzed and contain H2S, suggesting a deeper flow system in which fractionation by bacterial reduction of SO4(-2) is occurring. Waters with low SO4(-2) concentrations have delta S-34(SO4) values in the range of local fresh waters, indicating a shallow flow system. (Collier-IVI)
W85-00022

NITROGEN-ISOTOPE ANALYSIS OF GROUNDWATER NITRATE IN CARBONATE AQUIFERS: NATURAL SOURCES VERSUS HUMAN POLLUTION,
Texas Univ. at Austin. Bureau of Economic Geology.
For primary bibliographic entry see Field 5B.
W85-00023

REGIONAL GEOHYDROLOGY OF THE NORTHERN LOUISIANA SALT-DOME BASIN, PART IV, HYDRAULIC CHARACTERISTICS OF THE WILCOX-CARRIZO AQUIFER,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W85-00034

BASIC GROUND-WATER HYDROLOGY,
Geological Survey, Raleigh, NC. Water Resources Div.
R. C. Heath.
Available from Dist. Br., USGS, 604 S. Pickett St., Alex., Va. 22304. USGS Water-Supply Paper 2220, Second printing, 1984. 84 p, 10 Tab, 30 Ref.

Descriptors: *Groundwater, *Geohydrology, Groundwater pollution, *Aquifer characteristics, *Aquifer testing, Transmissivity, Permeability co-

efficient, Darcy's law, Water well hydraulics, *Groundwater movement, Thesis equation, Jacob equation, Water well problems.

This report has been prepared to help meet the needs of local, State and federal water managers, as well as the needs of hydrologists, well drillers, and others engaged in the study and development of ground-water supplies. It consists of 45 sections on the basic elements of ground-water hydrology, arranged in order from the most basic aspects of the subject through a discussion of the methods used to determine the yield of aquifers to a discussion of common problems encountered in the operation of ground-water supplies. Each section consists of a brief text and one or more drawings or maps that illustrate the main points covered in the text. In the sections dealing with the analysis of aquifer (pumping) test data, equations are given in both consistent units and in the inconsistent inch-pound units still in relatively common use among ground-water hydrologists and well drillers. As an aid to those who are not familiar with metric units and with the conversion of ground-water hydraulic units from inch-pound units to metric units, conversion tables are given on the inside back cover. Definitions of ground-water terms are given where the terms are first introduced. Abbreviated definitions are also given on the inside front cover for convenient reference by those who wish to review the definitions from time to time as they read the text. Finally, for those who need to review some of the simple mathematical operations that are used in ground-water hydrology, a section on numbers, equations, and conversions is included at the end of the text. (USGS)
W85-00036

GROUND-WATER REGIONS OF THE UNITED STATES,
Geological Survey, Raleigh, NC. Water Resources Div.
R. C. Heath.
Available from Supt. Documents, GPO, Washington, D.C. 20402. USGS Water-Supply Paper 2242, 1984. 78 p, 59 Fig, 6 Tab, 53 Ref.

Descriptors: *Groundwater reservoirs, *Groundwater availability, Geohydrology, *Groundwater regions, *Aquifer classification, Regional analysis, United States.

Features of ground-water systems useful in delineating ground-water regions include the components of the systems, the nature of the water-bearing openings, mineral composition of the rock matrix, water storage and transmission characteristics, and recharge and discharge conditions. Using these criteria the United States, Puerto Rico, and the Virgin Islands are divided into 15 ground-water regions. In addition to discussions of ground-water geology and the classification of ground-water systems, this report also contains a brief description of the physical features, geologic framework, and the principal aspects of ground-water occurrence in each region. (USGS)
W85-00037

HYDROLOGY OF THE NEWBERRY VOLCANO CALDERA, OREGON,
Geological Survey, Menlo Park, CA. Water Resources Div.
E. A. Samuel, and R. W. Craig.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water Resources Investigation Report 83-4091, 1983. 52 p, 5 Fig, 12 Tab, 17 Ref.

Descriptors: *Geothermal resources, Hydrology, *Areal hydrogeology, Natural resources, Data collection, *Oregon, *Newberry Volcano, Cascade range.

Precipitation in the Newberry Caldera is very nearly in balance with evaporation, evapotranspiration, and streamflow. Calcium, magnesium, and bicarbonate ions predominate in the more dilute ground and surface water. Thermal waters from springs and wells have concentrations of 900 milligrams per liter or more and are characterized by high concentrations of sodium and sulfate. Attempts to account for the origin of the hot springs on the basis of mixing relations and isotopic analyses were inconclusive; the springs may represent mixtures of thermal and nonthermal water which are altered by gases rising from sources beneath the caldera floor. Annual recharge to deep aquifers beneath the caldera is probably in the range 2,500 to 6,500 acre-feet. Observations in a Geological Survey drill hole suggest that part of the water may flow to aquifers at depths as much as 1,900 feet beneath the caldera floor. Potential recharge to a postulated geothermal reservoir probably is extremely small. (USGS)
W85-00084

EFFECT OF WATER TABLE DEPTH IN ORGANIC SOIL ON SUBSIDENCE AND SWELLING,
Department of Agriculture, Saint-Jean (Quebec). Research Station.
For primary bibliographic entry see Field 2G.
W85-00156

HEAT AND MASS TRANSFER IN A FAULT-CONTROLLED GEOTHERMAL RESERVOIR CHARGED AT CONSTANT PRESSURE,
California Univ., Berkeley. Lawrence Berkeley Lab.
K. P. Goyal, and T. N. Narasimhan.
Journal of Geophysical Research, Vol. 87, No. B10, p 8581-8590, October, 1982. 11 Fig, 1 Tab, 29 Ref, 1 Append. DOE contract DE-AC03-76SF00098.

Descriptors: *Geothermal studies, *Heat transfer, *Mass transfer, *Geothermal reservoirs, Boundary layers, Rayleigh number, Geologic fractures, Thermal water, Mathematical models.

A two-dimensional, generic-type model was developed for a liquid-dominated geothermal reservoir charged by heated water from a vertical fault zone and overlain by a thin, impermeable, thermally conducting cap rock. This model is applicable to a system with an impermeable clay cap orders of magnitude smaller than the underlying reservoir depth or to a system where the heated water is present in an extensive region just below the surface. The mass flow rate or the pressure associated with the charging process at the fault inlet is unknown and can only be estimated and the pressure in the fault at the bottom of the reservoir is assumed to be prescribed. Quasianalytic solutions for the velocity pressure, and temperature are obtained in the fault-reservoir system for a high Rayleigh number flow. In this approximation, the upwelling fluid does not cool off appreciably until it reaches the cold upper boundary of the reservoir and encounters conductive heat loss. This thermal boundary layer, which is thin at the top of the fault, grows outward laterally and occupies the full thickness of the aquifer far away from the fault. The mathematical model is based on the flow of liquid water in a saturated porous medium. The solution techniques involve the combination of perturbation methods, boundary layer theory, and numerical methods. (Collier-IVI)
W85-00176

THEORY OF THE DEVELOPMENT OF GEOTHERMAL SYSTEMS CHARGES BY VERTICAL FAULTS,
California Univ., Berkeley. Lawrence Berkeley Lab.
G. S. Bodvarsson, S. M. Benson, and P. A. Witherspoon.
Journal of Geophysical Research, Vol. 87, No. B11, p 9317-9328, November, 1982. 17 Fig, 1 Tab, 14 Ref, 2 Append. DOE contract DE-AC03-76SF00098.

Descriptors: *Geothermal studies, *Geologic fractures, *Susanville, *California, Heat transfer, Recharge, Boundary layers, Thermal water, Mathematical models.

A two-dimensional model has been developed of horizontal aquifers recharged with hot water by a vertical fault. The model considers the transient development of such systems including the effects of heat losses to the confining layers. The model can be used for theoretical studies of the development of fault-charged reservoirs. It can also be used to estimate the rate of recharge from the fault source and the time of evolution, using temperature data from wells. The evolution of the thermal field is greatly dependent on the ratio of the heat capacity of the aquifer to that of the caprock; the lower the ratio, the greater the heat losses from the aquifer to the caprock and bedrock. A steady state temperature field is greatly dependent on the distance to the constant temperature boundary condition at the ground surface. The model has been applied to the hydrothermal system at Susanville, California. A reasonable match with the areal temperature distribution in the primary aquifer and the temperature profiles of individual wells was obtained. This allowed an estimate of the recharge rate from the fault into the hydrothermal system to be obtained. As the calculated recharge rate (0.000009 cu cm/s m) into the Susanville hydrothermal system proved to be quite significant, a threefold increase in the potential of the Susanville hydrothermal anomaly for space heating purposes is predicted. (Collier-IVI)
W85-00177

FLUCTUATION OF THE GROUNDWATER LEVEL AND FRESH-SALT WATER INTERFACE IN RESPONSE TO THE TIDE (IN JAPANESE),
Ehime Univ., Matsuyama (Japan). Dept. of Applied Physics.
Y. Kishi, and K. Inouchi.
Japanese Journal of Limnology, Vol. 45, No. 1, p 61-68, January, 1984. 12 Fig, 15 Ref.

Descriptors: *Model studies, *Groundwater movement, *Saline-freshwater interfaces, *Tidal effects, Water level, Confined aquifers, Unconfined aquifers, Aquifers.

A model was used to investigate the fluctuation of groundwater level and fresh-salt water interface in response to tidal influences. The model assumes that groundwater is composed of two immiscible fluids, fresh water and salt water, in unconfined and confined coastal aquifers. Solving mathematical approximations of groundwater flow produces simple analytical forms which express the fluctuation of the groundwater level and fresh-salt water interface in response to the harmonic oscillation of the level of the sea. Numerical solutions of groundwater flow are then obtained and the results compared with simple analytical solutions. Fluctuation of the groundwater level was almost the same as that predicted from the model in which groundwater is assumed to be composed of only a single fluid. Amplitude and phase lag of the oscillation of the fresh-salt water interface are nearly the same as those of the groundwater level in the case of the unconfined aquifer. In the case of the confined aquifer, on the other hand, amplitude of the fresh-salt water interface is considerably smaller and the phase lag is about 45 degrees compared with those of the groundwater level. (Baker-IVI)
W85-00192

PUMPING TESTS IN PATCHY AQUIFERS,
Institute of Geological Sciences, London (England). Hydrogeology Unit.
For primary bibliographic entry see Field 4B.
W85-00300

PROGRAMMABLE HAND CALCULATOR PROGRAMS FOR PUMPING TEST ANALYSES BY LEAST SQUARES' METHOD USING JACOB'S MODIFICATION OF THEIS' EQUATION,
King Abdulaziz Univ., Jeddah (Saudi Arabia). Faculty of Earth Sciences.
For primary bibliographic entry see Field 4B.
W85-00301

HYDRAULIC CONDUCTIVITY OF A GLACIAL TILL IN ALBERTA,
Department of Agriculture, Lethbridge (Alberta). Irrigation Div.

For primary bibliographic entry see Field 4B.
W85-00302

LOWER HAWTHORN AQUIFER ON SANIBEL ISLAND, FLORIDA,
Law Engineering Testing Co., Marietta, GA.
For primary bibliographic entry see Field 4B.
W85-00303

HYDRAULIC CONDUCTIVITY OF A FINE-GRAINED TILL, CATTARAUGUS COUNTY, NEW YORK,
Geological Survey, Carson City, NV.
D. E. Prudic.
Ground Water, Vol. 20, No. 2, March-April, 1982. 7 Fig, 3 Tab, 18 Ref.

Descriptors: *Tills, *Permeability coefficient, *Cattaraugus County, *New York, Landfills, Radioactive waste disposal, Slug tests, Groundwater movement, Porosimeter tests, Anisotrophy, Overburden pressure.

Hydraulic conductivity of a fine-grained till was evaluated by field and laboratory techniques as part of a study of the movement of radionuclides at a nuclear-waste landfill in western New York. In general, both methods produced similar results. Hydraulic conductivity values determined from (a) slug tests of piezometers, (b) several types of laboratory tests on cores, and (c) calculation from mercury porosimeter tests, agreed within a factor of 25. Slug tests were analyzed by two methods: one assumed horizontal flow to the piezometer screen; the other assumed spherical, isotropic flow. Average horizontal hydraulic conductivity from slug tests of 12 piezometers was 6 x 10 to the -8 cm/s by the first method and 2 x 10 to the -8 cm/s by the second. Laboratory tests of core samples were designed to determine the extent to which anisotrophy and increased pressures with depth may affect hydraulic conductivity. Consolidation tests were done on four core samples to determine changes in hydraulic conductivity with pressure. Vertical hydraulic conductivity of the samples decreased by 40% as pressure increased from near atmospheric to the 7 kg/sq cm 2, a pressure that would prevail at a depth of 30 m. This indicates that hydraulic conductivity of the till decreases with depth in response to overburden pressure. Despite evidence of higher horizontal than vertical permeability in one set of laboratory tests of till samples, other laboratory and field tests as well as analyses of ground-water flow by a computer model indicate that the till is nearly isotropic. Hydraulic conductivity of the till was estimated with reasonable accuracy from mercury-porosimeter tests. However, estimating hydraulic conductivity of fine-grained samples from some regions by this method may be inappropriate because the method uses dry samples, which could severely affect the results if swelling clays are present. (Author's abstract)
W85-00305

CALCULATION OF VELOCITY IN THREE SPACE DIMENSIONS FROM HYDRAULIC HEAD MEASUREMENTS,
Princeton Univ., NJ. Dept. of Civil Engineering.
L. M. Abriola, and G. F. Pinder.
Ground Water, Vol. 20, No. 2, p 205-213, March-April, 1982. 5 Fig, 2 Tab, 1 Ref, 3 Append.

Descriptors: *Velocity, *Groundwater movement, *Hydraulic head, *Three dimensions, Mathematical studies, Vertical head gradient, Aquifer systems.

When an aquifer system exhibits a significant vertical head gradient, it is generally necessary to consider velocity components in three space dimensions. A systematic and straightforward method was developed for the estimation of velocity components in three dimensions from hydraulic head data from a network of wells screened at different elevations. Groups of four measurement points are connected to form tetrahedrons, and a linear interpolation scheme is used to obtain a head gradient estimate for each tetrahedron. Application of Darcy's law then yields the desired velocity component values. In the absence of significant vertical gradients, a two-dimensional approach will be roughly equivalent, and the simpler two-dimensional approach may be used with confidence. (Moore-IVI)
W85-00306

REPEATED PULSE TECHNIQUE FOR DETERMINING THE HYDRAULIC PROPERTIES OF TIGHT FORMATIONS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
G. R. Walter, and G. M. Thompson.
Ground Water, Vol. 20, No. 2, p 186-193, March-April, 1982. 10 Fig, 1 Tab, 10 Ref.

Descriptors: *Hydraulic properties, *Repeated pulse method, *Aquifer testing, Geohydrology, Transmissivity, Observation wells, Groundwater storage, Anisotrophy, Slug tests.

Slug and bailer tests are being used increasingly to evaluate the hydraulic properties of 'tight' geologic units. Although these pulse methods of stressing a system are used typically only on single wells, the repeated pulse method described here stresses the system in the same manner, but the response is measured in observation wells. This type of pulse test yields much the same information as conventional pumping tests, but it is easier to perform in very low permeability units. The observation well response hydrographs are analyzed by curve-matching techniques. In general, a unique set of type curves must be computed for each pulse test. These types curves are computed easily if the pulsed well is treated as a line-source (or sink). The accuracy of the value of transmissivity (T) determined from the line-source type curves compared to using the finite-diameter well solution depends both on the pulsed well radius (rc) and the time interval between pulses (delta t). If T delta t/rc sq is maintained greater than 50, then T determined from the line-source solution will be within 25% of that determined from more accurate, but computationally inconvenient, finite-diameter well type curves. The repeated-pulse test technique was applied to an experimental well array completed in the Conasauga Shale Formation at Oak Ridge National Laboratory. Values of transmissivity determined by the repeated-pulse method agreed well with the results of slug tests performed on each well individually, and in addition, provided information on storage coefficients and anisotrophy at the site. (Author's abstract)
W85-00308

TYPE CURVES FOR LARGE-DIAMETER WELLS NEAR BARRIERS,
King Abdulaziz Univ., Jeddah (Saudi Arabia). Faculty of Earth Sciences.
Z. Sen.
Ground Water, Vol. 20, No. 3, p 274-277, May-June, 1982. 3 Fig, 5 Ref.

Descriptors: *Aquifers, *Groundwater movement, *Wells, Barriers, Mathematical equations, Darcy's Law, Depression cone volume.

Large-diameter well with well storage are frequently encountered in finite aquifers. A new methodology is presented for deriving the relevant type curves for this situation. In the Mid-East, large-diameter wells are mostly hand dug with diameters of 1 to 3 meters. The continuity equation and Darcy's law are used, coupled with the image method and the depression cone volume. The resultant type curve equation is very simple and lends itself to calculation on an ordinary hand calculator. There is no need for any table to plot the required type curve. Comparisons with the corresponding type curves in an infinitely extensive aquifer have been given. (Baker-IVI)
W85-00310

SULFATE-REDUCING BACTERIA IN GROUND WATER FROM CLOGGING AND NONCLOGGING SHALLOW WELLS IN THE NETHERLANDS RIVER REGION,
Keuringsinstituut voor Waterleidingartikelen, Rijswijk (Netherlands).
For primary bibliographic entry see Field 4B.
W85-00313

ANALYSIS OF LEAKY AQUIFER PUMPING TEST DATA: AN AUTOMATED NUMERICAL SOLUTION USING SENSITIVITY ANALYSIS,
Kansas State Geological Survey, Lawrence.
P. M. Cobb, C. D. McElwee, and M. A. Butt.
Ground Water, Vol. 20, No. 3, p 325-333, May-June, 1982. 7 Fig, 2 Tab, 18 Ref, 1 Append.

Descriptors: *Pumping tests, *Leaky aquifers, *Drawdown, Confined aquifers, Mathematical models, Computer models, Sensitivity analysis, Algorithms.

A methodology for analyzing the leaky artesian-aquifer pumping test uses a numerical regression algorithm built on sensitivity analysis. A by-product is the solution to the drawdown equations. The algorithm has consistently proven its ability to converge the correct set of aquifer parameters for a typical data set. In this case correct means the values obtained by manual curve matching methods for real data, or the values used in generating the hypothetical data. Initial estimates of the aquifer parameters may vary by about three orders of magnitude above or below the correct values. For typical data sets the rms fitting error should be less than a few tenths of a foot. If this is not the case, one is probably not dealing with a simple leaky aquifer. If the data diverge too much from ideal data, convergence may not occur; if convergence does occur, the rms error may be unacceptable. Since the three degrees of freedom (three aquifer parameters) give the algorithm considerable latitude in achieving convergence, an imperfect data set may be run successfully and a set of values for transmissivity, storage, and leakage produced. For this reason, only the best data available should be analyzed, and the geohydrology should be examined by experienced personnel. (Moore-IVI)
W85-00315

REPRESENTATION OF MULTIAQUIFER WELL EFFECTS IN THREE-DIMENSIONAL GROUND-WATER FLOW SIMULATION,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 4B.
W85-00316

COMPACT MODIFIED THREE-DIMENSIONAL AQUIFER SIMULATION PROGRAM FOR SMALL COMPUTERS,
Osmania Univ., Hyderabad (India). Centre of Exploration Geophysics.
B. H. Briz-Kishore, and R. V. S. S. Avadhanulu.
Ground Water, Vol. 20, No. 3, p 342-344, May-June, 1982. 3 Fig, 1 Ref.

Descriptors: *Groundwater movement, *Computers, *Simulation, Aquifers, Computer models, Three-dimensional models, Geohydrology.

The three-dimensional ground-water flow model, developed by Trescott (U.S.G.S. Open-File Report 75-438, 1975) simulates aquifers with heterogenous, anisotropic character having irregular boundaries. The program requires about 250K bytes of memory for compilation and 72K bytes of memory for execution on IBM/370 using FORTRAN H OPT 2 system. To popularize the program for minicomputers, the entire organization was restructured and various programming facilities were used. The implementation of segmentation and overlay at job command level, design of new subroutines, and regrouping of the entries at program peripheral level and availing of program facilities have significantly reduced the program code. The new program requires about 11K bytes of memory. The modified design was tested with an example from Trescott and achieved 80% memory optimization with a slight increase of run time. The efficiency of the developed methodology is established by the identical results obtained. (Moore-IVI)
W85-00317

CLASSIFICATION OF GROUND-WATER SYSTEMS OF THE UNITED STATES,
Geological Survey, Raleigh, NC. Water Resources Div.
R. C. Heath.
Ground Water, Vol. 20, No. 4, p 393-403, July-August, 1982. 6 Fig, 3 Tab, 6 Ref.

Descriptors: *Groundwater systems, *Classification, Geohydrologic units, Mapping, Discharge, Recharge, Groundwater storage, Transmissivity, Geohydrology.

Delineation of groundwater regions is one of the most effective tools for transferring knowledge and for enhancing public understanding of groundwater occurrence and availability. The five features of groundwater systems useful in classification are: components of the system, nature of the water-bearing openings, composition of the rock matrix, storage and transmission characteristics, and recharge and discharge conditions. Using these features, the United States can be divided conveniently into 14 regions: Western Mountain Ranges; Alluvial Basins; Columbia Lava Plateau; Colorado Plateau and Wyoming Basin; High Plains; Nonglaciated Central Region; Glaciated Central Region; Piedmont and Blue Ridge; Northeast and Superior Uplands; Atlantic and Gulf Coastal Plain; Southeast Coastal Plain; Alluvial Valleys; Hawaii; and Alaska. (Moore-IVI)
W85-00318

REGIONAL STUDY OF THE DAKOTA AQUIFER (DARTON'S DAKOTA REVISITED),
Geological Survey, Lawrence, KS. Water Resources Div.
J. O. Helgesen, D. G. Jorgensen, R. B. Leonard, and D. C. Signor.
Ground Water, Vol. 20, No. 4, p 410-414, July-August, 1982. 6 Fig, 14 Ref.

Descriptors: *Dakota aquifer, *Geohydrology, Aquifer characteristics, Potentiometric level, Confined aquifers, Water supply development.

The Dakota aquifer is an important resource to the midwestern U.S. Early work of N. H. Darton was a significant contribution to understanding the hydrology of the system. Since Darton's work, many investigators have studied Dakota-aquifer hydrology with regard to development of local or statewide resources. Preliminary mapping of relatively recent fluid-level data indicates regional potentiometric trends similar to those interpreted by Darton, but altitudes substantially lower in part of the area. The classic artesian-system concept of the Dakota aquifer is not consistent with some of the data and observations of the past several decades. The simple aquifer geometry and effective lateral hydraulic continuity normally associated with that concept do not appear to characterize the Dakota aquifer regionally. Questions remain with regard to the significance of hydraulic head distributions, flow patterns, rates and distribution of recharge and discharge, geochemical processes, and water-quality variations. (Moore-IVI)
W85-00320

STATISTICAL IDENTIFICATION OF HYDRAULIC CONNECTIONS BETWEEN THE SURFACE OF A MOUNTAIN AND INTERNAL MINERALIZED SOURCES,
Idaho Univ., Moscow. Coll. of Mines and Earth Resources.
R. E. Williams.
Ground Water, Vol. 20, No. 4, p 466-478, July-August, 1982. 7 Fig, 2 Tab, 15 Ref.

Descriptors: *Mining, *Molybdenum, *Block caving, *Water pollution sources, *Geohydrology, *Mount Emmons, *Colorado, Groundwater pollution, Springs, Mine drainage, Water quality, Geologic fractures.

Mount Emmons (near Crested Butte, Colorado) is the site of a proposed molybdenum mine that would extract ore from within the core of the 12,000-foot plus peak. The ore body will be extracted using a block caving technique that requires a thorough understanding of the hydrology of the mountain. To test the hypothesis that water quality data from various sources can be clustered and grouped into distinct populations that can be correlated with hydrogeologic features, cluster analysis and canonical analysis are applied to mine water quality data, drillhole water quality data, springwater quality data and surface-water quality data. Identified subpopulations indicate the presence or absence of mineralized sources in recharge areas, along flow paths or in discharge areas for the different water quality groups. The statistical analyses in combination with fault-vein mapping and debris slide mapping facilitate identification of preferential hydraulic connections between the surface of Mount Emmons and internal mineralized zones. The majority of the springs on Mount Emmons were derived from debris slides. These springs discharge water than meets drinking-water standards, and they should not be affected significantly by mining. Groundwater discharge areas that can be expected to be affected by mining are located in the vicinity of the iron bog and the ferricrete soils and the Keystone and Union fault veins on the south side of the mountain. On the north side of the mountain both springs in Redwell basin appear to be fault-controlled and probably would be impacted by mining if block caving were to extend sufficiently far north. (Moore-IVI)
W85-00327

UNRELIABILITY OF OPEN OBSERVATION BOREHOLES IN UNCONFINED AQUIFER PUMPING TESTS,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W85-00331

HAND CALCULATOR PROGRAM FOR EVALUATING THEIS PARAMETERS FROM A PUMPING TEST,
Electronic Associates, Inc., West Long Branch, NJ.
For primary bibliographic entry see Field 4B.
W85-00332

EVALUATION OF AQUIFER BEHAVIOR IN A TYPICAL CRYSTALLINE BASEMENT,
Osmania Univ., Hyderabad (India). Centre of Exploration Geophysics.
B. H. Briz-Kishore, and V. L. S. Bhimasankaram.
Ground Water, Vol. 20, No. 5, p 563-568, September-October, 1982. 7 Fig, 3 Tab, 10 Ref.

Descriptors: *Crystalline basement, *Aquifer characteristics, *India, Drilling, Well yield, Cone of depression, Groundwater level, Laminar flow, Pumping tests, Surface-groundwater relations, Geologic fractures.

A systematic overal' study of aquifer characteristics, the flow and yields of groundwater in fractured crystalline rocks was conducted in a small area of 40,000 sq m in Shadnagar basin (India). The area represents a typical crystalline basement. The study area consists of a central pumping well and six observation wells placed in three different directions and at different distances. The water levels in all the wells observed during drilling rise after drilling is completed. Yields of the multilevel wells indicate that they are independent of the thickness of the weathered zone and the number of fractured zones. The observation of laminar flow, steady-state condition, and cone of depression during pumping revealed that the fractured aquifer responds similarly to a continuous porous medium. Saturation and dewatering of the aquifer system over a long period results in the continuity of the entire groundwater system. The cone of depression may change in response to fracture orientation and configuration of the surface drainage system. The fracture system is in hydraulic connection with surface water in streams after pumping. (Moore-IVI)
W85-00334

TRACING FLUID SOURCES IN THE EAST SHORE AREA, UTAH,
Oak Ridge National Lab., TN.
D. R. Cole.
Ground Water, Vol. 20, No. 5, p 586-593, September-October, 1982. 8 Fig, 1 Tab, 15 Ref. DOE contract DE-AC07-80ID12079.

Descriptors: *East Shore, *Utah, *Hot springs, *Warm springs, *Groundwater, Oxygen isotopes, Deuterium, Hydrogen, Cations, Anions, Geohydrology, Groundwater movement.

Stable isotope and fluid chemistry investigations in complex hydrogeologic areas have proven useful in delineating the origin of thermal waters and their interaction with local ground-water reservoirs. The application of these techniques is illustrated using water samples collected from all hot and warm springs and many of the wells in the East Shore area, Utah. These samples were analyzed for major cations and anions, oxygen-18/oxygen-16 and deuterium/hydrogen ratios. The data presented suggest the presence of at least two and perhaps three distinct hydrogeologic regimes. One regime involves fault-controlled deep circulation of waters derived from high elevations in mountains toward the east. These waters evolved into the sodium plus potassium, chloride-enriched hot spring fluids that are high in total dissolved salt concentration (greater than 4,000 mg/l), exhibit oxygen-18 enrichment due to geochemical rock-water interaction at depth and have deuterium/hydrogen ratios similar to high elevation mountain springs. A second hydrogeologic regime is comprised of waters derived from lower elevations that infiltrate into the shallow valley sediments. These dilute calcium plus magnesium, bicarbonate fluids comprise most of the area's ground-water supply. Leakage of thermal waters into overlying cooler aquifers is observed in the vicinity of the hot springs, and is believed to occur in several other portions of the East Shore area. These leakage zones make up the third hydrogeologic regime observed in the East Shore area. (Author's abstract)
W85-00337

IN-SITU DETERMINATION OF THREE-DIMENSIONAL AQUIFER PERMEABILITIES,
Insitu Consulting, Laramie, WY.
S.-C. Way, and C. R. McKee.
Ground Water, Vol. 20, No. 5, p 594-603, September-October, 1982. 12 Fig, 3 Tab, 13 Ref.

Descriptors: *Groundwater movement, *Aquifer properties, *Permeability, Testing, Mathematical equations, Groundwater flow, Flow.

In conventional methods of aquifer tests, homogeneous and isotropic formations are assumed. However, in many instances, aquifers are anisotropic. Three dimensional flow equations are derived to resolve this problem in homogeneous, anisotropic and leaky aquifers. With the equation and method as outlined, the three components of directional permeability can be determined in the presence of leakage, and the statistical distribution of fractures and stream channels can be determined. The directional permeability of the formation is analyzed by matching the field drawdown (or pressure buildup data) against one of the type curves generated by the computer. The drawdown data (or pressure buildup data) may be obtained in partially penetrating observation wells near a partially penetrating pumped well. An example using the partial penetration well function on an in-situ mining property to evaluate directional permeability demonstrated excellent agreement between field data and type curves generated from the equation on the computer, thus verifying the method as presented. (Baker-IVI)
W85-00338

DOWN HOLE FLOWMETER ANALYSIS USING AN ASSOCIATED CALIPER LOG,
Department of Scientific and Industrial Research, Taupo (New Zealand). Geophysics Div.
M. C. Syms.
Ground Water, Vol. 20, No. 5, p 606-610, September-October, 1982. 3 Fig, 4 Ref.

Descriptors: *Permeability coefficient, *Flowmeters, *Geothermal wells, Mathematical equations, Caliper logs, Groundwater movement.

A flowmeter has been constructed for use in geothermal wells and an interpretation technique developed for analyzing the logs. Because the geothermal wells are lined with slotted casing, which has an open annulus behind it, caliper logs are not easily obtained. The interpretation method as presented does not require borehole diameter information to derive volumetric flowrates. Location of constant flow regions, inflow and outflow zones is done by manually comparing the shapes of the caliper and flowmeter logs. A flowrate log is then produced using quantitative volumetric flowrates calculated for several depths in the well. The log contains all the significant flow information without spurious noise and would be suitable for converting to an apparent hydraulic conductivity log. (Baker-IVI)
W85-00340

HYDROGEOLOGIC CONTROL OF LOCALIZED IRON-ENRICHED GROUND WATER, LIMA, OHIO,
For primary bibliographic entry see Field 4B.
W85-00342

IDENTIFICATION OF RECHARGE AREAS USING GEOCHEMICAL FACTOR ANALYSIS,
Kentucky Geological Survey, Lexington.
F. W. Lawrence, and S. B. Upchurch.
Ground Water, Vol. 20, No. 6, p 680-687, November-December, 1982. 3 Fig, 1 Tab, 19 Ref.

Descriptors: *Factor analysis, *Groundwater recharge, *Floridan Aquifer, Permeability, Artificial recharge, Limestone, Geochemistry, Groundwater movement.

Factor analysis is useful for interpreting commonly collected groundwater quality data and relating those data to specific hydrogeologic processes. One hundred nine groundwater quality samples from wells completed in the upper Floridan Aquifer near Live Oak, Florida were analyzed for major dissolved constituents. R-mode factor analysis was used to separate those chemical variables that reflect areally-significant recharge processes from those related strictly to the dissolution of aquifer materials. Areas impacted by direct, rapid, artificial recharge through drainage wells and sinkholes, as well as by slow, natural recharge into the Floridan Aquifer were delineated. In spite of the relatively low amount of variability accounted for in the analysis, several clear patterns of recharge are apparent. These patterns demonstrate the utility of factor analysis as a data filtering and pattern recognition technique. Factor analysis aids in sorting out chemical variables related to hydrogeological processes beyond strict lithologic controls. The technique applied to the Floridan Aquifer confirmed that recharge rates and pathways are related to topographic regions, identified possible fracture traces that influence recharge and groundwater movement, and delineated areas in the vicinity of Live Oak where groundwater is impacted by artificial recharge from urban and agricultural sources. This technique is useful only in combination with sound chemical principles and procedures. (Baker-IVI)
W85-00345

GROUND-WATER AGE DISTRIBUTION IN MADRID BASIN, SPAIN,
Universidad Autonoma de Madrid (Spain). Dept. de Geologia.
M. R. Llamas, E. S. Simpson, and P. E. Martinez Alfaro.
Ground Water, Vol. 20, No. 6, p 688-695, November-December, 1982. 4 Fig, 4 Tab, 11 Ref.

Descriptors: *Groundwater dating, *Solute transport, *Madrid Basin, *Spain, Model studies, Carbon radioisotopes, Alluvial deposits, Fluvial sediments, Basins, Groundwater movement.

A flow net and a discrete-state compartment (or mixing cell) model were employed to calculate the age distribution of groundwater circulating through the aquifer formed by alluvial deposits that occupy the Madrid Basin in central Spain. Carbon-14 decay ages were determined for nine groundwater samples taken from eight locations. The ages obtained by the flow and mixing cell models were consistent and generally agreed with the ages obtained by C-14 studies. The disagreement of C-14 age in one sample possibly was caused by some contamination with modern water during sampling. The older age anomaly in another sample might have been caused by the long time required by the recharge water to pass through the unsaturated zone in the interfluves where this zone may be 100 m thick. Although a better adjustment of the C-14 data is desirable, it is not certain that this refinement will permit a better calibration of any of the models. It is more important to use the results of such studies to guide the design of future C-14 field sampling programs. The mixing cell model coupled with a flow model could provide a simplified method to analyze solute transfer in groundwater. (Baker-IVI)
W85-00346

SENSITIVITY ANALYSIS AND THE GROUNDWATER INVERSE PROBLEM,
Kansas State Geological Survey, Lawrence.
C. D. McElwee.
Ground Water, Vol. 20, No. 6, p 723-735, November-December, 1982. 4 Fig, 1 Tab, 28 Ref.

Descriptors: *Sensitivity analysis, *Model studies, *Groundwater hydrology, Evaluation, Mathematical studies, Error analysis, Transmissivity, Storativity.

An indirect inverse method using sensitivity analysis is employed to help understand the reasons for model insensitivity. The results of sensitivity analysis allow the modeler to delineate insensitive areas of the model where inverse procedures will be more subject to error. Sensitivity coefficients are defined and discussed. A differential equation is developed for the sensitivity coefficients that will generally be solved by numerical techniques. A relatively simple least squares' inverse procedure is used on a hypothetical model to illustrate typical problems that can be encountered. In particular, the effect of data accuracy is considered. The fact that considerable error in the transmissivity and storativity may occur in areas of low sensitivity should not be looked upon as a failing of the inverse procedure. It is simply a fact that not all areas of the model have been stressed equally. Until additional head data become available to establish a minimum sensitivity level in all areas of the model it simply is not possible to estimate accurately the transmissivity and storativity everywhere. The inverse process may also experience problems due to a basic nonuniqueness near no-flow boundaries. The main advantage of the present work is that areas of low sensitivity may be delineated. (Baker-IVI)
W85-00350

ISOTOPES IN GROUND-WATER INVESTIGATIONS,
Geological Survey, Reston, VA.
L. Toran.
Ground Water, Vol. 20, No. 6, p 740-745, November-December, 1982. 5 Fig, 34 Ref.

Descriptors: *Isotope studies, *Groundwater, Reviews, Tracers, Isotopic tracers, Environmental tracers, Groundwater movement, Mixing, Water chemistry.

Isotopes have been used during the past 20 years to obtain a better theoretical and practical understanding of groundwater. For an isotope to be useful in hydrology, the following characteristics are necessary. First, the relative mass difference of common to rare isotopes of the element should be large. Second, the abundance of the rare isotope must be substantial, but still contrast with the dominant isotope. Third, occurrence of some natural process modifies the relative abundance of an element's isotopes in a system. The distribution of isotopic species in water provides information on sources of groundwater, on flow paths and mixing, and on physical and chemical characteristics of aquifers. Numerous examples in the literature illustrate the techniques and applications of isotopes to groundwater studies. Demands are increasing for better understanding of hydrologic systems to facilitate management of water as a resource, and to evaluate environmental problems. (Baker-IVI)
W85-00351

GROUND-WATER DISPERSION CALCULATIONS WITH A PROGRAMMABLE CALCULATOR,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
W. E. Kelly.
Ground Water, Vol. 20, No. 6, p 736-738, November-December, 1982. 2 Tab, 3 Ref.

Descriptors: *Groundwater movement, *Error analysis, *Dispersion, Computers, Mathematical methods.

A simple and convenient method is presented for calculating two-dimensional dispersion on a TI 58 or 59 programmable calculator. Accurate values for the complementary error function may be obtained quickly using the solid state software program available in the Master Library module. With this capability, analytic expressions for dispersion may be easily evaluated and programs for computing one- and two-dimensional dispersion developed. An example is offered to show the type of results that may be obtained. The program retains the limitations of the analytic solution and the approximation of the well function. (Baker-IVI)
W85-00352

FIELD DETERMINATION OF AQUIFER THERMAL ENERGY STORAGE PARAMETERS,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
A. D. Parr, F. J. Molz, and J. G. Melville.
Ground Water, Vol. 21, No. 1, p 22-35, January-February, 1983. 14 Fig, 3 Tab, 30 Ref. Battelle Pacific Northwest Laboratories contract B-67770-A-0, Oak Ridge National Laboratory contract 7338.

Descriptors: *Aquifer characteristics, *Thermal capacity, *Thermal energy storage, Energy sources, Evaluation, Permeability, Thermal conductivity, Pumping tests.

Extensive testing is required to evaluate the potential of an aquifer for thermal energy storage. Important parameters include the regional gradient, vertical and horizontal permeability of the storage aquifer, horizontal dispersivity, vertical permeability of the upper and lower aquitard, thermal conductivities, heat capacities, and chemical characteristics of the aquifer matrix and native ground water. Procedures and analyses of a series of tests for a confined aquifer near Mobile, Alabama were completed prior to an aquifer thermal energy storage experiment. The chemical analyses indicated that there was a potential for clay particle swelling and loss of permeability in the storage aquifer if relatively high quality water was heated and injected. It appears that thermodynamic parameters such as heat capacities and thermal conductivities can be estimated without actually performing measurements. The determination of hydraulic parameters requires the performance of extensive field testing. Temporary, partially screened observation and pumping wells were installed into the aquifer for the anisotropy test. The series of pumping tests emphasized the importance of obtaining good early drawdown data for each of the well tests. (Baker-IVI)
W85-00355

RAINFALL/WATER-TABLE LEVEL RELATIONSHIP OF AN UNCONFINED AQUIFER,
Hunter District Water Board, Newcastle (Australia).
M. N. Viswanathan.
Ground Water, Vol. 21, No. 1, p 49-56, January-February, 1983. 7 Fig, 9 Ref.

Descriptors: *Aquifer recharge, *Water level, *Rainfall, Infiltration, Unconfined aquifers, Recursive least squares method, Groundwater recharge, Aquifer characteristics.

Soil parameters that determine the infiltration rates of a shallow unconfined coastal aquifer due to rainfall were obtained using the recursive least squares method. The parameters were predicted by minimizing the mean square error between the predicted and measured water table levels. The parameters were treated as time dependent variables, and their variation was tracked by introducing a forgetting factor of value 0.98 into the algorithm that predicts the parameters. Forgetting factor curtails the memory of the algorithm, hence, the parameter values depend more on current values of levels and rainfall than on past values. Three sets of soil parameters were used to determine the variation of water table levels. Most of the recharge due to rainfall appears to take place within the first two days of rainfall. After that there is very little variation in the water table level due to rainfall, although there is a slight drop in the level on the fourth and fifth day, presumably due to the escape of entrapped air beneath the water table. (Baker-IVI)
W85-00359

APPLICATION OF A MICROCOMPUTER IN THE ANALYSIS OF PUMPING TEST DATA IN CONFINED AQUIFERS,
Water Surveys (Nigeria) Ltd., Bauchi.
For primary bibliographic entry see Field 4B.
W85-00361

2G. Water In Soils

KARST DEVELOPMENT AND THE DISTRIBUTION OF KARST DRAINAGE SYSTEMS IN DEJIANG, GUIZHOU PROVINCE, CHINA,
Academia Sinica, Beijing (China). Inst. of Geography.
L. Song, Y. Zhang, J. Fang, and Z. Gu.
Journal of Hydrology, Vol. 61, No. 1-3, p 3-17, February, 1983. 5 Fig, 4 Tab.

Descriptors: *Karst hydrology, *Drainage systems, *China, *Dejiang, *Guizhou Province, Subsurface drainage, Geologic fractures, Groundwater.

The development and distribution of karst and underground drainage systems in the Dejiang Town and Shaqi areas are controlled by geologic structure, lithology, erosive and corrosive base level, history of geomorphologic evolution, hydrologic conditions and neotectonic movement. Karst features such as valleys, depressions, sinkholes and tunnels and the main courses of the subterranean drainage systems are distributed along the regional faults and the axial part of the folds. In the dolomite and dolomitic limestone terranes, underground passages have narrow fissure shapes and surface karst features are rare, but in limestone areas both surface and subsurface features are well developed. After the Cretaceous and especially the neotectonic era, intermittent movements created different levels of surfaces and caves with different ages, the older situated at higher altitudes. The gradient of underground drainage systems is similar to the slope of the land. Longitudinal profiles underground are convex. Controlled by geologic structure and neotectonic movements, the Naoshuiyan underground system has developed recently more rapidly than the Lengshuiyan system. Thus, the Naoshuiyan system has been capturing the Lengshuiyan system and the subsurface water-shed has migrated to the north. (Baker-IVI)
W85-00001

RADIATION AND ENERGETIC EXCHANGES AND THERMAL BALANCE OF THE SOIL IN THE JAMES BAY AREA (LES ECHANGES RADIATIFS ET ENERGETIQUES ET LE BILAN THERMIQUE DU SOL EN JAMESIE),
V. P. Singh, R. Taillefer, and J. Poitevin.
Canadian Geotechnical Journal, Vol. 21, No. 2, p 230-240, May, 1984. 11 Fig, 6 Tab, 38 Ref.

Descriptors: *Energy, *Radiation, *Soil water, *James Bay, Frost, Seasonal variation, Ground temperature, Temperature effects, Snow cover, Soil physical properties.

Detailed and regular measurements of the radiation and energy balances and of the thermal and water regimes of the soil to a depth of 5 m were conducted from August 1979 to August 1980 in an open pine forest near Lake Helene, James Bay. The results derived from these measurements indicate that temperature conditions and thus seasonal frost in the ground are explainable in terms of radiative and heat energy exchanges near the surface, of the physical properties of the soil, of snow accumulation, and of water concentrations and movements in the soil. (Author's abstract)
W85-00142

USE OF TEMPE CELL, MODIFIED TO RESTRAIN SWELLING, FOR DETERMINATION OF HYDRAULIC CONDUCTIVITY AND SOIL WATER CONTENT,
Department of Agriculture, Lethbridge (Alberta). Research Station.
T. G. Sommerfeldt, G. B. Schaalje, and W. Hulstein.
Canadian Journal of Soil Science, Vol. 64, No. 2, p 265-272, May, 1984. 3 Fig, 2 Tab, 9 Ref.

Descriptors: *Permeability coefficient, *Soil water content, *Tempe cells, *Swelling, Subsurface drainage, Permeameters, Pore size, Soil types, Soil water suction.

Saturated hydraulic conductivity (K) and volumetric soil water content (theta), at different levels of suction, must be known when designing subsurface drainage systems. A pressure cell, called the Tempe cell, modified by others to determine K, was further modified to restrain swelling of the soil and to facilitate air and water movement across the top and bottom of the sample. This method simulates the lateral and vertical restraints present under field condtions. If swelling is restrained, pore geometry is altered. An apparatus was developed whereby K and theta could be determined for several soil samples concurrently and suction levels could be varied without disturbing the sample. K and theta were determined for several prepared soil samples by the constant head permeameter method and by the Tempe cell with and without swelling restrained, and for soil cores by the Tempe cell with swelling restrained. With swelling restrained, the K results from the prepared samples did not differ significantly from those of the core samples. For the sandy to silty loam soils at suction levels 0, 10, and 20 kPa, theta of the core sample was less than that from the other samples, whereas for the clay loam soils, theta of the core sample was less than that from the others at suction levels of 0 and 10 kPa. For all methods, theta was correlated to clay content of the soil. The Tempe cell, as finally modified with swelling restraints, can be used to determine K and theta for characterizing the drainability of a non-structured to weakly structured soil, using either prepared samples or cores. (Collier-IVI)
W85-00155

EFFECT OF WATER TABLE DEPTH IN ORGANIC SOIL ON SUBSIDENCE AND SWELLING,
Department of Agriculture, Saint-Jean (Quebec). Research Station.
J. A. Millette, and R. S. Broughton.
Canadian Journal of Soil Science, Vol. 64, No. 2, p 273-282, May, 1984. 6 Fig, 3 Tab, 22 Ref.

Descriptors: *Water table, *Subsidence, *Swelling, *Organic soils, Density, Oxidation, Drainage, Carrots.

Organic soil subsidence occurs rapidly after initial drainage and subsequent cultivation. The subsidence process is mainly related to drainage depth, as well as organic soil thickness, bulk density, and other factors. The effects of two water table depths (WTD), 0.6 and 0.9 m below the soil surface, on subsidence, subsidence rate, and swelling of an organic soil were observed in large undisturbed cores under greenhouse conditions. Measurements were made in two tiers, 0-0.3 m (top tier) and 0.3 m to WTD (bottom tier) during the growth of a carrot crop with WTD as above, and continued following a rise in the water table. The WTD of 0.9 m caused the top tier to subside twice as much as the same tier in the 0.6 m WTD. Top tier subsidence seemed irreversible in both WTD because minor swelling was observed following a rise in the water table. Most of the reversible subsidence occurred in the bottom tier. Raising the water table reduced the total profile subsidence by 36 and 24% for the 0.6 and 0.9 m WTD, respectively. After correction for oxidation, subsidence accounted for 3.2 and 5.9% of the 0.6- and 0.9-m profiles, respectively. The bulk density increase in the 0.6-m profile before and after the end of the experiment was not significant but a significant increase of 11% was measured in the 0.9-m profile. Subsidence rate decreased in both tiers during the growing period reaching a minimum in both WTD at harvest time. The subsidence rate in the 0.9-m profile at 100 days after seeding was 2.5 times the rate in the 0.6-m profile. (Collier-IVI)
W85-00156

QUANTITATIVE EXPRESSION OF FUNCTION FOR REMOTE INDICATION OF SOIL MOISTURE,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
B. V. Vinogradov.
Doklady Biological Sciences, Vol. 272, No. 1-6, p 505-508, September, 1983. 1 Fig, 4 Ref. Translated from Doklady Akademii Nauk SSSR, Vol. 272, No. 1, p 247-250, September, 1983.

Descriptors: *Soil water, *Remote sensing, *Mathematical equations, Spectral analysis, Luminosity, Water supply development.

The mathematical description of the connection between the coefficient of spectral luminosity and soil moisture is presented. Experimental investigations on loamy achromatic soil demonstrated the complex nonlinear character of the relation between the coefficient of spectral luminosity (p) in the visible region of the spectrum and the moisture (w) of the 0-2 surface soil horizon. A universal equation was formulated which for the first time yields a quantitative expression of the p(w) dependence over the entire range of soil moisture and reflects the phase state of the moisture in the soil. This makes it possible to extrapolate widely the remote indicators of soil moisture, to minimize the learning sample, and to construct rapid calibration curves of p(w) for the changing natural and technical conditions of a survey. (Baker-IVI)
W85-00158

RESISTANCES TO WATER FLOW THROUGH THE SOIL-PLANT SYSTEM,
Soil and Irrigation Research Inst., Pretoria (South Africa).
For primary bibliographic entry see Field 2I.
W85-00216

TIME-DOMAIN REFLECTOMETRY: SIMULTANEOUS MEASUREMENT OF SOIL WATER CONTENT AND ELECTRICAL CONDUCTIVITY WITH A SINGLE PROBE,
Agricultural Research Service, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 7B.
W85-00220

PROGRAM HVRLV1 - INTERACTIVE DETERMINATION OF HORIZONTAL PERMEABILITIES WITHIN UNIFORM SOILS FROM FIELD TESTS USING HVORSLEV'S FORMULAE,
National Hydrology Research Inst., Calgary (Alberta). Ground Water Div.
K. U. Weyer, and W. C. Horwood-Brown.
Ground Water, Vol. 20, No. 3, p 289-297, May-June, 1982. 6 Fig, 4 Tab, 1 Ref.

Descriptors: *Permeability coefficient, *Computer models, *HVRLV1, Soil water, Slug tests.

A computer program is presented for interactive, user oriented calculation of permeabilities from slug tests using Hvorslev's formulae for filters in uniform soil. The analysis scheme is cost efficient and allows for simple sensitivity analyses. The program HVRLV1 applies to field conditions where the well point filter is installed in uniform soil. Three basic methods for permeability determination are considered: the constant head method, the variable head method, and the basic time lag method. Assumptions include: soil at filter intake; infinite depth and directional isotropy; no disturbance, segregation, swelling or consolidation of the soil; no air or gas entrapped in soil, well point or pipe; hydraulic losses in pipes, well point or filter negligible; and no sedimentation or leakage. (Baker-IVI)
W85-00312

RELATIONSHIPS BETWEEN SATURATED HYDRAULIC CONDUCTIVITY AND SOME PHYSICAL AND CHEMICAL PROPERTIES,
Department of Agriculture, Lethbridge (Alberta). Irrigation Div.
M. J. Hendry, and B. A. Paterson.
Ground Water, Vo. 20, No. 5, p 604-605, September-October, 1982. 2 Tab, 3 Ref.

Descriptors: *Permeability coefficient, *Soil properties, *Irrigation, Estimating, Permeability, Soil chemistry, Soil physical properties.

Possible relationships between measured saturated hydraulic conductivity and physical and chemical parameters could be found which would aid in estimating the irrigation potential of soil. Physicochemical parameters employed included: depth below ground at which the sample was collected or at which the measurement was made, texture, saturation percentage, bulk density, electrical conductance and the sodium adsorption ratio of the soil. Saturated vertical hydraulic conductivity was measured in the field at 1094 sites using a single ring infiltration method and on 995 undisturbed soil cores in the lab using the constant-head permeameter method. It was concluded that any attempt to use the independent parameters identified in this technical note to estimate either laboratory or field hydraulic conductivity values will likely produce erroneous results. Additional parameters are needed. (Baker-IVI)
W85-00339

2H. Lakes

EFFECTS OF BRYOPHYTES ON SUCCESSION FROM ALKALINE MARSH TO SPHAGNUM BOG,
Michigan State Univ., Hickory Corners. W.K. Kellogg Biological Station.
J. M. Glime, R. G. Wetzel, and B. J. Kennedy.
The American Midland Naturalist, Vol. 108, No. 2, p 209-223, October, 1982. 3 Fig, 3 Tab, 40 Ref.

Descriptors: *Marshes, *Bogs, *Mosses, *Succession, *Sphagnum, *Lawrence Lake, *Michigan, Marl, Sediments, Bryophytes, Aquatic plants, Calcium.

The alkaline eastern marsh of Lawrence Lake, a marl lake in southwestern Michigan, was sampled by randomly placed line transects to determine the bryophyte cover and corresponding vascular plant zones. Cluster analysis indicated three distinct bryophyte zones designated as: Drepanocladus/Brachythecium, Campylium/Drepanocladus, Campylium/Drepanocladus/Fissidens. These zones correspond with the recognized vascular plant zones cattail/sedge and rose/cattail/sedge, cattail/sedge/Potentilla, and upland Potentilla, respectively. Mosses occupied over 50% of the surface in some areas. Initial calcium ion concentration in marsh water used was 99.3 mg/liter. Both green and brown moss portions significantly lowered calcium ion concentration in both light and dark. Green moss portions were significantly more effective than brown in both light and dark. Specific conductance of marsh water used was 906 micromho/cm. Specific conductance of marsh water was lowered significantly following incubation of mosses. Brown senescent moss portions had significantly less effect on conductance than active green portions, except in Sphagnum. Invasion of Sphagnum, vertical zonation of the mosses on hummocks, zonation with distance from the lake, the abundance of non-Sphagnum moss hummocks, and the ability of the non-Sphagnum species to lower the pH of marsh water during laboratory incubations are evidence that non-Sphagnum mosses facilitate succession from alkaline marsh to Sphagnum bog. (Baker-IVI)
W85-00088

STUDIES ON LEBANESE STREAMS: THE BIOLOGICAL ZONATION OF THE NAHR QAB ILIAS (CONTRIBUTION A LA CONNAISSANCE DES COURS D'EAU DU LIBAN: LA ZONATION BIOLOGIQUE DU NAHR QAB ILIAS),
Lebanese Univ., Beirut. Faculty of Sciences.
N. J. Alouf.
Annales du Limnologie, Vol 19, No. 2, p 121-127, 1983. 1 Fig, 6 Tab, 6 Ref.

Descriptors: *Lebanon, *Nahr Qab Ilias, *Aquatic animals, Invertebrates, Insects, Plecoptera, Diptera, Ephemeroptera, Mountain streams.

Intermittent and permanent parts of the Nahr Qab Ilias, a chalky stream, are studied. Climatological, hydrogeological, hydrographic and biological data are given. The stream is divided into three sectors. Almost all of the fauna of the montaine section is composed of insects which withstand the dryness of summer by one means or another. The Plecotera dominate the upper part. The annual pattern of flow does not permit other insects to survive. The montaine zone is the refuge of Plecoptera, or any other macroinvertebrates not provided with rivals, except Diptera with rapid growth. The submontaine sector is characterized by the relative stability of the flow throughout the year. Thus colonization by other groups of insects is possible. The Ephemeroptera dominate in the lower part. The division of the hydrographic basin of the Qab Ilias into different sections, as a function of altitude, is comparable, in certain respects, to the biological zonation observed in Europe. (Moore-IVI)
W85-00093

SULFATE REDUCERS CAN OUTCOMPETE METHANOGENS AT FRESHWATER SULFATE CONCENTRATIONS,
Michigan State Univ., Hickory Corners. W.K. Kellogg Biological Station.
D. R. Lovley, and M. J. Klug.
Applied and Environmental Microbiology, Vol. 45, No. 1, p 187-192, January, 1983. 2 Fig, 3 Tab, 20 Ref.

Descriptors: *Lake sediments, *Eutrophication, *Bacteria, *Sulfates, Oligotrophic lakes, Methanogens, Anaerobic conditions, Sulfate-reducing bacteria.

Since the inability to adequately sample the most active sulfate reducing zone in eutrophic sediments may have resulted in an underestimate of the ability of sulfate-reducing bacteria (SRB) to compete with methanogenic bacteria (MB) in freshwater, the interactions between the two populations were investigated in the sediments of an oligotrophic lake in which the sulfate gradient in the sediments was less steep. Inhibition of sulfate reduction with molybdate stimulated methane production from both hydrogen and acetate. Molybdate did not stimulate methane production in sediments that were preincubated to deplete the sulfate pool. Sulfate reduction accounted for 30 to 81% of the total of terminal metabolism proceeding through sulfate reduction and methane production in Eckman grab samples of surface sediments. The ability of sulfate reducers to effectively compete with methanogens for acetate was related to the sulfate reducers' lower half-saturation constant for acetate metabolism at in situ sulfate concentrations. Processes other than sulfate reduction and methanogenesis consumed hydrogen at elevated hydrogen partial pressures and prevented a kinetic analysis of hydrogen uptake by sulfate reducers and methanogens. The demonstration that sulfate reducers can successfully compete with methanogens for hydrogen and acetate in sediments at in situ sulfate concentrations of 60 to 105 microM extends the known range of sediment habitat in which sulfate reduction can be a dominant terminal process. SRB have the potential to be the dominant acetate and hydrogen consumers in the surface sediments of freshwater lakes. (Baker-IVI)
W85-00098

PRODUCTION AND CONSUMPTION OF HYDROGEN IN A EUTROPHIC LAKE,
Max-Planck-Inst. fuer Chemie, Mainz (Germany, F.R.).
R. Conrad, M. Aragno, and W. Seiler.
Applied and Environmental Microbiology, Vol. 45, No. 2, p 502-510, February, 1983. 6 Fig, 44 Ref.

Descriptors: *Hydrogen, *Eutrophic lakes, *Lake Loclat, *Switzerland, Vertical distribution, Sediments, Lake sediments, Mineralization, Decomposing organic matter, Stratification.

The vertical distribution of hydrogen was measured in the Loclat, a eutrophic and holomictic lake near Neuchatel, Switzerland, before and during summer stratification. Hydrogen concentrations decreased with depth in the anaerobic hypolimnion and were often below the detection limit in the water adjacent to the lake sediment. Highest hydrogen concentrations were noted in the aerobic water of the epilimnion and metalimnion. The possible role of cyanobacteria and algae for hydrogen production is discussed. Aerobic or anaerobic hydrogen consumption activities were noted at all depths of the water column, with highest activities in the hypolimnion. Aerobic hydrogen consumption activity was insensitive to azide inhibition, but sensitive to heat, mercuric chloride, or cyanide. Aerobic hydrogen-oxidizing bacteria may play a role in the control of hydrogen escaping from particles into the free lake water. Whereas the free water usually contained less than 4 micro l of H/l, much higher hydrogen concentrations may locally arise on particles large enough to constitute microsites for anaerobic decomposition of organic matter. (Baker-IVI)
W85-00104

LIMNOLOGICAL STUDY OF LAKE RANCO (CHILE); MORPHOMETRY, PHYSICS, CHEMISTRY AND PLANKTON,
Universidad Austral de Chile, Valdivia. Inst. de Zoologia.
H. Campos, J. Arenas, W. Steffen, C. Roman, and G. Aguero.
Archiv fur Hydrobiologie, Vol. 94, No. 2, p 137-171, July, 1982. 15 Fig, 6 Tab, 35 Ref. Research Fund of the Univ. Austral de Chile grant S-80-23.

Descriptors: *Limnology, *Plankton, *Lake Ranco, *Chile, *Morphometry, Seasonal variation, Stagnation, Oligotrophic lakes, Zooplankton, Mountain lakes, Rainfall, Silica, Nutrients, Snowmelt, Rainfall runoff.

Lake Ranco lies in the pre-Andean mountain range with a surface altitude of 69 m. Ranco is a temperate, monomictic, oligotrophic lake with a period of winter circulation and one of summer stagnation. The physical and chemical parameters of the lake were studied over one year's cycle. Lake Ranco contains small amounts of orthophosphate and nitrate. The quality and quantity of phytoplankton were analyzed. The physicochemical factors present seasonal fluctuations principally due to high winter pluviosity (2400 mm a year) and to the spring-summer radiation. The amount of silica is high in Lake Ranco, similar to that existing in oligotrophic lakes with hard waters, averaging for the year 11.3 mg/l. The main supply of nutrient seems to come from the influents which are mainly influenced by rains and melted snow. In general the nutrients in oligotrophic lakes present orthograde distributions. Of the 90 phytoplankton species identified, only seven are periannuals. (Baker-IVI)
W85-00108

NITROGEN CYCLE OF LAKE VECHTEN (THE NETHERLANDS); ROLE OF SEDIMENTATION,
Limnologisch Inst., Nieuwersluis (Netherlands).
H. Verdouw, and E. M. J. Dekkers.
Archiv fur Hydrobiologie, Vol. 94, No. 2, p 251-263, July, 1982. 3 Fig, 6 Tab, 17 Ref.

Descriptors: *Nitrogen cycle, *Sedimentation, *Lake Vechten, *Netherlands, Particulate matter, Nitrogen, Transport, Seasonal variation, Stratification.

Sedimentation was measured in Lake Vechten during three year cycles to evaluate the role of downward transport of particulate matter in the nitrogen cycle. Besides seasonal patterns, horizontal and vertical variations in sedimentation were measured, revealing a funnel effect together with transport of particulate material along the lake's edge. The total nitrogen sedimentation at 8 m depth during the stratification period was calculated using correction factors for the edge effect caused by the consequent transport of particulate material along the lake bottom. The greatest rate of sedimentation occurred during spring and autumn, lowest during the winter. Average sedimentation rates during the stratification period also differed considerably in different years. Sedimentation of particulate material appeared to be an important element in the nitrogen cycle of the lake, as the amount of nitrogen sedimenting through the 8 m plane during stratification roughly equalled the total nitrogen content of the overlying water layers. (Baker-IVI)
W85-00109

CONTEMPORARY SEDIMENTARY ENVIRONMENTS ON BAFFIN ISLAND, N.W.T., CANADA: RECONNAISSANCE OF LAKES ON CUMBERLAND PENINSULA,
Queen's Univ., Kingston (Ontario). Dept. of Geography.
R. Gilbert, and M. Church.
Arctic and Alpine Research, Vol. 15, No. 3, p 321-332, August, 1983. 8 Fig, 2 Tab, 33 Ref. Canadian Dept. of Energy, Mines and Resources grant EMR 4-227/76.

Descriptors: *Glacial sediments, *Lake sediments, *Baffin Island, *Northwest Territories, Zooplankton, Cumberland Peninsula, Limnology, Varves, Iron, Redox conditions, Seasonal variation.

Studies were made of four lakes receiving significant quantities of glacial sediment and of five lakes receiving no glacial sediment. All waters contain less than 10 mg/l dissolved sediment, with highest values in the glacial lakes where ion scavenging can occur from fine suspended sediment. Zooplankton abundance and total carbon content of sediments are an order of magnitude higher in the nonglacial lakes. Shallow box cores were taken in order to study the recent sediments. Two distinct sedimentary environments are represented in the lake sediments: one dominated by higher energy, largely physical processes such as turbidity current flow, and another where chemical processes governed principally by oxidation/reduction conditions prevail. In the former, which occurs in both glacial and nonglacial lakes, periodic high sediment inflow associated with glacial or nival melt, or with summer precipitation, produces distinct laminae. The coarse laminae were supposedly deposited from the inflowing glacial streams which continued through the lake intermittently as underflows or possibly interflows. Although they contain less than 10% sand, grading and load structures indicate that these beds were probably deposited from underflows or interflows in the lake. Iron bands containing up to 39% by weight iron form where sedimentation occurs slowly and continuously under redox conditions which change as deposition occurs. Despite a very pronounced difference between winter and summer inflow to the lakes, varves could not be recognized in any of the sediments. (Baker-IVI)
W85-00110

E OF WATER BOATMEN (CORIXIDAE) IN E CLASSIFICATION OF LAKES,
Crewe and Alsager Coll. of Higher Education, Alsager (England).
A. A. Savage.
Biological Conservation, Vol. 23, No. 1, p 55-70, May, 1982. 8 Fig, 26 Ref.

Descriptors: *Lake classification, *Invertebrates, *Corixidae, *Scotland, *England, *Wales, Conservation, Conductivity, Distribution.

Data on populations of Corixidae in 55 water bodies in England, Scotland and Wales, are considered. There is a significant correlation between the distribution of each of six species of Corixidae and the conductivity of water bodies. Two species, S. scotti and S. concinna, are confined to waters of low and high conductivity respectively. S. falleni and C. praeusta tend to occur in water bodies of intermediate size and high conductivity; the former being more numerous. S. distincta occurs in ponds and lakes of relatively low conductivity but is replaced by S. scotti at very low conductivity. S. dorsalis is found at all but the lowest conductivities but tends to be replaced by S. falleni in water bodies of high conductivity and intermediate size. The comparisons of the relative numbers of the six species give an indication of the biological differences between a series of water bodies and therefore may be useful in planning programs of conservation. (Baker-IVI)
W85-00119

ECOLOGICAL SURVEY OF STANDING WATERS IN NORTH WEST AFRICA: II. SITE DESCRIPTIONS FOR TUNISIA AND ALGERIA,
Station Biologique de la Tour du Valat, Arles (France).
N. C. Morgan.
Biological Conservation, Vol. 24, No. 2, p 83-113, October, 1982. 2 Tab, 29 Ref.

Descriptors: *Standing waters, *Wetlands, *Ecology, *Tunisia, *Algeria, North West Africa, Lakes, Oases, Chotts, Sebkhets, Invertebrates, Waterfowl, Aquatic plants.

Outline ecological descriptions are given for 39 standing water sites visited in Tunisia from 5-20 May 1976 and Algeria, north of the Sahara, from 18 January to 3 February 1977. The study incorporates physical data, aquatic vegetation, invertebrates and waterfowl. An assessment is made of the conservation value of each site. The sites were chosen to provide a range of major standing water types from permanent freshwater to temporary saline chotts. Sites were primarily of a Mediterranean climate. The chotts consisted of a series of large shallow depressions stretching east-west along the northern extremity of the Sahara which were lakes during the Pleistocene pluvials and in some cases are below sea level. The unvegetated sebkhets lie to the north of the arid zone of the chotts, where the ratio evaporation:precipitation ranged from 2.3 to 4.2 for the sites sampled. They form shallow pans with clay/silt bottom and are seasonal with eu-hyperhaline water conditions. The distribution of the vegetated sebkhets is similar to that of the unvegetated sebkhets, being very shallow, seldom exceeding 1 m in water depth, and having a clay/silt and/or sandy substrate. Sites also included oases, freshwater mountain lakes, oligohaline lowland lakes, and shallow lakes. (Baker-IVI)
W85-00122

ECOLOGICAL SURVEY OF STANDING WATERS IN NORTH WEST AFRICA: III. SITE DESCRIPTIONS FOR MOROCCO,
Station Biologique de la Tour du Valat, Arles (France).
N. C. Morgan.
Biological Conservation, Vol. 24, No. 3, p 161-182, November, 1982. 1 Tab, 20 Ref.

Descriptors: *Standing waters, *Morocco, *Ecology, Aquatic plants, Invertebrates, Conservation, Waterfowl, Sebkhets, Lakes, Mountain lakes, Marshes, Wetlands, Marine wetlands, Seasonal variation, Salinity.

Outline ecological descriptions are given for 24 standing waters in Morocco incorporating physical data, aquatic vegetation, invertebrates, and waterfowl. An assessment is made of the conservation value of each site. The vegetated sebkhets comprise a group of shallow mixohaline waterbodies in which the salinity may range higher for short periods in the summer prior to seasonally drying out. They have clay silt or sandy bottoms and the salinity is low enough to allow the growth of several macrophyte species. Seasonal mesohaline wetlands dry out in the summer and showed similar physical and biological characteristics. They resemble some of the vegetated sebkhets in being coastal, and separated from the sea by a dune system. The principal source of water is the winter flooding of oueds, and they are thus fed by fresher water and less saline in character. The freshwater mountain lakes are all high altitude lakes above 1000 m of moderate size up to 250 ha. They are generally considerably deeper than the other water bodies sampled, up to a maximum of 100 m, and are fed by impermanent rivers and/or groundwater. The water is fresh, highly calcareous and permanent and the average ratio annual evaporation/rainfall does not exceed 1.5. The littoral substrate is variable but stones were present in eight of these sites, whereas they were only found in four others. Also sampled were seasonal marshes, and marine wetlands. (Baker-IVI)
W85-00123

RESPONSE OF FISHES TO PERIODIC SPRING FLOODS IN A SOUTHEASTERN STREAM,
University of Southern Mississippi, Hattiesburg. Dept. of Biology.
S. T. Ross, and J. A. Baker.
American Midland Naturalist, Vol. 109, No. 1, p 1-14, January, 1983. 6 Fig, 1 Tab, 44 Ref.

Descriptors: *Fish behavior, *Floodplains, *Floods, Population dynamics, Species diversity, Seasonal variation, Diurnal variation, Turbidity.

Periodic flooding is characteristic of most lotic systems. Nondestructive floods occur in low gradient systems in which floods are characterized by lateral expansion rather than increases in depth. Natural fringing floodplains may be seasonally inundated. Movement of fishes onto a fringing floodplain was studied by seining and trapping during five spring floods. Twenty-six species of fish were collected from the inundated foodplain. The known channel fauna is 42 species. Species numerically dominant on the floodplain were Fundulus olivaceus, F. notti, Gambusia affinis, Notropis welaka, N. texanus, N. roseipinnis, Lepomis macrochirus, L. cyanellus and L. marginatus. The number of fish taken per try was generally the greatest on the upper floodplain during the day and greatest nearer the channel at night. Night activity of fishes on the floodplain was apparently low. Several species were common in the channel but did not exploit the floodplain. Activity of P. nigrofasciata was negatively correlated with flood-induced turbidity. A flood-exploitative species, Notropis texanus, had higher population abundance during 3 high-flow years than in 3 low-flow years, suggesting that the fish in Black Creek may be controlled in part through structural habitat suitability and in part through stochastic events such as the intensity of spring flooding. It is apparent that each species responds differently to these factors. (Baker-IVI)
W85-00130

INTEGRATION OF FOREST AND LAKE FERTILIZATION: TRANSPORT AND TRANSFORMATIONS OF FERTILIZER ELEMENTS,
British Columbia Ministry of Environment, Vancouver. Fish and Wildlife Branch.
For primary bibliographic entry see Field 5G.
W85-00147

DISTRIBUTIONS OF FERROUS IRON AND SULFIDE IN AN ANOXIC HYPOLIMNION,

Lamont-Doherty Geological Observatory, Palisades, NY.
R. B. Cook.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 2, p 286-293, February, 1984. 3 Fig, 4 Tab, 53 Ref. NSF grants OCE-78-20898, DAR-79-17291 and DEB-80-17639.

Descriptors: *Hypolimnion, *Ferrous iron, *Sulfides, *Diagenesis, *Experimental Lakes Area, *Ontario, Sediment-water interfaces, Interstitial water, Iron, Lake sediments, Eutrophic lakes, Anaerobic conditions.

Equilibrium processes control the Fe(2+) and sigma-H2S concentrations in the water column and pore water of an anoxic hypolimnion. Measurements of the solid phase chemistry of the sediments may determine if the species predicted to have been formed on the basis of equilibria were actually present and may verify diagenetic changes. In 1979, water samples were collected from over the deepest part of an experimentally eutrophied lake, Lake 227 of the Experimental Lakes Area near Kenora, Ontario. In the anoxic hypolimnion, sigma-H2S exhibits a mid-depth maximum (15-22 micro mol/l, summer) while Fe(2+) increases with depth (650 micro mol/l, summer; 200 micro mol/l, winter). At the mid-depth sigma-H2S maximum and below, saturation with respect to amorphous FeS is reached, and the concentration of sigma-H2S is limited by the high Fe(2+) concentrations, in accord with the FeS solubility product. Values for pKsp (solubility product constant) for FeS determined from the sigma-H2S maximum and below averaged 3.16 in 1979. Sediment pore water samples were taken in the top 10 cm of sediment; pore water sigma-H2S and Fe(2+) are in equilibrium with amorphous FeS. Analyses of sediment sample cores confirms the existence of an iron sulfide phase. Fe(2+) increases to concentrations at which siderite may form, although the presence of siderite has not been verified. In the anoxic hypolimnion about 90% of the observed flux originates at the sediment-water interface, while the remainder is derived from pore water flux. (Collier-IVI)
W85-00149

CONTRIBUTION OF PARTICULATE PHOSPHORUS (> 250 MICRO M) TO THE TOTAL PHOSPHORUS POOL IN LAKE WATER,
Alberta Univ., Edmonton. Dept. of Zoology.
E. E. Prepas, and J. Vickery.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 2, p 351-363, February, 1984. 7 Fig, 1 Tab, 23 Ref, 3 Append.

Descriptors: *Alberta, *Phosphorus, *Lakes, *Particle size, Cycling nutrients, Euphotic zone, Productivity, Chlorophyll, Epilimnion, Hypolimnion, Thermal stratification, Mixing.

Previous studies have presented conflicting data on the importance of large particles to the total phosphorus pool of lakes. Particulate phosphorus (PP) > 250 micro m was concentrated in the euphotic zone of 17 lakes studied over a three year period in central Alberta. When the euphotic zone extended below the epilimnion, PP > 250 micro m was concentrated deep in the euphotic zone. PP > 250 micro m was a significant but variable portion of the total phosphorus (TP) pool in individual lakes. The contribution of this fraction varied among lakes: average summer values for the euphotic zone range from 3 to 19%. Among lakes, the contribution of large particles to the TP pool decreased proportionally as lake productivity (estimated by chlorophyll a (Chl-a)) increased. The relative contribution of PP > 250 micro m in summer accounted for a significant portion of the residual variation in the spring TP-summer Chl-a relationship but not the summer TP-summer Chl-a relationship in the study lakes. These apparently contradictory results can be explained by differences between lakes that mixed intermittently throughout the summer and those that remained permanently thermally stratified during this time. (Collier-IVI)
W85-00151

EMPIRICAL PREDICTION OF CRUSTACEAN ZOOPLANKTON BIOMASS AND PROFUNDAL MACROBENTHOS BIOMASS IN LAKES,
McGill Univ., Montreal (Quebec). Dept. of Biology.
J. M. Hanson, and R. H. Peters.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 3, p 439-445, March, 1984. 2 Fig, 4 Tab, 57 Ref.

Descriptors: *Biomass, *Lakes, *Productivity, *Macrobenthos, *Zooplankton, Chlorophyll a, Littoral zone, Phosphorous, Crustaceans, Nutrients, Benthos, Lake morphometry.

Changing nutrient levels and other factors are related to lake biomass and productivity. Data on 33 North American, 14 European, and two African lakes was taken from the literature to develop and compare several estimators of crustacean zooplankton biomass and profundal macrobenthos biomass. Parameters utilized were mean total phosphorus concentration, mean chlorophyll-a concentration, Secci depth, mean depth, maximum depth, lake surface area, mean crustacean zooplankton biomass, and mean profundal macrobenthos biomass. Both mean zooplankton biomass and mean profundal macrobenthos biomass correlated better with mean total phosphorus concentration than with Secchi depth, mean depth, maximum depth, or lake surface area. Mean total phosphorus concentration was also superior to mean chlorphyll-a concentration as an estimator of zooplankton biomass, but data were insufficient to evaluate chlorophyll-a concentration as an estimate of macrobenthos biomass. Inclusion of maximum depth as a variable in a multiple regression resulted in a slight but significant improvement in the zooplankton-total phosphorus relationship. Inclusion of lake surface area as a variable in a multiple regression significantly improved the predictive power of the profundal macrobenthos - total phosphorus relationship. Correlations of littoral zone production to lake nutrient levels or morphometry can not be attempted due to a scarcity of data. (Collier-IVI)
W85-00152

PREDICTION OF CHLOROPHYLL A CONCENTRATIONS IN FLORIDA LAKES: IMPORTANCE OF AQUATIC MACROPHYTES,
Florida Univ., Gainesville. Center for Aquatic Weeds.
D. E. Canfield, Jr., J. V. Shireman, D. E. Colle, W. T. Haller, and C. E. Watkins, II.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 3, p 497-501, March, 1984. 2 Fig, 3 Tab, 17 Ref. EPA grant R-905497.

Descriptors: *Chlorophyll a, *Macrophytes, *Florida, *Lake Pearl, Nitrogen, Phosphorus, Trophic level, Phytoplankton, Aquatic weed control, Eutrophic lakes, Nutrients.

Submersed aquatic macrophytes can inhibit the development of phytoplankton and thus may be an important source of the variability in nutrient-chlorophyll regressions which are an accepted tool for estimating the response of lakes to changes in nutrient load rates. Chlorophyll a concentrations in Lake Pearl, Florida, increased as the percentage of the lake's total volume infested with aquatic macrophytes decreased. Using data from 32 Florida lakes, predictions of chlorophyll a concentrations were improved by including a term for the percentage of the lake's total volume infested with macrophytes in existing nutrient-chlorophyll models. The best-fit multivariate regression equation was (log CHLA = 1.02 log TN + 0.28 log TP - 0.005 PVI - 2.08), where CHLA is the chlorophyll a concentration (mg/cu m), TN is the total N concentration (mg/cu m), TP is the total P concentration (mg/cu m) and PVI is the percentage of the lake's total volume infested with macrophytes; this equation assesses the potential effect of aquatic macrophytes on chlorophyll yields and Secchi disc transparencies in lakes of different trophic status. Chlorophyll concentrations in Lake Pearl averaged 12 mg/cu m during a monitoring period; predicted CHLA averaged 9 mg/cu m and were not significantly different from the measured average. The amount of variance in CHLA explained by including a PVA term will depend on the lakes included in the data set; other factors such as zooplankton grazing, nonalgal turbidity, and hydraulic flushing rates may be more important for determining CHLA in some lakes. Aquatic weed control measures may impact CHLA. (Collier-IVI)
W85-00154

SEASONAL VARIATIONS OF DOMINANT PHYTOPLANKTON, CHLOROPHYLL A AND NUTRIENT LEVELS IN THE PELAGIC REGIONS OF LAKE BIWA,
Kyoto Univ., Otsu (Japan). Otsu Hydrobiological Station.
Y. Tezuka.
Japanese Journal of Limnology, Vol. 45, No. 1, p 26-37, January, 1984. 11 Fig, 1 Tab, 37 Ref.

Descriptors: *Seasonal variation, *Phytoplankton, *Chlorophyll a, *Nutrients, *Lake Biwa, *Japan, Transparency, Nitrates, Nitrogen, Phosphorus, Trophic levels, Eutrophication.

In order to clarify the present trophic status of Lake Biwa, the largest, monomictic lake in Japan, seasonal variations of dominant phytoplankton, chlorophyll a and nutrient levels were surveyed for offshore waters of its north (main) and south (subsidiary) basins from February to December 1981. Thermal stratification began to develop in April and was well established in mid summer almost lacking an epilimnion. Practical destratification began to occur in September, and thereafter the depth of the epilimnion increased toward December. Surface water temperature in the south basin followed a similar seasonal pattern to that of the surface water temperature in the north basin but it was somewhat lower than that of the north basin in the coldest month. Secchi disc transparency of the north basin was high in winter, low in spring and autumn, and intermediate in summer; it was low in the south basin throughout the year. Species composition of dominant phytoplankters in the surface water was rather similar in both basins. For all water samples collected from both basins dissolved inorganic phosphorus was below the limit of detection. Total phosphorus concentrations were low in the summer. The annual mean concentration of total phosphorus in the surface water was higher in the south basin than in the north basin. Concentrations of ammonium nitrogen were low compared with nirate plus nitrite nitrogen. Nitrate plus nitrite nitrogen was detected in high concentrations except for three months from August to October in the surface layer of the north basin and the whole layer of the south basin. (Baker-IVI)
W85-00188

PARTITIONING OF HEAVY METALS INTO MINERAL AND ORGANIC FRACTIONS IN SEDIMENTS FROM A RESERVOIR,
Central Research Inst. of Electric Power Industry, Tokyo (Japan).
M. Sakata.
Japanese Journal of Limnology, Vol. 45, No. 1, p 38-43, January, 1984. 2 Fig, 16 Ref.

Descriptors: *Reservoirs, *Sediments, *Japan, *Heavy metals, Minerals, Manganese, Iron, Zinc, Cadmium, Copper, Nickel, Leaching, Sediment size, Storm runoff.

A sediment core was collected from S Reservoir located in the western part of Okayama Prefecture, Japan. Water depth at the sampling station was 5 m. Selective chemical leaching of the core sediment samples enabled the vertical distribution of six heavy metals (Fe, Mn, Zn, Ni, Cu, and Cd) to be determined. The heavy metal content of the core is relatively high in small grain layers. The variations of fine particle percentage and a heavy metal content in the sediment core may be attributed to the occurrence of storms with heavy rainfall which carries larger sizes of sediments. The majority of the Mn and Cd is contained in the NH2OH-HCl soluble fraction (mostly iron and manganese oxide and hydroxide coatings on silicate minerals), whereas more than 50% of the Zn, Ni, and Cu is present in the HF soluble fraction (silicate lattice). Only manganese is significa

ly enriched in the NH2OH-HCl soluble fraction of the settling material collected by the sediment trap near the bottom, probably due to the release of manganese from bottom sediment into overlying water. Manganese oxide and hydroxide reprecipitated under oxic conditions of the bottom water after the release might have been effectively collected by the sediment trap. (Baker-IVI)
W85-00189

SEASONAL FLUCTUATION IN THE NUMBER OF AEROBIC HETEROTROPHIC BACTERIA AND ITS RELATION TO ENVIRONMENTAL FACTORS IN THE UPSTREAM AREA OF THE TAMAGAWA RIVER (IN JAPANESE),
Tokyo Univ. of Agriculture and Technology (Japan). Lab. of Biology.
K. Morikawa.
Japanese Journal of Limnology, Vol. 45, No. 1, p 69-78, January, 1984. 8 Fig, 2 Tab, 21 Ref.

Descriptors: *Seasonal variation, *Rivers, *Bacteria, *Tamagawa River, *Japan, Chlorophyll, Acidity, Dissolved oxygen, Biochemical oxygen demand, Chemical oxygen demand, Nitrates, Nitrogen, Phaeophytin.

Seasonal variations in water temperature, pH, dissolved oxygen, BOD, COD, NO3-N, discharge, amount of chlorophyll a plus phaeophytin, and the number of aerobic heterotrophic bacteria in water were determined in an upstream area of the Tamagawa River in Tokyo, Japan. The number of bacteria in water fluctuated between 3000 and 14000 cells/cu cm. Generally, they were numerous when the discharge was small and vice versa. During flood stage, in spite of huge flow, the bacteria number was large. The periphyton of the river bed exfoliated when the discharge was large, and the amount of chlorophyll a plus phaeophytin a did not increae over 100 mg/sq m. The number of bacteria in periphyton and the amount of chlorophyll a plus phaeophytin a have a high correlation coefficient. The percentage of pigment producing bacteria rose with the increase of chlorophyll a plus phaeophytin a, suggesting a bacterial community relating to the epiphytic algae. After exfoliation of periphyton, the number of bacteria did not decrease as much as the amount of chlorophyll a plus phaeophytin a, suggesting another bacterial community not depending on them. No correlation was noted between the number of bacteria in water and that in periphyton. (Baker-IVI)
W85-00193

NITROGEN BUDGET OF A SUBARCTIC STREAM ALTERED BY BEAVER (CASTOR CANADENSIS),
Woods Hole Oceanographic Institution, MA.
J. J. Naiman, and J. M. Melillo.
Ecology, Vol. 62, No. 2, p 150-155, May, 1984. 3 Fig, 2 Tab, 36 Ref. NSF grant DEB 81-05677.

Descriptors: *Beavers, *Nitrogen, *Nutrient budget, *Beaver Creek, *Quebec, Nitrogen fixation, Ecosystems, Beaver dams, Sediments, Cycling nutrients, Microorganisms, Precipitation, Throughfall, Subarctic streams.

Beaver (Castor canadensis) affect the structure and dynamics of stream ecosystems by transferring organic matter from the terrestrial to the aquatic system and by building dams. To quantify their influence, measured rates of nitrogen dynamics were used to construct a nitrogen budget for a section of a second order stream (Beaver Creek) in western Quebec and a beaver dam in that stream. The budget demonstrates the importance of sediment accumulations and an expanded wetted area to the annual nitrogen economy and to pathways of nitrogen cycling. Major changes after impoundment (per unit area) include a reduction in allochthonous nitrogen and an increase in nitrogen fixation by sediment microbes. In riffles, 83.3% of the annual nitrogen inputs (7.2 g N/sq m) are accounted for by direct allochthonous inputs (79%) or as lateral inputs form the forest floor (4%). In the beaver pond, most of the annual input (7.7 g N/sq m) is accounted for by nitrogen fixation associated with accumulated sediment (92%); direct allochthonous inputs have been reduced to 22.1% and lateral inputs to 1.3% of the budget. Precipitation contributes 9.1%, but throughfall and nitrogen fixation associated with wood are negligible. The turnover time for nitrogen is a slow 72.4 yr. Overall, the beaver-modified section accumulated about 1000 times more nitrogen than before alteration. The ecosystem implications of beaver activity suggest that current concepts of patterns and processes in running waters require modification. (Moore-IVI)
W85-00209

STRUCTURE OF BENTHOFAUNA AGGREGATIONS IN THE LOTIC ENVIRONMENT OF THE RIVER WEL, MAZURIAN LAKE DISTRICT,
Akademia Rolniczo-Techniczna, Olsztyn-Kortow (Poland). Inst. of Hydrobiolgy and Water Conservation.
S. Wielgosz.
Acta Hydrobiologica, Vol. 23, No. 4, p 349-361, 1981. 3 Fig, 5 Tab, 20 Ref.

Descriptors: *Benthic fauna, *Lotic environment, *Poland, *River Wel, Mazurian Lakes, Zoobenthos, Population dynamics, Species diversity, Distribution.

The structure of zoobenthos aggregations in the longitudinal profile of the River Wel was investigated and 63 taxons were identified. Among the identified taxons, 27 forms and morphological groups of Chironomidae, Odontomesa fulva, and Paratrissocladius excerptus were found for the first time in the the Mazurian Lake district. They are rarely found in Polish inland waters. The location of various species suggests considerable differentiation of lotic environments in the River Wel. Differentiation of the taxons at various locations made it possible to classify the stations in the epipothammon zone. On the basis of variability indices the degree of water degradation was evaluated. Fluctuations in numbers and biomass of the benthofauna were described. Young cohorts of Glyptotendipes spp. drifting from the lake had a marked influence on the density of zoobenthos in the river. (Baker-IVI)
W85-00225

FACTORS AFFECTING ALKALINE PHOSPHATASE ACTIVITY IN A LAKE (SHORT-TERMS EXPERIMENTS),
Warsaw Univ. (Poland). Dept. of Environmental Microbiology.
W. Siuda, R. J. Chrost, R. Wcislo, and M. Krupka.
Acta Hydrobiologica, Vol. 24, No. 1, p 3-20, 1982. 4 Fig, 4 Tab, 35 Ref.

Descriptors: *Lakes, *Plankton, *Alkaline phosphatase, Eutrophication, Enzymes, Stagnation, Seasonal variations, Diurnal distribution, Phytoplankton, Bacteria.

The dynamics of alkaline phosphatase activity of plankton in the epilimnion of eutrophic lakes for a day and night cycle during summer stagnation were investigated. Environmental factors which might influence enzymatic hydrolysis of organic phosphorus compounds were studied as well. A great range of variations of physicochemical and biological parameters was discovered during 24 hr when measuring these parameters in 4 hr intervals. The results indicate the existence of complex and subtle mechanisms of circulation and transformation of phosphorus in the waters between algae, environment, and bacteria. A number of factors influencing circulation of phosphorus in the epilimnion undergo significant changes and fluctuations in a day-and-night cycle. The realization of the range of these variations is very useful in helping to estimate the dynamics of seasonal or annual variations. (Baker-IVI)
W85-00226

EFFECT OF WASTE WATER ON CILIATE COMMUNITIES IN THE BIALA PRZEMSZA RIVER,
Jagiellonian Univ., Krakow (Poland). Inst. of Environmental Biology.
A. Czapik.
Acta Hydrobiologia, Vol. 24, No. 1, p 29-37, 1982. 1 Fig, 2 Tab, 14 Ref.

Descriptors: *Rivers, *Bioindicators, *Water pollution effects, *Ciliates, *Biala Przemsza River, *Poland, Industrial wastes, Municipal wastes, Heavy metals, Sulfates.

The Biala Przemsza River is polluted by both municipal and industrial waste waters which also include the salts of heavy metals and sulfates. Two communities containing diverse species of ciliates were identified according to their pollution levels. The common most important species in the biocenosis occurred both in cold and warm seasons, showing that water temperature is not an important factor in population diversity. In the ciliate communities the microphagous ciliates were predominant. Algivorous species were found only where the pollution was decreasing owning to the river's self-purification process. The quality of water was classified as polysaprobic or beta-mezosaprobic according to the location. The ability of some species to serve as pollution level indicators was discussed. (Baker-IVI)
W85-00227

GROUPS OF PELAGIC ZOOPLANKTON IN THREE LAKES OF DIFFERENT TROPHY,
Akademia Rolnicza, Lublin (Poland). Dept. of Zoology and Hydrobiology.
C. Kowalczyk, and S. Radwan.
Acta Hydrobiologia, Vol. 24, No. 1, p 39-51, 1982. 2 Fig, 2 Tab, 27 Ref.

Descriptors: *Zooplankton, *Trophic levels, *Bikcze Lake, *Brzeziczno Lake, *Piaseczno Lake, *Poland, Bioindicators, Cladocera, Rotatoria, Species composition.

In the material collected from three lakes of the Leczna - Wiodawa, Lakeland: Bikcze, Brzeziczno, and Piaseczno, 42 species and forms of Rotatoria, 12 species of Cladocera, and 8 species of Copepoda were found. The predominating species indicate clearly the differentiation of those lakes, especially in the Rotatoria and Cladocera groups. Indicators of ecological importance were calculated on the basis of which characteristic species composition was found for the investigated lakes. For lakes Bikcze and Brzeziczno the species composition consisted of 4 species (Keratella cochlearis, Bosmina coregoni, Eudiaptomus graciloides and Polyarthra vulgaris) and for lake Piaseczno, 5 species were identified (Keratella cochlearis, Conochilus unicornis, Daphnia hyalina, Bosmina coregoni and Eudiaptomus graciloides). The most essential differences between the lakes occurred in the Cladocera group, then in the Rotatoria group. Keratella cochlearis, a species of great ecological valence, shows a high value as an indicator in each investigated lake reaching its highest potential in Lake Piaseczno. (Baker-IVI)
W85-00228

ZONATION OF MAYFLIES (EPHEMEROPTERA) IN SEVERAL STREAMS OF THE TATRA MTS AND THE PODHALE REGION,
Polish Academy of Sciences, Krakow. Zaklad Ochrony Przyrody i Zasobow Naturalnych.
M. Olechowska.
Acta Hydrobiologia, Vol. 24, No. 1, p 63-71, 1982. 2 Fig, 4 Tab, 11 Ref.

Descriptors: *Mayflies, *Tatra Mountains, *Podhale region, *Poland, *Zonation, Larvae, Mountain streams, Seasonal variation, Altitude.

The zonation of mayfly larvae was investigated in four large streams of the Podhale region: Czarny Dunajec, Bialka, Rogoznik and Bystry. Preliminary observation were carried out on the zonation of mayflies in the Waksmundzki stream (High Tatra Mountains)and in the the streams Pysznianski and Koscieliski (Western Tatra Mountains.). In podhale streams, larval communities are unaffected by polution and correspond to zones 1-3 of settlement. In the high-mountain stream Waksmundzki (characterized by difficult environmental conditions) only four species were found. In this

stream mayfly larvae were found only up to an altitude of 1400 m. Their absence above 1400 m may be due to the great seasonal variation in water yield in the upper part of the valley. (Moore-IVI)
W85-00229

RECENT TROPHIC CHANGES IN KOOTENAY LAKE, BRITISH COLUMBIA, AS RECORDED BY FOSSIL DIATOMS,
Department of Fisheries and Oceans, Vancouver (British Columbia). Field Services Branch.
G. L. Ennis, T. G. Northcote, and J. G. Stockner.
Canadian Journal of Botany, Vol. 61, No. 7, p 1983-1992, July, 1983. 6 Fig, 2 Tab, 50 Ref.

Descriptors: *Diatoms, *Kootenay Lake, *British Columbia, *Trophic level, Fossils, Eutrophication, Fertilizers, Industrial wastes, Phosphorus, Sedimentation rate, Species diversity, River regulation, Nutrients, Turbidity.

Short sediment cores (ca. 40 cm long) were collected from three locations within Kootenay Lake, B.C., and the occurrence of diatoms within the cores was recorded and analyzed. This analysis of fossil diatoms in the sediments of Kootenay Lake has provided evidence for environmental change as a result of man's activities in the drainage basin. Changes to the trophic status of the lake are related to operation of a phosphate fertilizer plant (beginning in 1953) on the major southern inlet river and to more recent water regulation on both the southern and northern major inlet rivers. Diatom numbers and volumes at the deeper core depths were lowest. Diatom species in the deeper core depths consisted of an assemblage of oligotrophic and eutrophic indicators corresponding to high (but not critically high) phosphorus loading to the lake. Above the 5-cm depth, numbers increased and peaked at the 3-cm depth in samples nearest the south end of the lake. At other locations within the lake, where sedimentation rates were lower, numbers peaked in the top centimeter of sediment. Concomitant with increased phosphorus loading diatom species indicative of oligotrophic conditions such as Cyclotella ocellata declined, while eutrophic indicators including Cyclotella glomerata. Melosira granulata v. angustissima, Stephanodiscus spp., Asterionella formosa, and Fragilaria crotonensis increased. Asterionella formosa and Fragilaria crotonensis showed highest abundances in the top 2 cm of the core. These species, which form a major component of the spring and fall diatom blooms, were responding to both increased nutrients and improved light conditions resulting from decreased freshet turbidity. The Araphidineae/Centrales ratio was not useful in classifying trophic changes in Kootenay Lake since numbers of centric diatoms did not decline with nutrient enrichments (although there was a dominance shift from oligotrophic centrics to eutrophic centrics). Shannon-Wiener diversity values remained high throughout the recent history of the lake. (Author's abstract)
W85-00249

IDENTIFICATION OF PHOTOSYNTHESIS-LIGHT MODELS FOR AQUATIC SYSTEMS; I. THEORY AND SIMULATIONS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
B. J. Cosby, and G. M. Hornberger.
Ecological Modelling, Vol. 23, No. 2, p 1-24, May, 1984. 4 Fig, 4 Tab, 38 Ref.

Descriptors: *Photosynthesis, *Solar radiation, *Mathematical models, Simulation, Dissolved oxygen, Mass balance, Extended Kalman filter, Autotrophs, Streams.

The rate of photosynthesis (defined as the rate of oxygen release by photoautotrophs) determines the rate of energy input to an ecosystem. A general procedure is described which uses a noisy series of diel oxygen concentration measurements to test the adequacy of non-linear photosynthesis-light models containing uncertain parameters. The extended Kalman filter (EKF), used with an oxygen mass balance equation and observed stream oxygen concentrations, provides serial estimates of the state (oxygen concentration) and the model parameters. While the expected behavior of the innovations can be derived from theoretical considerations for linear systems, no such theory exists for non-linear systems. Simulated data were used to demonstrate that the theoretical criteria are applicable to non-linear photosynthesis-light models. Five mass balance equations containing photosynthesis-light relationships were each used with five different levels of system and parameter noise to produce 25 time series of oxygen concentration. The procedure was applied repetitively in attempts to identify adequate models for each of these data sets. In 1250 tests of model adequacy there were no Type I errors (failure to accept the correct model as adequate) and the incidence of Type II errors (accepting as adequate an incorrect model) was less than 3%. The EKF estimation procedure is reliable and robust; it should be useful in examining the photosynthesis-light (P-I) relationship in streams. (Moore-IVI)
W85-00268

IDENTIFICATION OF PHOTOSYNTHESIS-LIGHT MODELS FOR AQUATIC SYSTEMS; II. APPLICATION TO A MACROPHYTE DOMINATED STREAM,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
B. J. Cosby, G. M. Hornberger, and M. G. Kelly.
Ecological Modelling, Vol. 23, No. 1/2, p 25-51, May, 1984. 5 Fig, 11 Tab, 18 Ref.

Descriptors: *Photosynthesis, *Solar radiation, *Macrophytes, *Aquatic plants, *Gryde River, *Denmark, Mathematical models, Extended Kalman filter, Dissolved oxygen, Autotrophs.

A recursive estimation technique, the extended Kalman filter (EKF), is used with stream oxygen data to identify photosynthesis-light (P-I) models for the Gryde River. The Gryde river is a small second-order stream in the Jutland peninsula in Denmark. The autotrophic component of the stream is dominated by macrophytes. A detailed account is given of the procedures for establishing operating conditions for the EKF. The utility of the innovations based criteria for model discrimination using data from a natural system is demonstrated. Eight P-I models are examined using twelve sets of data. Application of the innovations-based criteria required athat all of the models be rejected as inadequate for all time periods examined. A posteriori analysis of the models' failures indicated: linear models of the P-I relationship are inadequate for this river; photosaturation was a necessary characteristic of P-I models; static P-I models are inadequate for this river; all models were improved by allowing temporal variation of the photosynthesis parameters. Unlike bulk data estimation techniques, recursive analysis techniques applied to a time series of environmental data provide objective a priori criteria of model adequacy and explicitly recognize uncertainty in the system and observations. (Moore-IVI)
W85-00269

TEMPORAL SUCCESSION IN A DESERT STREAM ECOSYSTEM FOLLOWING FLASH FLOODING,
Arizona State Univ., Tempe. Dept. of Zoology.
S. G. Fisher, L. J. Gray, N. B. Grimm, and D. E. Busch.
Ecological Monographs, Vol. 52, No. 1, p 93-110, March, 1982. 14 Fig, 8 Tab, 67 Ref. NSF grants DEB 77-24478 and DEB 80-04145.

Descriptors: *Succession, *Desert streams, *Flash floods, *Ecosystems, *Sycamore Creek, *Arizona, Algae, Invertebrates, Mayflies, Diptera, Diatoms, Primary productivity, Organic matter, Nitrogen, Phosphorus.

Recovery of a desert stream after an intense flash flooding event is described as a model of temporal succession in lotic ecosystems. A late summer flood in Sycamore Creek, Arizona, virtually eliminated algae and reduced invertebrate standing crop by 98%. Physical and morphometric conditions typical of the preflood period were restored in 2 d and the biota recovered in 2-3 wk. Algal communities responded rapidly and achieved a standing crop of nearly 100 g/sq m in 2 wk. Community composition was dominated by diatoms early in succession and by filamentous greens and blue-greens later. Macroinvertebrates also recolonized denuded substrates rapidly, largely by immigration of aerial adults and subsequent oviposition. Growth and development were rapid and several generations of the dominant mayfly and dipteran taxa were completed during the 1st mo of recovery. Invertebrate dry biomass reached 7.3 g/sq m in 1 mo. Gross primary production (Pg) measured as O2 increased in a similar asymptotic fashion and reached 6.6 g/sq m/d in 30 d. Pg exceeded community respiration (R) after day 5 and Pg/R averaged 1.46 for the remainder of the 2-mo sequence. This ecosystem is thus autotrophic and exports organic matter downstream and by drying, laterally. Uptake of nitrate and phosphorus were proportional to net primary production and exhibited a marked downstream decline in concentration during both light and dark periods. Temporal trajectories of various community and ecosystem attributes are compared with those suggested by Odum (Science 164:262-270, 1969) to be diagnostic of successional status. Agreement was poor in attributes which are especially modified in open, frequently disturbed ecosystems such as streams. (Author's abstract)
W85-00270

IMPORTANCE OF SEDIMENT IN THE GRAZING ECOLOGY AND SIZE CLASS INTERACTIONS OF AN ARMORED CATFISH, ANCISTRUS SPINOSUS,
Washington Univ., Seattle. Dept. of Zoology.
M. E. Power.
Environmental Biology of Fishes, Vol. 10, No. 3, p 173-181, April, 1984. 4 Fig, 1 Tab, 28 Ref.

Descriptors: *Catfish, *Ancistrus, *Stream sediments, *Rio Frijoles, *Panama, Sediments, Algae, Detritus, Fish behavior, Feeding, Seasonal variation.

In the Rio Frijoles of central Panama, many log and rock substrates are mantled with sediment, particularly during the dry season when water levels are low. Armored catfish, Ancistrus spinosus, graze rock and wood substrates and ingest both attached algae and sediment that settles onto substrates. During the dry season, this sediment is organic-rich (18-24% ash-free dry weight), and is derived from decomposing periphyton and vegetation from the surrounding, largely deciduous forest. This sediment is not a food for Ancistrus, and imposes energetic costs. These costs were estimated to be 15-22% of the daily energy budgets of 10 g individuals held under experimental conditions. In the stream, the presence of thick sediment on substrates increases the tendency for small Ancistrus to seek out larger individuals or areas cleared by them. Sedimentation is probably most stressful for Ancistrus in the Rio Frijoles during the dry season. Sediment-free substrate is not in short supply during the rainy season, due to expansion of the habitat and the prevalence of deep, fast-flowing water. (Moore-IVI)
W85-00279

DISTRIBUTIONAL PATTERNS OF SUNFISHES ON THE NEW JERSEY COASTAL PLAIN,
Rutgers - The State Univ., Piscataway, NJ. Dept. of Biological Sciences.
J. H. Graham, and R. W. Hastings.
Environmental Biology of Fishes, Vol. 10, No. 3, p 137-148, April, 1984. 4 Fig, 1 Tab, 53 Ref, 1 Append.

Descriptors: *Sunfish, *Ecological distribution, *New Jersey, *Pine barrens, Hydrogen ion concentration, Acidic waters, Aquatic habitats, Trophic level, Currents, Substrates, Fish food, Embryonic growth stages.

Sunfishes of the genera Lepomis and Enneacanthus are characteristic inhabitants of quiet waters on the New Jersey coastal plain. In southern New Jersey, E. chaetodon and E. obesus are now almost totally restricted to the Pine Barrens region of the Outer

Coastal Plain. In contrast, E. gloriosus is widely distributed. Lepomis gibbosus and L. macrochirus are also widespread, but have established few populations in the more acidic waters of the Pine Barrens. Factor analysis was used to determine underlying patterns of distribution among these 5 species, using 6 habitat variables, measured over 54 collection sites in New Jersey. Two general factors account for 41% of the distributional variation. Habitat variables most strongly associated with factor 1 suggest an underlying trophic gradient (dystrophy to eutrophy) with its associated species. Factor 2 suggests an underlying current-bottom gradient. The basis for the scarcity of Lepomis spp. from acidic waters was explored by examining the olerance of recently hatched embryos to reduced pH. No increase in mortality was observed at pH 4.25 for L. gibbosus eleutheroembryos and pH 4.5 or L. macrochirus eleutheroembryos. The two pecies appear to be poorly suited to dystrophic abitats; young Lepomis are primarily planktivores, a dietary niche that is conspicuously reduced in dystrophic waters. Fish of the genus Enneacanthus glean invertebrates on substrate or egetation, a behavior well suited for dystrophic abitats where most primary and secondary production is associated with aquatic macrophytes and ubstrate. (Author's abstract)
W85-00280

RELIMINARY CLASSIFICATION OF RUNING-WATER SITES IN GREAT BRITAIN ASED ON MACRO-INVERTEBRATE SPEIES AND THE PREDICTION OF COMMUNIY TYPE USING ENVIRONMENTAL DATA,
ak Ridge National Lab., TN. Environmental Sciices Div.
F. Wright, D. Moss, P. D. Armitage, and M. T. urse.
reshwater Biology, Vol. 14, No. 3, p 221-256, ne, 1984. 4 Fig, 11 Tab, 47 Ref.

escriptors: *Invertebrates, *Biological communis, *England, *Scotland, *Wales, *Lotic environent, Rivers, Aquatic environment, TWINSPAN, etrended correspondence analysis, Multiple disminant analysis.

acro-invertebrate species lists were obtained for 3 sites on forty-one river systems throughout eat Britain by qualitative sampling in spring, mmer and autumn. Information on twenty-eight vironmental variables was also collated for each . The sites were ordinated on the basis of their cies content using detrended correspondence lysis (DCA) and classified by two-way indicaspecies analysis (TWINSPAN). Correlation coicients between ordination scores and single enonmental variables indicated that Axis 1 distinshed between types of rivers and Axis 2 reflectvariation along the length of rivers. A preliminy classification of sites into sixteen groups has n proposed, together with a key which allows sites to be classified. Information on the spe- and environmental features which characterize n group is also presented. Multiple discriminant ysis (MDA) was employed to predict the up membership of the 268 sites using the nty-eight environmental variables. 76.1% of were classified correctly. An independent asment of predictive ability using forty test sites ded a 50% success rate. Predictive ability was er for the classification presented in this paper in fifteen additional classifications produced g data from single seasons and/or different nomic treatments. TWINSPAN and MDA e found to be useful approaches to the classifion of running-water sites by their macro-invertte fauna and the prediction of community (as indicated by the occurrence of species in ites comprising the group) using environmenariables. Extension of the scope of the classifin, coupled with the use of additional environal variables to increase predictive ability, is in progress. (Author's abstract)
-00293

CROINVERTEBRATES AND FISH OF A ORADO STREAM DURING A PERIOD OF CTUATING DISCHARGE,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
S. P. Canton, L. D. Cline, R. A. Short, and J. V. Ward.
Freshwater Biology, Vol. 14, No. 3, p 311-316, June, 1984. 1 Fig, 4 Tab, 23 Ref.

Descriptors: *Stream biota, *Invertebrates, *Fish, *Low flow, *Trout Creek, *Colorado, Flow discharge, Drought, Trout, Sucker, Mayflies, Odonata, Ephemeroptera, Species composition.

Severe fluctuations in flow can have adverse effects on the biota of normally permanently flowing streams. During a 2-year study of the fish and macroinvertebrates of Trout Creek, a third-order montane stream, a severe drought in the first year resulted in a temporary cessation of surface flow. Flow was continuous during the second year. During the study, 72 invertebrate taxa were collected in the study area; only 20 were common. Some taxa (e.g. Ophiogomphus severus) exhibited higher density during the drought year, others declined in abundance during low flow (e.g. Baetis spp.) whereas a few (e.g. Tricorythodes minutus) appeared unaffected. Total macroinvertebrate density decreased by 50% during the low flow year compared to the normal flow year. Mayflies were most severely affected, but also exhibited the most dramatic recovery. The collector-gatherer functional feeding group was abundant only during the normal flow year, whereas shredders and predators exhibited increased relative abundance during low flow. Three fish species were collected during the study: brook trout, longnosed sucker and white sucker. Fish populations were severely reduced in the low flow year. Fishes rapidly invaded the area following resumption of normal flow. Regenerated scales, which often indicate environmental stress, were found on many fish in 1979, after the drought year of 1978. (Moore-IVI)
W85-00295

HYDROGEOCHEMISTRY OF BIG SODA LAKE, NEVADA: AN ALKALINE MEROMICTIC DESERT LAKE,
Geological Survey, Menlo Park, CA.
Y. K. Kharaka, S. W. Robinson, L. M. Law, and W. W. Carothers.
Geochimica et Cosmochimica Acta, Vol. 48, No. 4, p 823-835, April, 1984. 9 Fig, 5 Tab, 54 Ref.

Descriptors: *Big Soda Lake, *Nevada, *Chemical analysis, *Saline lakes, *Desert lakes, Alkaline water, Anaerobic conditions, Geochemistry, Meromictic lakes, Meteoric water, Minerals.

Big Soda Lake, located near Fallon, Nevada, occupies an explosion crater rimmed by basaltic debris; volcanic activity apparently ceased within the least 10,000 years. This lake has been selected for a detailed multidisciplinary study that will ultimately cover the organic and inorganic hydrogeochemistry of water and sediments because the time at which chemical stratification was initiated is known (about 1920) and chemical analyses are available for a period of more than 100 years. Detailed chemical analyses of the waters show that the lake is at present alkaline (pH = 9.7), chemically stratified (meromictic) and is extremely anoxic (total reduced sulfur - 410 mg/L as H2S) below a depth of about 35 m. The average concentrations (in mg/L) of Na, K, Mg, Ca, NH3, H2S, alkalinity (as HCO3), Cl, SO4, and dissolved organics (as C) in waters of the upper layer (depth 0 to 32 m) are 8,100, 320, 150, 5.0, < 0.1, < 0.5, 4,100, 7,100, 5,800, and 20 respectively; in the deeper layer (depth 37 to 64 m) they are 27,000, 1,200, 5.6, 0.8, 45, 410, 24,00, 27,500, 6,800, and 60 respectively. Chemical and stable isotope analyses of the waters, delta C-13 and Delta C-14 values of dissolved total carbonate from this lake and surface and ground waters in the area together with mineral-water equilibrium computations indicate that the waters in the lake are primarily meteoric in origin with the present chemical composition resulting from the following geochemical processes: (1) evaporation and exchange with atmosphere, the dominant processes, (2) mineral-water interactions, including dissolution, precipitation and ion exchange, (3) inflow and outflow of ground water and (4) biological activity of macro- and microorganisms, including sulfate reduction in the water column of the deeper layer at a very high rate of 6.6 micro mol/L/day. (Author's abstract)
W85-00297

FACTORS CONTROLLING PRIMARY PRODUCTION IN A HYPERTROPHIC LAKE (HARTBEESPORT DAM, SOUTH AFRICA),
National Inst. for Water Research, Pretoria (South Africa).
R. D. Robarts.
Journal of Plankton Research, Vol. 6, No. 1, p 91-105, 1984. 9 Fig, 32 ref.

Descriptors: *Hartbeespoort Dam, *South Africa, *Primary productivity, Monomictic lakes, Reservoirs, Nitrogen, Phosphorus, Microcystis, Wind, Water temperature, Photosynthesis, Buoyancy, Solar radiation, Chlorophyll a.

Hartbeespoort Dam is a hypertrophic, warm, monomictic lake which lies near the cities of Pretoria and Johannesburg in South Africa. The very high nitrogen and phosphorus loads to the lake from the northern suburbs of Johannesburg ensure an overabundance of algal growth nutrients throughout the year. This study was done at a permanently buoyed station in the main basin. Weekly measurements were made at the surface, 0.5, 1, 2, 3, 4, 5, 6, 8, 10 and 15 m depths. The surface chlorophyll a concentration ranged from 2.7 mg/cu m (following overturn in April 1981) to 1180 mg/cu m (December 1981). The maximum rate of photosynthesis in the depth profile (Amax) ranged between 12.4 mg C /cu m/h in April 1981 and 5916 mg C/cu m/h in December 1981. Areal rates varied between 46.9 and 3381 mg c/sq m/h. The factors permitting and controlling production were subjectively separated into two categories. In category 1, nutrients (N + P), which were in overabundance, permitted large standing crops of Microcystis aeruinosa to develop (>1000 micro g chl a/l). Wind patterns determined the dramatic spatial and temporal changes in algal standing crop which could drop to 2.7 micro g chl a/l. In category 2 were the factors which affected the rate processes. The buoyancy mechanism of Microcystis usually kept the alga in the euphotic zone. The attenuation of light with increasing chlorophyll concentration was moderated in Hartbeespoort Dam because of the ability of microcystis to form large chlorophyll packages. Variations in solar radiation had a significant effect on the integrated daily production. The saturation parameter and photosynthetic capacity were temperature dependent. There is a significant correlation between water column stability and integral primary production in this hypertrophic lake. (Moore-IVI)
W85-00384

DISTRIBUTIONAL PATTERNS AND HABITAT CHARACTERISTICS OF AMPHIPODA (CRUSTACEA) IN THE INLAND WATERS OF ISRAEL AND SINAI,
Hebrew Univ., Herusalem (Israel). Dept. of Zoology.
G. N. Herbst, and C. Dimentman.
Hydrobiologia, Vol. 98, No. 1, p 17-24, January, 1983. 4 Fig, 1 Tab, 29 Ref.

Descriptors: *Amphipods, *Crustaceans, *Distribution, *Aquatic habitats, *Israel, *Sinai, Biological oxygen demand, Chemical oxygen demand, Dissolved oxygen, Chlorides, Flow velocities, Salinity.

Nine amphipod species from six genera were collected from approximately 140 inland water sites in Israel and the Sinai. Included were museum specimens collected over 40 years ago from habitats now greatly modified. Water samples were taken for analysis during specimen collection. Nine species from six genera were identified: Gammarus syriacus, G. pseudosyriacus, Echinogammarus n. sp., E. foxi, E. veneris, Corophium orientalis, Orchestia cavimana, O. platensis, and Metacrangonyx n. sp. The nine species display two principal distribution patterns. A north-south pattern is typical of freshwater fauna in the Levant and is probably controlled by climatic factors; the distribution of

the genus Gammarus is characteristic of this pattern. This pattern is distinguished from that displayed by species of marine origin that penetrated into inland waters; the distribution of the genus Echinogammarus is similar to this pattern. Within their ranges the common Gammarus and Echinogammarus species display differences in preference for current velocities, salinities and habitat types. Both Gammarus species collected require high dissolved oxygen content (DO), low biological oxygen demand (BOD), and low chemical oxygen demand (COD); they are never found at chlorinities greater than 170 ppm. The three Echinogammarus taxa are all found under a wide range of environmental parameters, particularly chlorinity which varies from 21 ppm Cl(-) to more than 3500 ppm Cl(-). The relationships of chemical and physical parameters to amphipod distribution may have important management and conservation implications. (Collier-IVI)
W85-00395

TRANSPORT OF ORGANIC CARBON IN THE ATCHAFALAYA BASIN, LOUISIANA,
Office of Radiation Programs-Las Vegas Facility, NV.
V. W. Lambou, and S. C. Hern.
Hydrobiologia, Vol. 98, No. 1, p 25-34, January, 1983. 2 Fig, 5 Tab, 30 Ref.

Descriptors: *Atchafalaya River Basin, *Lousiana, *Organic carbon, *Solute transport, Dissolved solids, Particulate matter, Cycling nutrients, Nutrient removal, Sedimentation, Flooding.

The Atchafalaya Basin comprises an 8345 sq km lowland area within Louisiana. Annual organic carbon fluxes were determined for the 2129 sq km Atchafalaya Basin Floodway, which is subject to frequent and prolonged natural flooding, and for subunits within the Floodway. During the period of July 1976 to June 1977, 36 pairs of samples were collected at approximately monthly intervals from an inlet and from outlets of the Atchafalaya Basin. Samples were also collected from 11 stations located at all inlets and outlets to three hydrologic subunits. Samples were analyzed for dissolved organic carbon (DOC), total organic carbon (TOC), and particulate organic carbon (POC). Net change in water volume representing storage changes as a result of inflow, outflow, or a combination of the two was calculated. Carbon fluxes were determined by multiplying carbon concentrations times flow volumes at each major opening of the various hydrological subunits. Comparisons are made with an area not subject to extensive overflow due to its isolation from the Atchafalaya River by manmade levees. The three overflow subunits were found to have a large areal net export of DOC; values were 10,000, and 10,600, and 11,600 kg/sq km. The non-overflow subunit had a low net DOC export of 1100 kg/sq km. Areal export of POC was high in the non-overflow subunit (8400 kg/sq km) while the overflow subunits acted as sinks for particulate organic carbon. The Atchafalaya Basin Floodway, as a whole, acted as a major sink for TOC through the sedimentation of POC. Prolonged overbank flooding, with the annual inundation of additional land areas and the decomposition of herbaceous materials and forest litter, renews the supply of organic carbon. (Collier-IVI)
W85-00396

SUCCESSION OF PLANKTONIC ROTIFER POPULATIONS IN SOME LAKES OF THE EASTERN RIFT VALLEY, KENYA,
Concordia Univ., Loyola Campus, Montreal (Quebec).
T. Nogrady.
Hydrobiologia, Vol. 98, No. 1, p 45-54, January, 1983. 7 Fig, 5 Tab, 21 Ref.

Descriptors: *Rotifers, *Succession, *Plankton, *Eastern Rift Valley, *Kenya, Lake Naivasha, Lake Oloidien, Lake Victoria, Lake Nakuru, Lake Elmenteita, Lake Bogoria, Conductivity, Alkalinity, Saline lakes, Alkaline lakes, Biomass.

The quantitative succession of the spring and summer rotifer plankton and its biomass in six lakes of the Eastern Rift Valley of Kenya is discussed. The lakes can be divided into two groups: the low conductivity slightly alkaline lakes Naivasha, Oloidien and the Winam Gulf of Lake Victoria; and the high conductivity, highly alkaline-saline lakes Nakuru, Elmenteita and Bogoria. The former three show a qualitatively rich, typical warmwater rotifer association dominated by Brachionids and Filinia. The saline soda lakes are dominated by several populations of Brachionus dimidiatus, which can reach enormous numbers. The taxonomy and biometry of this species was subjected to statistical analysis. Some interesting and rare species are described: Anuraeopsis coelata, Lepadella triptera f. deconincki, Trichocerca gracilis and T. mus. The chemical limnology of the lakes is discussed and compared with other soda lakes in Central Africa, Europe and North America. (Author's abstract)
W85-00398

INVERTEBRATE DRIFT, DISCHARGE, AND SEDIMENT RELATIONS IN A SOUTHERN APPALACHIAN HEADWATER STREAM,
Georgia Univ., Athens. Dept. of Entomology.
J. O'Hop, and J. B. Wallace.
Hydrobiologia, Vol. 98 No. 1, p 71-84, January, 1983. 8 Fig, 8 Tab, 40 Ref. NSF grant 77-05234-A01.

Descriptors: *Aquatic drift, *Suspended sediments, *Invertebrates, *North Carolina, *Hugh White Creek, Stream discharge, Seston, Detritus, Aquatic insects, Caddisflies, Plecoptera.

Drift, the downstream transport of invertebrates in the water column, is an integral part of the food web of running waters since drifting organisms are utilized by some stream fish and by filter-feeding insect larvae. Drifting invertebrates and suspended sediments were collected at monthly intervals, from June 1977 to May 1978, from Hugh White Creek, a small second order mountain headwater stream in Macon County, North Carolina. Non-storm export and concentrations of detritus and inorganic sediments were lowest in early summer after several weeks of calm weather and a slowly descending hydrograph. Coarse detritus concentration also decreased in December. The numbers and biomass of drifting organisms reflected the seasonal cycles of aquatic insects. Some aquatic organisms showed behavioral drift either during a sample day or during some portion of their life cycle. Parapsyche cardis and Diplectrona modesta dispersed as first instar larvae; few later instars of these two net-spinning caddisflies drifted. The drift of nymphal Peltoperla maria was apparently related more to detritus transport than to benthic densities or discharge alone. The general level of stream invertebrate drift appears to be related to detritus transport; drift during storms is also related to detritus transport. During storms, terrestrial invertebrate drift was related to rainfall intensity, canopy washing, and channel expansion. Drift density of aquatic invertebrates in Hugh White Creek was within the range of previously reported values for other streams, but the estimate of yearly export (aquatic invertebrates = 134 g/y; terrestrial invertebrates = 23 g/y) is lower reflecting the smaller size of Hugh White Creek in comparison with those other streams. (Collier-IVI)
W85-00400

AQUATIC CRYPTOGRAMS OF NATURAL ACID SPRINGS ENRICHED WITH HEAVY METALS: THE KOOTENAY PAINT POTS, BRITISH COLUMBIA,
Durham Univ. (England). Dept. of Botany.
J. D. Wehr, and B. A. Whitton.
Hydrobiologia, Vol. 98 No. 2, p 97-105, January, 1983. 3 Fig, 7 Tab, 28 Ref. Department of Environment grant DGR/480/571.

Descriptors: *British Columbia, *Kootenay Paint Pots, *Acid springs, *Heavy metals, Paint pots, Algae, Mosses, Liverworts, Anaerobic conditions, Chlamydomonas, Acid mine drainage.

An account is given of the chemistry and aquatic cryptograms of the Kootenay Paint Pots, British Columbia. The waters fell in the pH range 3.2 to 4.0, were mostly anaerobic, and had high levels of Fe and Zn. Fourteen species of algae, one liverwort (Cephalozia bicuspidata) and one moss (Dicranella heteromalla) were found in the various springs and pools. The two dominant Chlamydomonas species existed as palmelloid growths where they occurred among sediments, while Dicranella heteromalla occurred everywhere only as protonema. The flora is different in many respects from that of typical acid mine drainages, the Dicranella being the only one of eight common species in such drainages represented. Most of the photosynthetic organisms in the Paint Pots must tolerate anaerobic conditions for long periods and it is suggested that this may be a key factor explaining the floristic difference. (Author's abstract)
W85-00402

MICROBIOLOGICAL EXAMINATION OF LAKE ERIE AND LAKE ONTARIO SEDIMENTS,
National Water Research Inst., Burlington (Ontario). Analytical Methods Div.
B. J. Dutka, and K. K. Kwan.
Hydrobiologia, Vol. 98, No. 2, p 135-145, January, 1983. 6 Fig, 4 Tab, 24 Ref.

Descriptors: *Lake Erie, *Lake Ontario, *Lake sediments, *Bacterial analysis, Sediments, Oxidation-reduction potential, Bacteria, Hydrogen ion concentrations, Organic carbon, Heterotrophic bacteria.

Diver collected cores of similar type sediments from within the Lower Great Lakes were found to have numerically similar microbial flora regardless of the site of collection; overlying water samples were also collected. Cores from three sites in Lake Erie (west of Cleveland, Eastern basin and near Buffalo) and one from Lake Ontario near the mouth of the Niagara River, were sectioned to 20 cm and examined for sulfur cycle and nitrogen cycle bacteria, heterotrophic bacteria, insoluble organic and inorganic phosphate solubilizing bacteria and manganese oxidizing bacteria. Eh, pH, nitrogen, organic carbon and percentage moisture determinations were also made. There was a lack of correlation between microbial populations, organic content, Eh, and oxygen consumption rates. Heterotrophic bacterial populations recorded in this study confirm the typical heterotrophic distribution patterns encountered in Lake Erie and Lake Ontario sediments. The heterotrophic bacteria populations are a reflection of the number of heterotrophics capable of surviving by facultative and obligate mechanisms in an anaerobic environment. (Collier-IVI)
W85-00403

STRATIFICATION OF MICROORGANISMS AND NUTRIENTS IN THE SURFACE MICRO LAYER OF SMALL FRESHWATER PONDS,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
S. C. Danos, J. S. Maki, and C. C. Remsen.
Hydrobiologia, Vol. 98, No. 3, p 193-202, February, 1983. 2 Fig, 6 Tab, 37 Ref.

Descriptors: *Microorganisms, *Nutrients, *Stratification, *Surface water, Ponds, Microlayers, Pigments, Bacteria, Phototrophs, Epilimnetic waters.

The location of the surface microlayer guarantees that both its physical and chemical composition will be significantly different from the subsurface waters. Stratification within the surface micro layers of two small experimental ponds was examined and the distribution of nutrients, pigments and bacteria within upper epilimnetic waters was investigated. The two ponds (at the University of Wisconsin-Milwaukee field station) were sampled 2 times from June, 1978 through August, 1979. Using two different surface microlayer sampling devices (the Harvey and Burzell glass plate and the Garrett screen), two microlayer fractions could be distinguished. The first was from 0 to 50 micro m and the second was from 51 to 320 micro m. Significantly different ($p < 0.05$) concentrations of dissolved nutrients between the two microlayer fractions strongly suggests stratification within the surface microlayer. This apparent stratification is also examined for phototrophs, bacteria and other m

terial found within the surface microlayer. (Moore-IVI)
W85-00407

RELATIONSHIP BETWEEN FOSSIL DIATOM ASSEMBLAGES AND LIMNOLOGICAL CONDITIONS,
Southern Illinois Univ. at Edwardsville. Dept. of Biological Sciences.
R. B. Brugam.
Hydrobiologia, Vol. 98, No. 3, p 223-235, February, 1983. 4 Fig, 3 Tab, 27 Ref. NSF grants EAR76-01412 and DEB 8004286, OWRT grant B-128 Minn.

Descriptors: *Minnesota, *Diatoms, *Fossils, *Limnology, Alkalinity, Sulfates, Phosphorus, Transparency, Water depth, Cluster analysis, Eutrophic lakes, Oligotrophic lakes, Acid lakes, Meromictic lakes.

Fossil diatom assemblages from the sediment/water interface in 105 Minnesota lakes were compared with measurements of alkalinity, sulfate, total phosphorus, transparency, and water depth at the sample site. Similar assemblages were placed together using cluster analysis and comparisons of environmental variables between diatom clusters were made using an analysis of variance. Total alkalinity and transparency showed the greatest difference among clusters. Samples from shallow eutrophic prairie lakes were dominated by Melosira granulata, Stephanodiscus niagarae and, occasionally, by Stephanodiscus hantzschii. Deep oligotrophic lakes had modest percentages of Cyclotella comta. Dilute acid lakes were dominated either by Melosira distans and M. italica or by Tabellaria fenestrata, Cyclotella stelligera, and in some cases C. glomerata. Assemblages with Cyclotella glomerata and Synedra nava were found in naturally meromictic lakes. Stephanodiscus hantzschii showed a preference for extremely eutrophic lakes. The relationships between recently deposited diatom assemblages and the lake environmental conditions studied here can be used to evaluate the extent of past environmental change in lakes. (Author's abstract)
W85-00409

ANNUAL CYCLE OF GROSS PRIMARY PRODUCTION AND RESPIRATION IN THE VIROIN RIVER (BELGIUM),
Bruxelles Univ. (Belgium). Lab. de Traitement des Eaux et Pollution.
M. Servais, E. Debecker, and G. Billen.
Hydrobiologia, Vol. 111, No. 1, p 57-63, 1984. 7 Fig, 2 Tab, 13 Ref.

Descriptors: *Primary productivity, *Viroin River, *Belgium, *Respiration, Dissolved oxygen, Aeration, Ranunculus, Macrophytes, Solar radiation, Decomposition, Seasonal variation.

The quality of river water depends to a great extent upon the dissolved oxygen content. This is regulated by the equilibrium among three processes: exchange of oxygen with the atmosphere, production of oxygen by photosynthesis and consumption of oxygen by respiration. Gross primary production, community respiration and reaeration coefficient were determined during an annual cycle in the Viroin River (South Belgium), based on the daily variations of dissolved oxygen concentration. The Viroin is a shallow tributary of the Meuse River, in which the primary producers are dominated by the macrophyte Ranunculus fluitans. The reaeration coefficient remains remarkably constant (0.26/h) during the year in spite of discharge fluctuations. Primary production parallels the variations of total solar radiation, and ranges from 0 in winter to 8 g O2/sq m/d in summer. In spring and summer, respiration variations parallel those of primary production (average value: 10 g O2/sq m/d); during dry autumn, decomposition of dying macrophytes considerably enhances the community respiration (15 g O2/sq m/d). No oxygen problems occur during the winter. In late spring and summer the river exhibits a moderate eutrophication with important daily fluctuations of dissolved oxygen. The most critical situation, in terms of deficit in the oxygen status, is encountered during the dry autumn where high respiration occurs due to the decomposition of dying macrophytes. (Moore-IVI)
W85-00413

EFFECTS OF A MASSIVE SWARM OF ANTS ON AMMONIUM CONCENTRATIONS IN A SUBALPINE LAKE,
Michigan State Univ., Hickory Corners. W.K. Kellogg Biological Station.
R. G. Carlton, and C. R. Goldman.
Hydrobiologia, Vol. 111, p 113-117, 1984. 2 Fig, 19 Ref.

Descriptors: *Castle Lake, *California, *Ants, *Swarming, *Ammonium, *Subalpine lakes, Nutrients, Primary productivity, Fish, Phytoplankton.

Castle Lake is a small, dimictic, subalpine lake lying in a granitic cirque basin at an elevation of 1706 m in the Klamath Mountains of northwestern California. On August 9 and 26, 1979, massive flights of alates of the ground dwelling ant Lasius alienus descended upon the surface of Castle Lake. Each event resulted in the delivery of millions of ants to the lake surface. Consumption and subsequent excretion by fish, in addition to direct release from ants, produced a brief, but marked increase in water column ammonium levels. Castle Lake phytoplankton are often nitrogen limited and possess a high affinity for ammonium. Cloudy weather which followed the ant swarming events may have masked any effect on productivity. Implications for nutrient limited systems include the role of spatial and temporal heterogeneity of nutrients in algal community dynamics, with respect to shifts in nutrient ratios and concentrations, as well as enhancement of overall primary production. (Moore-IVI)
W85-00417

VERTICAL DISTRIBUTION OF ORGANIC CONSTITUENTS IN AN ANTARCTIC LAKE: LAKE VANDA,
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
G. Matsumoto, T. Torii, and T. Hanya.
Hydrobiologia, Vol. 111, No. 2, p 119-126, April 1984. 6 Fig, 35 Ref.

Descriptors: *Organic carbon, *Antarctic, *Lake Vanda, *Vertical distribution, Stratification, Hydrocarbons, Lake sediments, Sterols, Fatty acids, Phenolic acids, Decomposition, Anaerobic conditions.

Vertical distribution of organic constituents, i.e. total organic carbon (TOC), extractable organic carbon with ethyl acetate (EOC), hydrocarbons, phytol, sterols, fatty acids and phenolic acids in Lake Vanda was studied to elucidate their features to the stratification of lake water and the distribution of lake organisms. The concentrations of TOC, EOC and sterols increased with depth and attained the maximum values of 25 and 1.5 mg C/l and 1.4 micro g/l in the bottom, respectively, while those of fatty acids showed the maximum value of 61 micro g/l at a depth of 55.4 m, along with the highest value of the ratio of unsaturated (uC16, uC18) to saturated (C16, C18) acids (8.5) and with the highest carbon preference index (35). Hydrocarbons were only found in the bottom layers (60.4 and 65.9 m) and bottom sediment. These results suggest strongly that the vertical distribution of lake organisms and their activity are quite different due to depth. In the bottom warm anoxic layers the degradation of organic materials must have occurred significantly and thus refractory organic materials should be concentrated. (Author's abstract)
W85-00418

COST AND PRECISION IN A STREAM SAMPLING PROGRAM,
Montana Univ., Missoula. Dept. of Zoology.
For primary bibliographic entry see Field 6A.
W85-00420

EXCHANGE BETWEEN INTERSTITIAL AND SURFACE WATER: IMPLICATIONS FOR STREAM METABOLISM AND NUTRIENT CYCLING,
Arizona State Univ., Tempe. Dept. of Zoology.
N. B. Grimm, and S. G. Fisher.
Hydrobiologia, Vol. 111, No. 219-228, 1984. 1 Fig, 6 Tab, 45 Ref. NSF grant DEB 80-04145.

Descriptors: *Streams, *Metabolism, *Surface water, *Interstitial water, *Cycling nutrients, *Sycamore Creek, *Arizona, Ecosystems, Respiration, Oxygen, Nitrates, Primary productivity, Hyporheic zone.

Summertime stream metabolism was studied in a 30-m reach of Sycamore Creek, Arizona by both enclosure and whole system oxygen techniques. Recirculating chambers were used to estimate surface sediment metabolism and measured deep sediment respiration in isolated sediment cores. The study was done on 6 and 17 August 1982, 14 and 25 days after a resetting flash flood of 2 cu m/s occurred at the site. Metabolism of the stream ecosystem was determined for the reach as dark and light oxygen change with and without black plastic sheeting that darkened the stream and prevented diffusion. Average ecosystem respiration for two dates in August (440 mg O2/sq m/h) exceeded respiration of either that surface sediment community (155 mg O2/sq m/h) or the hyporheic community (170 mg O2/sq m/h) alone. Deep sediments show substantial oxygen and nitrate uptake when isolated. In the stream, this low nitrate interstitial water is exchanged with surface water. Metabolism of the isolated surface community suggests a highly productive and autotrophic system, yet gross production is balanced or exceeded by community respiration when ecosystem boundaries include the hyporheic zone. Despite high rates of gross primary production (600-1200 mg O2/sq m/h), desert streams may be heterotrophic (Pg < R) during summer. The substantial contribution of the hyporheic community to whole ecosystem metabolism argues strongly for inclusion of deep sediments in conceptualizations of stream ecosystems. (Moore-IVI)
W85-00422

COLONIZATION AND SUCCESSION OF BENTHIC MACROINVERTEBRATES IN A NEW RESERVOIR,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Entomology.
For primary bibliographic entry see Field 6G.
W85-00425

ANIMAL COMMUNITY STRUCTURE AS A FUNCTION OF STREAM SIZE,
Lund Univ. (Sweden). Dept. of Animal Ecology.
C. Bronmark, J. Herrmann, B. Malmqvist, C. Otto, and P. Sjostrom.
Hydrobiologia, Vol. 112, No. 73-79, 1984. 3 Fig, 2 Tab, 21 Ref.

Descriptors: *Stream size, *Invertebrates, *Distribution, *Bornholm, *Denmark, Water quality, Nutrients, Insects, Aquatic animals, Habitats.

A variety of abiotic factors affect the occurrence of stream-living invertebrates, but these factors alone seldom explain the occurrence of certain species in closely situated streams of similar size. Differences in faunal composition were analyzed for small, closely situated coastal streams exposed to similar abiotic conditions, and between which dispersal should be high since most of the invertebrates have winged stages. The investigation was carried out in 22 Bornholm (Denmark) streams. The species-area relationship of the island biogeography theory was calculated for macroinvertebrates in the 22 streams. A z-value of 0.19 was obtained. The low z-value was probably a consequence of the short distances between streams as well as high dispersal rates. A cluster analysis based on the dissimilarity of species assemblages showed that stream size was of prime importance in categorizing the streams. Although stream size seemed to be the main factor governing the number of species present, nutrient load also affected the species distribution. The increase number of species with area is probably associated with the

increase in the number of microhabitats. (Moore-IVI)
W85-00426

2I. Water In Plants

WATER TRANSFER IN PLANTS; III. - SIMULATION OF THE INFLUENCE OF CANOPY PARAMETERS FOR DIURNAL DEVELOPMENT OF LEAF WATER POTENTIAL (TRANSFERT HYDRIQUE DANS LE VEGETAL; III. - SIMULATION DE L'INFLUENCE DES PARAMETRES DU COUVERT SUR L'EVOLUTION DIURNE DU POTENTIEL HYDRIQUE FOLIARIE),
Institut National de la Recherche Agronomique, Versailles (France). Station de Bioclimatologie.
N. Katerji, M. Hallaire, and R. Durand.
Acta Oecologica: Series Oecologica Plantarum, Vol. 5, No. 2, p 107-117, 1984. 2 Fig, 2 Tab, 13 Ref.

Descriptors: *Leaves, *Water potential, *Transpiration, *Stomatal transpiration, Plant water reserves, Canopy, Plant tissue.

A model for water transfer in plants permits calculation of the evolution of leaf potential psi-F during the course of the day. The calculations undertaken successively varied the parameters in 1 to 2 and 1 to 4 proportions and allowed for a regular variation in transpiration during the course of the day, excluding consequently the case of variable weather days as well as the phenomenon of stomatal regulation. In the graphs of psi sub F as a function of time and in the times at which psi sub F reaches a given value, one can appreciate the respective influences of the four parameters (R, V/rho, r, psi sub pc) characteristic of a plant canopy. One finds, of course, the previously underlined preponderant influence of resistance R. But the novelty is the almost equivalent influence (under certain conditions) of the V/rho and psi-pc parameters which determine the mobilization of plant water reserves. (Author's abstract)
W85-00085

MOISTURE STRESS EFFECTS ON BIOMASS PARTITIONING IN TWO SONORAN DESERT ANNUALS,
Arizona State Univ., Tempe. Dept. of Botany and Microbiology.
S. R. Szarek, S. D. Smith, and R. D. Ryan.
American Midland Naturalist, Vol. 108, No. 2, p 338-345, October, 1982. 1 Fig, 5 Tab, 11 Ref.

Descriptors: *Soil water, *Waster stress, *Plant growth, *Deserts, Moisture deficiency, Drought, Plant reproduction, Biomass partitioning, Arid lands, Plantago, Schismus.

The relative biomass accumulation rate and allocation to reproduction were quantified for Plantago insularis and Schismus barbatus, growing under four different levels of moisture stress. As the growing season progressed and ambient temperatures rose, the incremental irrigations increased the whole plant growth rates progressively for both species. Plants of Plantago from control, low, and medium irrigation treatments reached their peak seasonal biomass on the 7 April sampling date, whereas plants of the high irrigation treatment did not reach their peak seasonal biomass until 21 April. Peak seasonal biomass values were 23.3 (control), 28.4 (low irrigation), 38.2 (medium irrigation) and 40.9 (high irrigation) mg dry weight/plant. All plants of Schismus reached their peak seasonal biomass at the last sampling time. These values were 14.4 (control), 18.0 (low irrigation), 24.5 (medium irrigation), and 49.5 (high irrigation) mg dry weight/plant. Irrigation also affected the survival of plants following initial germination and the occurrence of subsequent germination events, both of which influenced the density of plants in the experimental plots. None of the water treatments markedly altered the relative foliar growth rate of either species. Schismus responded to water input by significantly increasing the biomass allocated to reproduction, which increased relative reproductive allocation. The computed reproductive allocation of Plantago was not correlated with water input, although the ultimate reproductive biomasses were correlated with the summation of plant moisture stress during reproduction. Thus, the bar-day formulation is useful in estimating the relative sensitivity of reproduction to drought for native annual species growing in similar habitats with varying levels of moisture stress. (Baker-IVI)
W85-00089

PLANT RESPONSES TO FLOODING OF SOIL,
Wisconsin Univ.-Madison. Coll. of Agricultural and Life Sciences.
T. T. Kozlowski.
BioScience, Vol. 34, No. 3, p 162-167, March, 1984. 5 Fig, 54 Ref.

Descriptors: *Plant growth, *Flooding, Photosynthesis, Minerals, Absorption, Hormones, Plant pathology, Oxygen, Flood tolerance.

Flooding of soil rapidly depletes soil oxygen and alters plant metabolism, thereby inhibiting growth. Reduced growth is preceded by stomatal closure, reduced photosynthesis, carbohydrate translocation, and mineral absorption; as well as altered hormone balance. Flood tolerance varies widely among plant species, cultivars, and ecotypes and is associated with both morphological and physiological adaptations. Mineral uptake of flooded plants is complicated and variously influenced by soil type, specific mineral ions absorbed, effects of anaerobiosis on mechanisms of ion absorption, and flood tolerance of different species of plants. Flooding of soil for more than a brief period adversely affects growth of most plants by inhibiting seed germination, leaf initiation and expansion, internode elongation, cambial growth, and root growth. Prolonged flooding is often fatal to higher plants. Flood-tolerant plants adapt to anaerobic environments by various mechanisms, depending on the species and environmental conditions. Important morphological adaptations include formation of aerenchyma, hypertrophy of lenticels, and regeneration of new roots. Others depend on their ability to transport air from leaves to roots. (Baker-IVI)
W85-00126

RIPARIAN FORESTS AS NUTRIENT FILTERS IN AGRICULTURAL WATERSHEDS,
Georgia Coastal Plain Experiment Station, Tifton.
R. Lowrance, R. Todd, J. Fail, Jr., O. Hendrickson, Jr., and R. Leonard.
BioScience, Vol. 34, No. 6, p 374-377, June, 1984. 2 Fig, 1 Tab, 18 Ref. NSF grants DEB 78-10841 and DEB 82-07210.

Descriptors: *Riparian vegetation, *Agricultural watersheds, *Nutrient removal, Sediment transport, Path of pollutants, Forests, Sodium, Phosphorus, Potassium, Magnesium, Chloride, Water pollution control.

Riparian vegetation (streamside) may help control transport of sediments and chemicals to stream channels. Studies of a coastal plain agricultural watershed showed that riparian forest ecosystems are excellent nutrient sinks and buffer the nutrient discharge from surrounding agroecosystems. Nutrient uptake and removal by soil and vegetation in the riparian forest ecosystem prevented outputs from agricultural uplands from reaching the stream channel. The watershed studied is 1568 ha with 30% riparian forest, 41% row crops, 13% pasture, and 16% roads, residences, fallow land, and other uses. Annual inputs of nutrients in fertilizer and lime to row crops and pastures in the uplands are high. Inputs, outputs, and vegetation storages of N, P, K, Ca, Mg, and Cl in the riparian ecosystem were measured from 1979 to 1981. Waterborne inputs exceeded streamflow outputs for all elements. The riparian ecosystem can apparently serve as both a short- and long-term nutrient filter and sink if trees are harvested periodically to ensure a net uptake of nutrients. Based on this study, good water quality for agricultural watersheds depends largely on nutrient uptake and removal in the riparian ecosystem. Removal of the riparian forest, accompanied by tile drainage, would tend to contribute to higher nutrient loads in streams and lower water quality through loss of nutrient uptake and storage by woody vegetation. (Baker-IVI)
W85-00127

WATER BALANCE AND PATTERN OF ROOT WATER UPTAKE BY A QUERCUS COCCIFERA L. EVERGREEN SCRUB,
Centre National de la Recherche Scientifique, Montpellier (France). Centre d'Etudes Phytosociologiques et Ecologiques Louis-Emberger.
S. Rambal.
Oecologia, Vol. 62, No. 1, p 18-25, 1984. 6 Fig, 2 Tab, 41 Ref.

Descriptors: *Plant water balance, *Root water uptake, *Oak, *Scrub, *France, Evapotranspiration, Soil water, Drainage, Seasonal variation, Limestone.

The Quercus coccifera evergreen scrub (garrigue) covers more than 100,000 ha in the south of France. The water balance of a Q. coccifera evergreen scrub was studied over 7 consecutive years. The study site is located 10 km north of Montpellier, at the top of a west-facing 15% slope. The karst formation is heterogenous and composed of soft to hard limestone covered with a very shallow soil mantle. Soil water content was measured with a neutron meter; calibration curves were calculated from the thermal neutron macroscopic cross-sections of soil (< 2-mm fraction) and rock samples, and the profile of wet bulk density measured with a subsurface gamma-ray gauge. The annual and seasonal patterns of actual evapotranspiration and of deep drainage were calculated using field-measured drainage characteristics. The soil water content data were used to compute water uptake rates and pattern for the root zone over a 4-month drying period. The 906 mm of mean annual precipitation yielded 603 mm of actual evapotranspiration (AET) and 296 mm of drainage. No drainage occurred with precipitation less than 578 mm. The average AET values for the months from April to September were 57, 74, 89, 96, 70, and 42 mm respectively. Q. coccifera consumed considerable quantities of water from the soil-rock complex. Roots could extract 270 mm of water in the first 470 cm of soil. There was a gradual downward shift of the zone of maximum root water uptake as the soil dried. (Moore-IVI)
W85-00207

EFFECT OF DIFFERENT GROWING CONDITIONS ON WATER RELATIONS PARAMETERS OF LEAF EPIDERMAL CELLS OF TRADESCANTIA VIRGINIANA L,
Bayreuth Univ. (Germany, F.R.).
E. Brinckmann, S. D. Tyerman, E. Steudle, and E. D. Schulze.
Oecologia, Vol. 62, No. 1, p 110-117, 1984. 7 Fig, Tab, 32 Ref.

Descriptors: *Tradescantia, *Plant water relations *Solar radiation, *Air temperature, *Humidity *Nutrients, Turgor, Volumetric elastic modulu Plant water potential, Permeability coefficien Leaves.

Tradescantia virginiana L. plants were cultivate under contrasting conditions of temperature, h midity, light quality and intensity, and nutrie status in order to investigate the effect of grow conditions on the water relations parameters of t leaf epidermal cells. Turgor pressure (P), volume ric elastic modulus (epsilon), half-time of wat potential equilibration (T 1/2), hydraulic condu tivity (Lp) were measured with the miniaturiz pressure probe in single cells of the upper a lower epidermis of leaves. Turgor differed (rang 0.1 bar to 7.2 bar) between treatments with lowe values under warm and humid conditions and ad tional supply of fertilizer, and highest values unc conditions of low air humidity and low nutri supply. The volumetric elastic modulus chang by 2 orders of magnitude (range: 3.0 bar to 350 b 158 cells), but epsilon was only affected by treatments, in as much as it was dependent turgor. The turgor dependence of epsilon, me ured on intact leaves of T. virginiana, was sim

to that for cells of the isolated (peeled) lower epidermis, where epsilon as a function of turgor was linear over the whole range of turgors. This result has implications for the discussion of pressure/volume curves as measured by the pressure bomb where changes in 'bulk leaf epsilon' are frequently discussed as 'adaptations' to certain treatments. The measurements of the hydraulic conductivity indicate that this parameter varies between treatments (range of means: 0.0000024 m/s/bar to 0.0000134 cm/s/bar). There was a negative correlation for Lp in cells of intact leaves as a function of turgor which was altered by the growing conditions. However, a correlation with turgor could not be found for cells from isolated epidermis or cells from a uniform population of plants. The large variation in Lp from cell to cell observed in the present and in previous studies was accounted for in a study of 100 cells from a uniform population of plants by the propagation of measurement errors in calculating Lp. The results suggest that in T. virginiana cellular water relations are changed mainly by the turgor dependence of epsilon. (Author's abstract)
W85-00208

ROUGHT STRESS AND THE DEMISE OF CACIA ALBIDA ALONG THE LOWER UISEB RIVER, CENTRAL NAMIB DESERT: RELIMINARY FINDINGS,
ital Univ., Durban (South Africa). Dept. of tany.
r primary bibliographic entry see Field 2B.
85-00215

ISISTANCES TO WATER FLOW THROUGH IE SOIL-PLANT SYSTEM,
l and Irrigation Research Inst., Pretoria (South rica).
M. Oosterhuis.
uth African Journal of Science, Vol. 79, No. 11, 59-465, November/December, 1983. 155 Ref.

scriptors: *Soil-water-plant relationships, *Root stance, *Plant resistance, *Soil resistance, Soil er, Plant water flow.

istances along the pathway of water movement n the soil through the plant to the atmosphere of fundamental importance in soil-plant-water tions. The largest resistance to water flow in soil-plant-atmosphere continuum is the diffu- resistance encountered in the vapor phase. In liquid phase, the plant initially presents a great- esistance to water movement than does the soil ne soil dries out. The main plant resistance is rently in the roots. Root resistance is parti- ed into radial resistance to water flow across oot to the xylem, and axial resistance to longi- nal water movement up the root in the xylem. al resistance is usually substantial relative to resistance. Uncertainty exists as to the main way of radial flow, and also the exact location sistance, with the endodermis considered the likely site. Furthermore, root resistance is st in meristematic regions and lowest in a of maximum absorption between the meriste- and suberised regions. Many chemical, phys- nd biological factors influence root resistance ater flow. Furthermore, root resistance has shown to change with different flow rates. resistance is thus dynamic in nature and nced by environmental conditions. There is a te need to standardize the units used to ex- resistance values. The SI system using s, seconds and pascals is suggested. (Author's ct)
00216

ERENCES IN WATER UPTAKE RATES OYBEAN ROOTS ASSOCIATED WITH AND DEPTH,
State Univ., Ames. Dept. of Agronomy.
Jung, and H. M. Taylor.
Science, Vol. 137, No. 5, p 341-350, May, 5 Fig, 3 Tab, 27 Ref.

iptors: *Soybean, *Water uptake, *Mathe- l models, Soil resistance, *Root resistance, resistance, Axial resistance, Soil water, water potential, Transpiration.

A mathematical model, based on the water flow equations to simulate water uptake, was developed incorporating soil, root-soil contact, and radial and axial resistances to water flow in soybean. Parameters for the model were developed from field experiments conducted during the 1979 growing season on Ida silt loam, a loess soil, at Castana, Iowa. The specific water uptake rate decreased from 0.23 to 1 x 10 to the -4 cu cm H2O/cm root/day as the soil water became depleted in a particular layer. The average conductivity of the soil-root system decreased linearly with age of plant. The axial resistance estimated from the Poiseuille-Hagen equation was 0.00085 (bar-sec-mm to the -4). The water potential decrease along the vertical axis at the 20-cm depth was 0.0615 bar/cm when the transpiration rate was 1 cm/day. A simulation of water uptake, based on a solution of the water flow equation with a sink term and performed with the aid of a differential equation solver DGEAR, tracks the seasonal withdrawal of water in a reasonably accurate manner. (Moore-IVI)
W85-00218

GROWTH OF ALPINE PLANTS UNDER CONTROLLED DROUGHT,
Duke Univ., Durham, NC. Dept. of Botany.
K. M. Peterson, and W. D. Billings.
Arctic and Alpine Research, Vol. 14, No. 3, p 189-194, August, 1982. 2 Tab, 20 Ref.

Descriptors: *Drought resistance, *Alpine plants, *Plant growth, Snowmelt, Water stress, Alpine regions, Habitats.

Plants of 11 alpine species (5 from the Rocky Mountains and 6 from the Sierra Nevada) were grown from seed under contrasting watering frequencies in controlled phytotron environments. Differences in the growth of these plants between treatments were compared to the presence or absence of meltwater in their respective habitats. In general, plants characteristic of habitats receiving meltwater from permanent or long-lasting snowbanks showed a greater reduction in growth under drought stress than plants from habitats with little meltwater moisture. Relative growth rate, net assimilation rate, leaf area duration and root-shoot ratios were calculated for each species. Plant dry weights were statistically greater in the daily water treatment than under the weekly water application for 7 of the 11 species. Total dry weight in Silene acaulis did not vary significantly between the two treatments, but its net assimilation rate was significantly higher under drought even though its leaf area duration was significantly lower. Drought had the most marked effect on Deschampsia caespitosa, a moist-site grass. (Author's abstract)
W85-00235

COMPARATIVE WATER RELATIONS OF PHREATOPHYTES IN THE SONORAN DESERT OF CALIFORNIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
E. T. Nilsen, M. R. Sharifi, and P. W. Rundel.
Ecology, Vol. 65, No. 3, p 767-778, 1984. 10 Fig, 2 Tab, 39 Ref. NSF grant 79-21971.

Descriptors: *Phreatophytes, *Drought resistance, *Sonoran Desert, *California, Shrubs, Plant water potential, Deciduous plants, Seasonal variation, Diurnal variation, Water stress, Plant physiology, Desert plants, Osmotic pressure.

The seasonal and diurnal water relations were compared among six desert phreatophytes, two evergreen shrubs, and one deciduous shrub. All species were located in one wash woodland in the Sonoran Desert of southern California. There are several mechanisms by which these phreatophytes have adapted to the desert environment. One group of winter-deciduous phreatophytes (Olneya tesota, Prosopis glandulosa, and Acacia greggii) experienced summer midday leaf water potentials below -4.0 MPa. These phreatophytes had a series of physiological mechanisms for tolerating summer water stress, including seasonal and diurnal osmotic adjustment and the maintenance of high leaf conductance at low leaf water potential. Osmotic adjustment of these three phreatophytes was similar to or greater than that of two evergreen species (Larrea tridentata and Simmondsia chinensis). Dalea spinosa, a stem-photosynthetic phreatophyte, avoided water stress by maintaining a very small leaf area. The summer-deciduous phreatophytes (Hyptis emoryi, and Chilopsis linearis) demonstrated mechanisms of drought avoidance such as change in leaf biomass and low summer leaf conductance. Little osmotic adjustment occurred in the summer-deciduous phreatophytes. The phreatophytic species studied in this investigation have evolved adaptations to water stress that are similar to those of deciduous and evergreen shrubs of the Sonoran Desert. Desert phreatophytes are a complex group of species with varied adaptive mechanisms to tolerate or avoid drought and should not be considered simply as group of species that avoid desert water stress by utilizing deep ground water unavailable to other desert species of drought tolerance and avoidance. (Author's abstract)
W85-00256

FLOODING AND SO2 STRESS INTERACTION IN BETULA PAPYRIFERA AND B. NIGRA SEEDLINGS,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
R. J. Norby, and T. T. Kozlowski.
Forest Science, Vol. 29, No. 4, p 739-750, 1983. 2 Fig, 3 Tab, 40 Ref.

Descriptors: *Flooding, *Sulfur dioxide, *Birch, *Seedlings, Air pollution, Plant growth, Stomatal conductance, Chlorosis, Stomatal closure, Flooding stress.

The effects of flooding of soil for 5 weeks and fumigation of shoots with 0.35 ppm SO2 for 30 hours, alone and in combination, were studied on Betula papyrifera Marsh. (paper birch) and Betula nigra l. (river birch) seedlings. B. papyrifera, an upland species, was adversely affected by flooding more severely than B. nigra, a lowland species. Symptoms of flooding injury in both species included stomatal closure, chlorosis, deterioration of root systems, and greatly reduced dry matter accumulation. Flooding induced formation of hypertrophied lenticels and adventitious roots in B. nigra but not B. papyrifera seedlings. Seedlings of both species recovered 1 to 2 wk after flooding ended and continued growing at a faster rate than unflooded seedlings, thereby partially or completely compensating for the growth-inhibiting effects of flooding. Fumigation with SO2 at the end of the flooding period induced partial stomatal closure, injury to leaves, and reductions in mean relative growth rates in both species. Stomatal conductance and SO2 uptake in B. nigra seedlings were reduced 40 and 45% by flooding, respectively, and consequently SO2 caused less visible injury (17 vs. 44% of leaf area) and less growth inhibition (0 vs. 26% in mean relative root growth rate) in flooded than in unflooded seedlings. Stomatal conductance and SO2 uptake were reduced even more in flooded B. papyrifera (75 and 77%, respectively), yet flooded and unflooded seedlings were similarly affected by SO2. Flooding stress apparently affected mechanisms of pollution avoidance and pollution tolerance differently in the two species. (Author's abstract)
W85-00292

2J. Erosion and Sedimentation

ACCELERATED SOIL EROSION IN A KARST AREA: THE BURREN, WESTERN IRELAND,
Trinity Coll., Dublin (Ireland). Dept. of Geography.
D. P. Drew.
Journal of Hydrology, Vol. 61, No. 1-3, p 113-124, February, 1983. 9 Fig, 1 Tab, 8 Ref.

Descriptors: *Karst hydrology, *Soil erosion, *Burren, *Ireland, Soil properties, Vegetation, Rocks, Glacial drift, Erosion.

The Burren is a plateau karst on the west coast of Ireland. It is characterized by thin soils, patchy vegetation and large areas of bare rock, supposedly

a legacy of glacial erosion. Archaeological and palynological evidence suggest that the area was well populated and forested in prehistoric times, though now it is a marginal area agriculturally. Investigation of palesols and of karren forms on ancient structures support the idea of an extensive cover of mineral soil, removed by forest clearance initiated erosion over a relatively short period of time. In the context of the Burren it seems improbable that the original forest could disappear sufficiently rapidly under natural conditions to allow unprotected soil to be washed underground in large quantities. Therefore the present day karst landscape of the Burren may represent an example of man induced destabilization of a sensitive environment. (Baker-IVI)
W85-00007

HISTORICAL AND PROJECTED SHORELINE CHANGES, OCEAN CITY AND NORTH ASSATEAGUE ISLAND, MARYLAND,
Maryland Univ., College Park. Dept. of Geography.
S. P. Leatherman.
Available from the National Technical Information Service, Springfield, VA 22161, as PB84 180206, Price codes: A03 in paper copy, A01 in microfiche. Maryland Water Resources Research Center Publication No. 79, August 1983. 39 p, 20 Fig, 2 Tab, 22 Ref. OWRT Project No. A-065-MD (1), Contract/Grant No. 14-34-0001-2122.

Descriptors: *Recession, Beaches, Coasts, *Beach erosion, Beach profiles, *Littoral drift, *Jetties, Breakwaters, Silting, Storm surges, Assateague Island, Ocean City, *Maryland.

Quantitative analysis of historical shorelines from 1850 to 1980 indicates a prevailing trend of recession along the Maryland Atlantic Coast, which has averaged 1.9 feet per year. The rate of shoreline retreat along the northern end of Assateague Island, MD, has been greatly accelerated by interruption of the net southerly littoral drift since construction of the Ocean City Inlet jetties in 1934-5. The barrier island has responded to this sediment deficiency by forming a concaval shoreline configuration and has migrated very rapidly landward along the northern end. At the present rate of migration (averaging 36 feet per year), the barrier will reach the mainland bayshore near the Ocean City airport location by the year 2000. In addition to the dissolution of the northern end of Assateague Island, Ocean City will experience increased storm surge flooding and inlet/bay siltation problems if some action is not taken to mitigate the effects of jetty emplacment and downdrift sediment starvation.
W85-00074

BOX-JENKINS TRANSFER FUNCTION MODELS APPLIED TO SUSPENDED SEDIMENT CONCENTRATION-DISCHARGE RELATIONSHIPS IN A PROGLACIAL STREAM,
Southampton Univ. (England). Dept. of Geography.
A. M. Gurnell, and C. R. Fenn.
Arctic and Alpine Research, Vol. 16, No. 1, p 93-106, February, 1984. 7 Fig, 5 Tab, 24 Ref.

Descriptors: *Suspended sediment, *Model studies, *Glacial streams, *de Tsidjiore Nouve, *Switzerland, Linear regression analysis, Glacial sediments, Sediment load.

Suspended sediment rating curves have provided a simple method for the interpolation and extrapolation of suspended sediment concentration and load in proglacial streams. The usefulness of suspended sediment rating curves is explored using observations of suspended sediment concentration and discharge from the proglacial stream of the glacier de Tsidjiore Nouve, Valais, Switzerland. A logarithmic transformation of both suspended sediment concentration and discharge was suitable for estimating suspended sediment rating curves by linear regression analysis, but in spite of lagging, differencing, and weighting the variables, a consistently good method of predicting suspended sediment concentration from discharge was not found. A major problem was serial autocorrelation in the residuals from the sediment rating curves, and so a method placing central attention on the autocorrelation in the data series was adopted. A transfer function between the discharge and suspended sediment series was estimated. The transfer function gave by far the best forecasts of suspended sediment concentration of all the models investigated, even when it was applied to a different ablation season from that for which it was estimated. In addition, the transfer function and associated univariate time series models also provided information about the character of the suspended sediment and discharge series, which could be used to interpret the hydrology of the proglacial zone and the lower part of the glacier de Tsidjiore Nouve. The findings indicate that transfer functions are so superior to ordinary rating curves that they should be used whenever possible to predict suspended sediment load in proglacial streams. In the absence of a sufficiently good data base, the ordinary rating curve seems to be the second best approach of the methods investigated, but the resulting load estimates are likely to be highly erroneous. (Baker-IVI)
W85-00112

CAUSES, CONSEQUENCES AND REMEDIES OF SOIL EROSION IN KENYA,
Kungliga Vetenskapsakademien, Stockholm (Sweden). Beijerinstitutet.
For primary bibliographic entry see Field 4D.
W85-00129

HUDSON BAY RIVER SEDIMENTS AND REGIONAL GLACIATION: I. IRON AND CARBONATE DISPERSAL TRAINS SOUTHWEST OF HUDSON AND JAMES BAY,
Geological Survey of Canada, Ottawa (Ontario). Terrain Sciences Div.
J. D. Adshead.
Canadian Journal of Earth Sciences, Vol. 20, No. 2, p 290-304, February, 1983. 5 Fig, 2 Tab, 53 Ref.

Descriptors: *River sediments, *Hudson Bay, *James Bay, *Glaciation, *Iron, *Carbonates, Severn River, Winisk River, Attawapiskat River, Churchill River, Nelson River, Moose River, Albany River, Glacial drift, Fluvial sediments, Silt, Sand.

The composition of sands deposited from seven major rivers that flow into western Hudson and James Bays are described. An attempt is made to infer regional drift dispersal limits based on regional patterns of fluvial sand composition and on watershed patterns of rivers with sediment of characteristic composition. The effects of water sorting during the transition from drift to fluvial sediment are indicated by a higher content of total iron and carbonate minerals in the fine-grained silty sand and sandy silt samples. However, comparison of sediments of similar particle size characteristics demonstrates that there are no systematic differences in total iron content or carbonate mineralogy within localities, regardless of sampling location in river channels or off the mouths of rivers in Hudson or James Bays. Sands of the Severn, Winisk, and Attawapiskat Rivers are characterized by significantly higher calcite/dolomite ratios than the sands of the Churchill and Nelson Rivers north of Cape Henrietta Maria and the Albany and Moose Rivers south of it. Calcite enrichments indicate that a distinctive carbonate dispersal train extends southwest of Cape Henrietta Maria, suggesting a dominant pattern of southwesterly ice flow in this region. Total iron oxide contents are highest for sands from rivers in the Cape Henrietta Maria area, where local averages are 2.2 to 2.7% as compared with 1.4% for the Churchill and Nelson Rivers, and 1.9% for the Moose River, north and south of the cape, respectively. The pattern suggests that a broad train of drift with higher iron content extends southwest of Cape Henrietta Maria, roughly delineated by the watershed of the Severn, Winisk, Attawapiskat, and Albany Rivers. The dispersal train inferred from calcite/dolomite ratios overprints part, but not all of the dispersal train inferred from the iron content. (Baker-IVI)
W85-00145

HUDSON BAY RIVER SEDIMENTS AND REGIONAL GLACIATION: II. COMPARISON OF CARBONATE MINERALOGY OF SIZE FRACTIONS FOR ICE MOVEMENT INFERENCE,
Geological Survey of Canada, Ottawa (Ontario). Terrain Sciences Div.
J. D. Adshead.
Canadian Journal of Earth Sciences, Vol. 20, No. 2, p 305-312, February, 1983. 4 Fig, 1 Tab, 14 Ref.

Descriptors: *Fluvial sediments, *Glaciation, *Rivers, *Hudson Bay, *James Bay, Carbonates, Mineralogy, Ice movement, Sand, Silt, Clay, River sediments, Limestone, Glacial drift.

To study the effects of differential abrasion on fluvial sediments in the Hudson Bay area, the mineralogy of the silt and clay fractions of river muds from the west side of Hudson and James Bays is compared with the mineralogy of river sands from the same area. Regional calcite/dolomite patterns for coarse silt, fine silt, and coarse clay fractions parallel the regional pattern for sands, further indicating the presence of a train of drift with distinctive carbonate composition extending southwest of Cape Henrietta Maria. Mineralogical results emphasize the role of common underlying factors such as source bedrock and ice dispersal patterns in influencing the distribution of carbonate minerals in glacial derivative sediments. Conversely, carbonates in river sediment of the Hudson Bay region are useful indicators of regional drift dispersal and ice-flow patterns. The abundance of dolomite over calcite in coarse silt and the enrichment of calcite in fine silt may be explained by a greater resistance to abrasion of grains of dolomite than grains of calcite after particles have been reduced to sizes lying in the coarse silt range. Clay-size particles of calcite and dolomite are among the most susceptible of sediment components to acid dissolution, but constitute 10-20% of the 0.2-2 micro m fraction of muds from the Nelson, Severn, and Attawapiskat localities. The widespread use of silt or combined silt and clay fractions for calcite and dolomite determinations in drift provenance studies is not upheld by the results of this study. Use of the sand particle size grade is advocated for studies of the carbonate mineralogy of tills or galcial derivative sediments. It is clear from the carbonate mineralogy of river sediments from the lowlands that sands reflect the composition of carbonate source rocks in the region much better than silts. (Baker-IVI)
W85-00146

DEPOSITION OF FINE AND COARSE SAND IN AN OPEN-WORK GRAVEL BED,
Freshwater Biological Association, Ambleside (England).
P. A. Carling.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 2, p 263-270, February, 1984. 6 Fig, 2 Tab, 41 Ref, 1 Append.

Descriptors: *Sand, *Streambeds, *Siltation, *Sedimentation, Water pollution effects, Stream fisheries, Stream degradation, Gravel, Bed load, Suspended sediments, Deposition.

Low silt content in stream bed sediments is generally regarded as important to the survival of the young stages of salmonids. Knowledge of processes, rates, and downstream extent of siltation would be invaluable when evaluating pollution impact or gravel restoration programs. The siltation of small shallow upland streams with well-graded gravel was modeled using an experimental gravel bed in a flume with three grades of sands moving in suspension and as bedload. For low suspended concentrations (< 300 mg/L) the mean deposition rate was 1.34% of the initial gravel volume filled per hour. Deposition rates for sands 0.15-1.4 mm in diameter with suspended sediment concentrations of 38-911 mg/L and Froude numbers in the range 0.008-1.2 were constant with respect to Froude number. For all concentrations the deposition rate was strongly linearly correlated with the suspended sediment concentration. The downstream decrease in siltation rate from a point source was a negative exponential function of distance from that source. Turbulent resuspension of sediment prevented depos

tion in a surface layer of gravel of thickness approximately equal to the mean grain size of the gravel. Hydraulic parameters, velocity, and depth in particular, act to control the downstream distribution of the sediment load rather than the overall magnitude of deposition. Mean flow data, especially where derived from velocity profile data measured in the outer boundary layer, have limited value for siltation investigations concerned with processes occurring very close to the bed. Openwork gravels will rapidly become silted in flows with low concentrations of suspended solids. Without natural disturbance of gravels by high flows, mechanical cleansing of spawning beds has limited value where sediment pollution is likely to be a recurrent problem. (Collier-IVI)
W85-00148

COARSE SEDIMENT YIELDS FROM THE UPPER WAIPAWA RIVER BASIN, RUAHINE RANGE,
Ministry of Works and Development, Napier (New Zealand). Water and Soil Div.
P. J. Grant.
Journal of Hydrology (New Zealand), Vol. 21, No. p 81-97, 1982. 6 Fig, 5 Tab, 12 Ref, 1 Append.

Descriptors: *Waipawa River, *New Zealand, Sediment yield, *Tukituki River, Erosion rates, Floods, Cyclones, Middle Stream, Smith Stream, Mangataura Stream, Flood control, Rock, Scree.

Recent aggradation of the channels of Waipawa and Tukituki Rivers in the Ruataniwha Plains area North Island, New Zealand, has seriously reduced the protection now given by the Upper Tukituki Flood Control Scheme. Throughout the Ruahine Range, the source region of Waipawa and Tukituki Rivers, the current trend of change appears to be one of increased erosion and sediment transport. The floods resulting during cyclone Alison, March 1975, from North Branch, in the Upper Waipawa River basin, having a sediment supply area of 0.354 sq km and a drainage area of 9 sq km, transported more than 44,400 cu m of coarse sediment; this represents a specific yield of 5000 cu m/sq km. A three year period prior to Alison was suitable for the accumulation of a large supply of loose rock waste and, as well as transporting this, Alison floodwater eroded much bedrock and some old scree material. The flood level produced by cyclone Alison on the Upper Waipawa River has an estimated recurrence interval of about 7.5 years leading to a minimum average annual sediment yield of 3700 cu m/sq km/a from this storm alone. When other floods are taken into account a more realistic average annual sediment yield of North Branch is estimated to be 4500 cu m/sq km/a, but this also is conservative. From other specific yield other approximate specific yields can be derived for the headwater areas of: Middle Stream, 2100 cu m/sq km/a; Smith Stream, 3200 cu m/sq km/a; and Mangataura Stream, 1400 cu m/sq km/a. Compared with available values of natural erosion rate and sediment yield for geologically and physiographically similar regions in New Zealand, the coarse sediment yield from the Upper Waipawa branches of > 4500 cu m/sq km/a may be one of the highest, if not the highest, in New Zealand. (Collier-IVI)
W85-00178

SIMULATION OF DISPERSION OF HEAVY PARTICLES IN CONFINED TURBULENT FLOWS,
Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
A. Weber, F. Boysan, W. H. Ayers, and J. Shenbank.
AIChE Journal, Vol. 30, No. 3, p 490-492, May, 1984. 3 Fig, 10 Ref.

Descriptors: *Sediment transport, *Turbulent flow, *Simulation, Lagrangian method, Mathematical equations, Computer models, Particulate matter.

The turbulent dispersion of particles is of major importance in such diverse applications as liquid and coal combustion, reaction quenching, sediment transport in rivers and gas-solid separation in cyclones. The application of a Lagrangian formulation to experimental situations both in pulverized coal burners and the case of particle-laden cold flow to validate the physical modelling is described. In the Lagrangian approach a representative number of individual particle trajectories are calculated within the Eulerian gas flow field, which is obtained either experimentally or through the solution of the governing equations of the gas phase complemented by a suitable turbulence model. The results of the large number of particle trajectory calculations are ensemble averaged to give the particle concentration distribution defined in the Eulerian sense. (Baker-IVI)
W85-00197

BRAIDED-STREAM DEPOSITION IN THE MPEMBENI RIVER, ZULULAND,
Southern Sphere Mining and Development, Randburg (South Africa).
O. R. Dix.
South African Journal of Science, Vol. 80, No. 1, p 41-42, January, 1984. 5 Fig, 5 Ref.

Descriptors: *Braided streams, *Deposition, *Mpembeni River, *Zululand, *South Africa, Bedforms, Sandwaves, Dunes, Flooding, Velocity, Water depth, Erosion, hannel morphology.

The Mpembeni River is a perennial stream which runs east of Babanago in Zululand. It has a catchment area of 260 sq km above the reach investigated with a high proportion of granitic and arkosic bedrock. Investigations of the area suggest the following sequence of events occurs during flooding. First, at high water, all sand and some gravel in the braided reach is transported downstream, leaving a lag of only the larger clasts. When the flow is waning, smaller clasts and sand-size sediment are deposited on the lag. Bedforms such as sandwaves and dunes probably form, depending on factors such as flow velocity and water depth. Transition from high to intermediate flow results in braiding. High-flow bedforms such as sandwaves emerge and are no longer in equilibrium with flow. Complex patterns of erosion and deposition ensue, and the bedforms are dissected to form a series of compound bars. With further decline in discharge, water flow concentrates in a single channel with high depth to width ratio. This concentration of flow and reduced sediment input from upstream results in greater competency. Degradation ensues, progressing upstream from the weir, which acts as a local base level. The effect of degradation is to reduce gradient and cause the channel to meander. These changes involve the concepts of geomorphic thresholds and complex response. (Baker-IVI)
W85-00217

SEDIMENTATION AND RESUSPENSION IN A NEW ENGLAND SALT MARSH,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
T. E. Jordan, and I. Valiela.
Hydrobiologia, Vol. 98, No. 2, p 179-184, January, 1983. 5 Fig, 2 Tab, 15 Ref.

Descriptors: *Sedimentation, *Resuspension, *Great Sippewissett Salt Marsh, *Massachusetts, Salt marshes, Particulate matter, Particle size, Nitrogen, Sediment transport, Tidal effects, Mussels.

Particulate matter in a salt marsh can undergo repeated sedimentation and resuspension. Sedimentation in Great Sippewissett Salt Marsh, Massachusetts, was compared to other fluxes of particulate matter. Resuspension was calculated using measured rates of filtration and biodeposition by mussels, tidal exchange of particulate matter, and sedimentation. Sedimentation measured with sediment traps, increases with tidal amplitude in areas with fast tidal current, but is unaffected by tidal amplitude in areas with slow currents. The total sedimentation of particulate nitrogen in areas with slow tidal currents is three times as large as the gross tidal exchanges of particulate nitrogen between the marsh and coastal waters. Net tidal export of particles by the marsh suggests that sedimentation is more than offset by resuspension. Resuspension of fine (4-40 micro m) particles occurs early in the flood tide in tidal creeks with slow currents. This resuspension does not increase with tidal amplitude, suggesting that it is not caused by tidal currents. Stirring by wind or fish, and the lifting of particles in surface films, cause resuspension in muddy areas with slow tidal currents. This resuspension results in a significant input of particles into the marsh water column, one that greatly exceeds input of particles with the tide. (Collier-IVI)
W85-00405

2K. Chemical Processes

HYDROLOGY AND HYDROCHEMISTRY OF THE CAVES BRANCH KARST, BELIZE,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2F.
W85-00006

TRACE-ELEMENT PARTITION COEFFICIENTS IN THE CALCITE-WATER SYSTEM AND THEIR PALEOCLIMATIC SIGNIFICANCE IN CAVE STUDIES,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2F.
W85-00018

EFFECTS OF GEOMORPHOLOGY AND SEASONALITY ON THE CHEMISTRY OF CARBONATE GROUNDWATER,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2F.
W85-00019

SULFUR ISOTOPES AND HYDROCHEMICAL VARIATIONS IN SPRING WATERS OF SOUTHERN INDIANA, U.S.A.,
Indiana Univ. at Bloomington. Dept. of Geology.
For primary bibliographic entry see Field 2F.
W85-00022

QUALITY OF GROUND WATER IN SOUTHERN BUCHANAN COUNTY, VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
S. M. Rogers, and J. D. Powell.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water Resources Investigations Report 82-4022, 1983. 36 p, 24 Fig, 1 Tab, 7 Ref.

Descriptors: *Coal hydrology, *Groundwater quality, Water quality, Groundwater contamination, Buchanan County, *Virginia.

In seven small contiguous stream basins in the coal area of southwest Virginia, ground water is predominantly bicarbonate in anion composition, with calcium as the major cation in the ridges and sodium the major cation in the lower altitudes. Sulfate is the major anion in water associated with coal seams and in stream waters draining areas extensively disturbed by mining activities. Water found along a major linear feature in the Big Prater Creek valley and water from deep wells in Levisa Fork basin contain chloride as the predominant anion. Hydrogen ion activities (pH) in the ground water range from 5.2 to 8.4. Iron concentrations as high as 14,000 micrograms per liter are present in domestic wells. The chemical composition of most streams changes with diminishing discharge and at baseflow is similar to the composition of local ground water. At high flows, streams draining mined areas are enriched with sulfate. (USGS)
W85-00025

HYDROGEOLOGIC AND WATER-QUALITY CHARACTERISTICS OF THE IRONTON-GALESVILLE AQUIFER, SOUTHEAST MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.

For primary bibliographic entry see Field 4B.
W85-00028

CHEMISTRY OF MONTANA SNOW PRECIPITATION, 1982,
Montana State Univ., Bozeman. Dept. of Chemistry.
G. K. Pagenkopf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 190123, Price codes: A04 in paper copy, A01 in microfiche. Montana Water Resources Research Report No. 136, Bozeman, June 1983. 26 p, 2 Fig, 5 Tab, 13 Ref. OWRT Project No. A-138-MONT (1), Contract/Grant No. 14-34-0001-2128.

Descriptors: *Chemistry of precipitation, *Snowfall, Acidity, Chemical analyses, Water quality, Acid streams, *Montana, Sampling, *Acid precipitation, *Acid snow, Contaminant transport, Acid precipitation effects, Pollutant identification.

This project investigated the chemistry of precipitation in the western mountain region of Montana. Of particular concern was the acid content of the snowfall. Seventy-seven snow samples were collected during the winter of 1982 and analyzed for chemical constituents. Several of the samples indicated the presence of acid precipitation; however, in general the study areas were not being subjected to acid precipitation. Surface water samples were collected from twenty-eight lakes and streams. Chemical analyses of these water samples indicated that many of the lakes could be classified as moderately or extremely sensitive to acid precipitation, based on their respective calcium saturation index.
W85-00072

OXYGEN CONSUMPTION IN THE BOTTOM WATER RELATED WITH THE PRODUCTION OF SULFIDES IN THE BOTTOM SEDIMENTS,
Kinki Univ., Osaka (Japan). Dept. of Fisheries.
A. Kawai, and H. Maeda.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 50, No. 1, p 119-124, January, 1984. 6 Fig, 4 Tab, 19 Ref.

Descriptors: *Lake sediments, *Dissolved oxygen, *Lake Biwa, *Japan, *Sulfides, Lake sediments, Regression analysis, Seasonal variation.

The actual distribution and seasonal variation of the dissolved oxygen in the water as well as the sulfide concentration in the bottom sediment of the north and south basins of Lake Biwa were examined. Dissolved oxygen consumption due to the bottom sediment was estimated from the dissolved oxygen uptake in the core tube. Chemical oxygen uptake in the bottom sediment core was measured separately from total uptake by supplementation of formalin or mercury chloride. Total dissolved oxygen consumption rates in the north and south basins averaged 0.4 g of oxygen/sq m/day and 0.02 g oxygen/sq m/day, respectively. Chemical oxygen uptake accounted for about 80% and 17% of the total oxygen uptake in the north and south basins. The sulfide accumulation was much higher in the north basin than in the south. In both basins the concentration of sulfide in the bottom sediment was correlated with chemical dissolved oxygen consumption in the overlying water. Regression analysis suggests that the rate of chemical dissolved oxygen consumption in the overlying water in both basins depends mainly on the amount of sulfides in the bottom sediment. (Baker-IVI)
W85-00139

CALCITE FORMATION IN CALCIUM CHLORIDE RICH WATER,
Nagoya Univ. (Japan). Water Research Inst.
C. Tomiyama, and Y. Kitano.
Japanese Journal of Limnology, Vol. 45, No. 1, p 1-5, January, 1984. 2 Fig, 4 Tab, 13 Ref.

Descriptors: *Calcite, *Chemical reactions, *Calcium chloride, *Dry Valleys, *Antarctica, *Don Juan Basin, Sediments, Carbonates, Calcium carbonate, Magnesium, Aragonite.

Calcium carbonate is contained in the sediment of the Don Juan basin, the south fork of the Wright Valley in the Dry Valleys region of Antarctica. To clarify the calcite formation process a study was made of the crystal form of calcium carbonate precipitation from calcium rich solution containing magnesium ions and the transformation of aragonite to calcite in calcium chloride type brine. The study indicates that calcite was formed in calcium-rich solution in spite of the presence of magnesium ions, and that aragonite was not transformed into calcite in calcium chloride rich solution containing magnesium ions. These findings suggest that calcite has been formed from the Don Juan Pond water through inorganic processes and that the past pond water contained a large amount of calcium chloride and a rather small amount of magnesium ions as seen in the present pond water. (Baker-IVI)
W85-00185

BEHAVIOUR OF TRACE ELEMENTS IN THE TAKAHASHI RIVER ESTUARY, JAPAN,
Okayama Univ., Kurashiki (Japan). Inst. for Agricultural and Biological Sciences.
H. Teraoka, and M. Ogawa.
Japanese Journal of Limnology, Vol. 45, No. 1, p 6-12, January, 1984. 2 Fig, 4 Tab, 18 Ref.

Descriptors: *Adsorption, *Trace elements, *Takahashi River Estuary, *Estuarine environment, *Japan, Lead, Copper, Zinc, Nickel, Manganese, Chromium, Cobalt, Phosphorus, Organic matter.

The concentrations and the enrichment factors for iron, manganese and organic matter in suspended solids were slightly higher in estuarine water than in rivers, suggesting adsorption of these trace elements on particles. In addition, concentrations of trace elements such as Pb, Cu, Zn, Ni, Mn, Cr, Co and P in suspended solids in water columns and in the sieved sediments were positively correlated with the amount of organic matter at $p = 0.1\%$. As to trace elements dissolved in the water, the concentrations of Fe, Cu, Ni, Pb and Cr in estuarine surface waters were slightly lower than in river waters, but Mn, Ag and Zn showed the reverse tendencies. The comparison of concentrations of trace elements in the interstitial water obtained from estuarine sediments with the overlying water indicates a characteristic increase of Mn and Co by factors of 620 and 37, respectively, and a 7.3-15 fold increase of Cr, Cu, Zn, Pb, Ag, Fe, and Ni. Almost all trace elements and organic matter that had been adsorbed is released again in the reducing environment of sediment. Owing to the positive correlation between trace elements and organic matter in the various sized sediments and the abundance of organic matter in interstitial water, organic matter may be most important for postdepositional migration of trace elements. (Baker-IVI)
W85-00186

WATER QUALITY AND ROCK WEATHERING IN THE UPPER REACHES OF THE TENRYU RIVER IN CONNECTION WITH LANDSLIDE DISASTERS,
Miyazaki Univ. (Japan). Faculty of Engineering.
S. Nakamura, M. Takemura, and Y. Kitano.
Japanese Journal of Limnology, Vol.45, No. 1, p 13-25, January, 1984. 8 Fig, 3 Tab, 6 Ref.

Descriptors: *Landslides, *Weathering, *Water quality, *Tenryu River, *Japan, Chemical reactions, Bicarbonates, Calcium, Natural waters, Geochemistry.

Natural waters in the upper reaches of the Tenryu River were analyzed in connection with landslide disasters. Landslides occurred in the limestone areas and metamorphic rock plus limestone areas where the concentrations of bicarbonate and calcium in natural waters were more than 40 mg/l and 13 mg/l, respectively. Landslides occurred in metamorphic rock plus granite areas where the concentrations of bicarbonate and calcium were more than about 25 mg/l and 8 mg/l, respectively. Landslides occurred in the granite areas where the concentrations of bicarbonate and calcium are more than about 20 mg/l and 7 mg/l, respectively. These geochemical considerations and discussion are helpful for the understanding of the chemical weathering of rocky materials and also the occurrence of landslides. (Baker-IVI)
W85-00187

SHORT STUDY OF THE INFLUENCE OF A VALLEY ON THE COMPOSITION OF RAINWATER,
Central Electricity Generating Board, Ratcliffe-on-Soar (England). Scientific Services Dept.
For primary bibliographic entry see Field 5B.
W85-00238

PRECIPITATION CHEMISTRY PROBABILITY - THE SHAPE OF THINGS TO COME,
Pack (Donald H.), McLean, VA.
D. H. Pack.
Atmospheric Environment, Vol. 16, No. 5, p 1145-1157, 1982. 8 Fig, 6 Tab, 14 Ref.

Descriptors: *Chemistry of precipitation, *Probability, *Ions, Hydrogen ion concentration, Sulfates, Nitrates, Chloride, Ammonia, Calcium, Magnesium, Potassium, Temporal distribution.

Cumulative frequency distributions, presented in probability terms, were determined for the five major ions (H(+), SO4(2-), NO3(-), Cl(-), NH4(+) at five MAP3S sites and Ca(2+), Mg(2+) and K(+) for two of these locations). The sites used are: Pennsylvania State University, PA; Ithaca, NY; University of Virginia, VA; Whiteface Mountain, NY; and Champaign/Urbana, IL. Curvilinear regressions were fitted to these data. The majority of the distributions are exponential (81%) with excellent correspondence with the observations (r sq = 0.90 or larger for 89% of the distributions). The remaining 19% of the data was best fitted by a power law distribution. In no case did a logarithmic or linear regression fit the data best. These equations are directly and conveniently applicable to the design of simulated rain exposures to reproduce the natural probability of an ecosystem receiving a specified ion concentration. The analysis produced a median little affected by outliers, either real or artifacts, and so is a better statistic for use in trend analysis. If combined with flux or ridit analysis approaches the entire concentration distribution can be examined for temporal changes with much more opportunity for detecting subtle shifts in the chemistry. (Moore-IVI)
W85-00239

MAP3S/RAINE PRECIPITATION CHEMISTRY NETWORK: STATISTICAL OVERVIEW FOR THE PERIOD 1976-1980.
Atmospheric Environmental, Vol. 16, No. 7, p 1603-1631, 1982. 5 Fig, 11 Tab, 16 Ref, 2 Append

Descriptors: *Chemistry of precipitation, *Meteorological data collections, *Statistical analysis, Sulfur, Sulfur dioxide, Hydrogen ion concentration, Ammonia, Nitrates, Seasonal variation.

The MAPS3S/RAINE precipitation chemistry network was initiated in 1976 with the objective of creating a long-term, high-quality data base for the development of regional transport and deposition models. A basic statistical summary is presented for the the initial 3 1/2 year operating period of the MAP3S/RAINE network. The overview considers statistical features of the precipitation event data base, including temporal and variable-pair behavior and spatial (site-to-site) relationships. Seasonal variations in concentrations of the species total sulfur, SO2, free hydrogen ion and NH4(+) are easily identifiable from both event and monthly average time trend analyses. Species-pair correlations are generally strong and positive among the major ionic species total S, nitrate, free hydrogen and ammonium; variations from this trend at individual sites can be related to geographical location. Though reasonable coherency is exhibited in site-to-site correlation analyses, the questions of proper averaging time and network density make interpretation of spatial statistics difficult. Significant features of the data set include seasonal cycling for some species, variability of the data, and interrelationships between pollutants. There is very lit

trend to the data, over the approximately three-year period of record. (Moore-IVI)
W85-00240

FACTORS INFLUENCING TRACE METAL, SULFATE AND HYDROGEN ION CONCENTRATIONS IN RAIN,
Oak Ridge National Lab., TN. Environmental Sciences Div.
S. E. Lindberg.
Atmospheric Environment, Vol. 16, No. 7, p 1701-1709, 1982. 5 Fig, 3 Tab, 36 Ref. DOE contract W-7405-eng-26.

Descriptors: *Trace metals, *Sulfates, *Hydrogen ion concentration, *Chemistry of precipitation, *Tennessee, Lead, Manganese, Zinc, Air pollution, Seasonal variation, Rainfall, Wet deposition.

Precipitation collected as wetfall-only and primarily on an event basis at a site in the Tennessee Valley is a dilute sulfuric acid solution containing trace metals whose concentrations exhibit log normal distributions. The concentrations of H(+), SO4(2-), Pb, Mn, and Zn exhibit maxima in the warmer months in response to synoptic meteorologic conditions. These conditions result in elevated air concentrations during air stagnation and in generally lower rainfall amounts per event and hence less dilution of the scavenged material. Dilution is indicated by significant negative correlation coefficients between concentrations and rainfall amount, the rainfall parameter exerting the strongest influence on concentrations. Concentrations are negatively correlated with rainfall duration and intensity to a lesser event. The relationship between concentration and rainfall amount can be described by a negative exponential, while that between wet deposition and rainfall amount is approximately a 0.6-power relationship. Calculated scavenging ratios generally increase with increasing atmospheric particle mass-median diameter of each element and are on the order of 100 for Pb, 1000 for SO4(2-) and Zn, and 5000 for Cd and Mn. (Author's abstract)
W85-00241

IMPACT OF LAND-USE ON THE ACID AND TRACE ELEMENT COMPOSITION OF PRECIPITATION IN THE NORTH CENTRAL U.S.,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
D. Thornton, and S. J. Eisenreich.
Atmospheric Environment, Vol. 16, No. 8, p 1945-1955, 1982. 8 Fig, 6 Tab, 43 Ref. DOE grant DE-AC02-77-EVO4327.

Descriptors: *Land use, *Chemistry of precipitation, *Acid rain, *Trace elements, *Minnesota, Snow, Rain, Metals, Sulfates, Nitrates, Ammonia, Hydrogen ion concentration, Prairies, Cultivated lands, Forests, Soils, Neutralization.

Snow (wet-only) precipitation and snow core samples from a transect across northern Minnesota provided a means for examining the influence of land use on the composition of wet deposition. Analyses included major cations (Al, Ca, Mg, Fe, Mn), major anions (SO4, NO3), trace metals (Cu, Zn, Pb, Cr, Ni, Zn), ammonia and pH. Soil from the prairie-agricultural area greatly influences the composition of precipitation. The effect was most pronounced for the major cations which had concentrations in the prairie-agricultural area up to 5 times greater than in the forested areas. Due to the influence of alkaline soils in the agricultural area, soil sources appeared to mask anthropogenic contribution for SO4, NO3, and the trace metals in those areas. In areas of soil deficient, forested areas of northeastern Minnesota, anthropogenic sources were more important. This is due to: less exposed, erodible soil; fewer local anthropogenic emissions; and closer proximity to the industrial Midwest. Soil source was significant for the major cations. Based on volume-weighted, mean concentrations of H(+), SO4(2-), and NO3(-), between 64 and 91% of the precipitation acid was neutralized. In the agricultural area, the extent of the neutralization of rainfall was greatest and included NH4(+) (84%) and soil minerals (16%). In the forested area, the extent of acid neutralization was the least and was primarily due to NH4(+) (96%). (Moore-IVI)
W85-00243

ATMOSPHERIC TRACE METALS IN THE SNOW LAYERS DEPOSITED AT THE SOUTH POLE FROM 1928 TO 1977,
Laboratoire de Glaciologie et Geophysique de l'Environnement, Grenoble (France).
C. Boutron.
Atmospheric Environment, Vol. 16, No. 10, p 2451-2459, 1982. 3 Fig, 4 Tab, 35 Ref.

Descriptors: *Snow, *Antarctic, *Trace metals, *South Pole, *Air pollution, Polar regions, Sodium, Magnesium, Potassium, Calcium, Iron, Aluminum, Manganese, Lead, Cadmium, Copper, Zinc, Silver.

Forty-seven successive dated snow samples, covering a 50 y continuous time sequences between 1928 and 1977 with a time resolution of approximately one sample per year, have been collected using stringent contamination-free techniques from a 10 m deep pit in the clean sector at the geographic South Pole, Antarctia. They have been analysed for Na, Mg, K, Ca, Fe Al, Mn, Pb, Cd, Cu, Zn and Ag in clean room conditions by flameless atomic absorption after preconcentration. For all the elements, the concentrations observed in the most recent snow layers are comparable to the ones in the 50 y old snow layers, except for Pb, for which an increase (x 4) is observed after 1960 approximately. These data therefore confirm that the influence of global atmospheric pollution is probably still negligible in the remote areas of the southern hemisphere for the 12 measured elements, except possibly for Pb after 1960. For this last element, however, an alternative explanation of the post-1960 increase could be that the post-1960 snow layers have been contaminated by operations at Amundsen Scott station, which has been occupied since 1957. (Author's abstract)
W85-00244

ACIDITY OF RAIN IN EUROPE,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
A. S. Kallend, A. R. W. Marsh, J. H. Pickles, and M. V. Proctor.
Atmospheric Environment, Vol. 17, No. 1, p 127-137, 1981. 6 Fig, 5 Tab, 11 Ref.

Descriptors: *Acid rain, *Europe, Hydrogen ion concentration, Statistical analysis, Trends.

A detailed statistical evaluation has been made of the precipitation acidity data from the European Atmospheric Chemistry Network for the time period 1956-1976 in an attempt to establish what trends are apparent. Out of 120 sites with 5 or more years data, 29 show a significant trend of increasing annual average precipitation acidity during the period and five a decrease. For these sites substantially the same result arises for the hydrogen ion concentration calculated from ionic balance based on detailed chemical analysis of the precipitation samples. The data showed that the increased annual levels of H(+) arose from an increased number of intermittent high monthly values after about 1964 rather than a sustained high level of acidity with some months continuing to show low values similar to those seen pre-1964. This gives rise to an apparent step-increase in annual average precipitation acidity for several of the sites at this time. Comparison of data from four adjacent Swedish sites showed that they were not well correlated suggesting that the major part of the variance was explained by local rather than regional influences. (Author's abstract)
W85-00245

ANALYSIS OF THE CHEMICAL PROPERTIES OF RAIN IN MINNESOTA,
Minnesota Univ., St. Paul. Dept. of Plant Pathology.
G. C. Pratt, M. Coscio, D. W. Gardner, B. I. Chevone, and S. V. Krupa.
Atmospheric Environment, Vol. 17, No. 2, p 347-355, 1983. 3 Fig, 10 Tab, 16 Ref.

Descriptors: *Chemistry of precipitation, *Minnesota, Hydrogen ion concentration, Sulfates, Nitrates, Ammonium ion, Calcium, Magnesium, Sodium, Powerplants, Air pollution.

Individual rain event samples were collected at seven sites in central Minnesota during the summers of 1977-1980 using automatic, sequential precipitation samplers placed 3.75 m above the ground. The sites were clustered with 40 km of each other in a rural area in the vicinity of a coal-burning power station. The samples were analyzed for pH; anions (ion chromatography), metallic cations (inductively coupled plasma spectrometry) and the ammonium ion (colorimetry). Spatial and temporal variations in the concentrations and deposition of chemical species in the precipitation were observed. No definite trends in the concentrations of the ionic components with time or location could be identified over the study period. Sulfate and nitrate were the predominant anions, and through correlation and regression analyses they appeared to be associated more with metallic cations (calcium, magnesium and sodium) and the ammonium ion than with the hydrogen ion. Concentrations of the major ionic components generally tended to decrease during rain events. No obvious pattern in ionic concentrations between the sites was observed which could be related to the point source. (Moore-IVI)
W85-00246

INVESTIGATION OF ACID PRECIPITATION IN QINGHAI PROVINCE, CHINA,
East-West Environment and Policy Inst., Honolulu, HI.
For primary bibliographic entry see Field 5B.
W85-00247

COMPLEXATION OF TRACE METALS BY ADSORBED NATURAL ORGANIC MATTER,
Geological Survey, Miami, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-00296

DETERMINATION OF HYDROGEN ION CONCENTRATION IN SOFTWATER LAKES USING CARBON DIOXIDE EQUILIBRIA,
Lamont-Doherty Geological Observatory, Palisades, NY.
A. L. Herczeg, and R. H. Hesslein.
Geochimica et Cosmochimica Acta, Vol. 48, No. 4, p 837-845, April, 1984. 5 Fig, 4 Tab, 24 Ref.

Descriptors: *Hydrogen ion concentration, *Chemical analysis, *Carbon dioxide, *Experimental Lakes Area, *Ontario, Inorganic carbon, Organic carbon, Alkalinity, Carbonates, Surface water.

A strategy for determining the hydrogen ion content of fresh waters is proposed that involves total dissolved inorganic carbon (DIC or sigma CO2) and CO2 partial pressure (PCO2) measurements rather than pH electrode measurements. This recommendation derives from discrepancies between pH and carbon dioxide equilibria measurements made on several softwater lakes at the Experimental Lakes Area, northwestern Ontario. The pH calculated from DIC, PCO2, and the first dissociation constant of carbonic acid (K1) data was consistently higher than that directly measured with a pH electrode. Similarly, calculation of PCO2 of surface waters from pH, DIC, and K1 data gave values up to twice that of atmospheric saturation despite repeated equilibrations with atmospheric PCO2. Laboratory experiments demonstrated that the high dissolved organic carbon content of these waters appears to alter the electrode response yielding pH values lower than the true values. Furthermore, the uptake of protons by weak acid anions appear to be the cause of the measured difference between total (Gran) and carbonate (DIC - dissolved CO2) alkalinity. Therefore bicarbonate ion concentration must be calculated from the difference between the total dissolved inorganic carbon content and uncharged dissolved CO2 content. These procedures should provide more

accurate and consistent results in the pH trend in surface waters and hence yield a solid baseline against which the effects of acid precipitation can be assessed. (Author's abstract)
W85-00298

COMPUTER PROGRAM FOR A TRILINEAR DIAGRAM PLOT AND ANALYSIS OF WATER MIXING SYSTEMS,
Kent State Univ., OH. Dept. of Geology.
For primary bibliographic entry see Field 5A.
W85-00360

FATE OF ORGANIC COMPOUNDS IN MOUNTAIN STREAMS IN THE MARMOT BASIN: A PROCESS REACTOR MODEL,
Calgary Univ. (Alberta). Kananaskis Centre for Environmental Research.
S. A. Telang, and G. W. Hodgson.
Hydrobiologia, Vol. 98, No. 2, p 185-191, January, 1983. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Organic compounds, *Mountain streams, *Degradation, *Marmot Basin, Humic acids, Fulvic acids, Tannins, Lignins, Hydrocarbons.

Clear cold mountain streams of the Marmot Creek drainage basin are surprisingly active in the conversion of organic matter. A conceptual process reactor model with input/output functions was developed for the Marmot basin to evaluate the stream as a reactor and to quantify many of the processes within the process reactor of the stream. The flow of refractory organic compounds through a 2 km reach of the Marmot Creek basin showed no conversion, just simple transport from input to output, for humic and fulvic acids. Tannins and lignins, which are commonly regarded as less refractory, showed conversions. Mass balance data for the input/output flow of more labile substances-amino acids, carbohydrates, fatty acids and phenols-confirmed the processes of degradation. Further, they showed a great deal of dynamic activity in the stream that resulted in some cases in net generation of labile compounds such as hydrocarbons, i.e, where processes of generation dominated those of degradation. (Author's abstract)
W85-00406

DRY WEIGHT LOSS AND CHANGES IN CHEMICAL COMPOSITION OF PINE (PINUS KESIYA ROYLE) NEEDLES AND TEAK (TECTONA GRANDIS L.) LEAVES DURING PROCESSING IN A FRESHWATER LAKE,
North-Eastern Hill Univ., Shillong (India). Dept. of Botany.
B. K. Tiwari, and R. R. Mishra.
Hydrobiologia, Vol. 98, No. 3, p 249-256, February, 1983. 3 Fig, 1 Tab, 31 Ref.

Descriptors: *Decomposition, *Litter, *Pine, *Teak, *Wards Lake, *Shillong, *India, Cellulose, Hemicellulose, Lignin, Sugars, Amino acids.

The dry weight loss and chemical changes during the process of decomposition of two types of litters viz.; pine (Pinus kesiya Royle) needles and teak (Tectona grandis L.) leaves have been studied in a small freshwater lake (Wards Lake, Shillong, India) using plastic net (1 mm pore size) bags. The results reveal that type of litter and depth of water were the most important factors regulating the rate of decomposition. The percentage composition of cellulose and hemicellulose showed little variation and only a minor fall was noted in their values towards the end of the study period. The lignin percentage increased steadily at all the stations except the deepest station. The sugar and amino acid concentration dropped appreciably during the initial phase and stabilized during later periods. The general trend of change in nitrogen percentage was initial fall-increase-fall-stabilization at a near original value. The rate of decomposition was faster when compared with similar studies in Canada and Europe. (Author's abstract)
W85-00411

LEAF LITTER PROCESSING IN AQUATIC SYSTEMS: A TWO VARIABLE MODEL,
Brigham Young Univ., Provo, UT. Dept. of Zoology.
B. J. Hanson, K. W. Cummins, J. R. Barnes, and M. W. Carter.
Hydrobiologia, Vol. 111, No. 1, p 21-29, 1984. 2 Fig, 4 Tab, 30 Ref. DOE contract DE AT06 79EV 10004.

Descriptors: *Litter, *Mathematical models, *Decomposition, *Aquatic environment, Time, Temperature effects, Detritus.

A negative exponential model with one independent variable, days or accumulated time, was examined for adequacy as a descriptive equation for aquatic leaf litter processing. The effect of adding a second independent variable, degree days or accumulated temperature, to the model was also examined. The two variable negative exponential model was shown to have two advantages over the single variable model. The expanded model provided an adequate fit of litter processing data for more cases than the single variable model. Also, the two variable model allowed determination of rate coefficients corresponding to each temperature level of the experiment rather than assuming a single, constant rate coefficient as with the one variable model. The trends of the temperature dependent rate coefficients were useful for examining processing differences between experiments for different sites and seasons. (Author's abstract)
W85-00412

WATER CHEMISTRY OF THE RIVER KWAI, THAILAND,
Tasmania Univ., Hobart (Australia). Dept. of Botany.
P. A. Tyler.
Hydrobiologia, Vol. 111, No. 1, p 65-73, 1984. 9 Fig, 3 Tab, 8 Ref.

Descriptors: *Water chemistry, *River Kwai, *Thailand, Bicarbonates, Limestone, Hydrogen ion concentration, Calcium.

The River Kwai (Thailand) has two branches, the large Mae Nam Kwai Yai and the smaller Mae Nam Kwai Noi. The water chemistry of the River Kwai Noi, its tributaries, and the neighboring Kawi Yai is shown to be dominated heavily by calcium bicarbonate. Local rainwater is relatively dilute and unbuffered with a pH close to that of distilled water in equilibrium with air. Even during months of high rainfall, river waters are heavily dominated by alkaline earth bicarbonates, and have a consequently high pH. Dominance by calcium rather than calcium plus magnesium is to be expected since limestone predominates in the catchment. The river is turbid but well oxygenated. It will soon be impounded by a new dam, the Khao Laem project. The dam will flood much of the upper Kwai Noi valley below. Bangkhlaburi. (Moore-IVI)
W85-00414

2L. Estuaries

DEMOGRAPHY AND FLORA OF THE OUSE WASHES, ENGLAND,
Royal Society for the Protection of Birds, Sandy (England).
G. J. Thomas, D. A. Allen, and M. P. B. Grose.
Biological Conservation, Vol. 21, No. 3, p 197-229, 1981. 11 Fig, 8 Tab, 21 Ref.

Descriptors: *Ouse Washes, *England, *Demography, *Vegetation, East Anglia, Marshes, Fenland, Floods, Wetlands, Peat, Drainage, Grazing, Glyceria, Aquatic plants, Aquatic weeds, Habitats.

The Ouse Washes remain as the last, large, extensively flooded washland in the fenland region of East Anglia. They mainly comprise high marsh and grassland with minority areas of low marsh and open water. Their principal function remains as a storage site for excess winter flood water which restricts the agricultural use to seasonal grazing and mowing. Drainage developments have allowed about three quarters of the remaining area of washland to be converted into arable land. The flora of the washes seems typical of fenland peat except where clay and limestone have local influences in promoting diversity. Phalaris arundinacea and Glyceria maxima predominate in the fields and the latter is the dominant emergent in the aquatic habitats. The main biotic factors diversifying the habitats and flora are pool creation, ditch clearance and cattle grazing. Although no quantitative studies were made on the response of ditch plants to different grazing pressures, the impression gained was that to check Glyceria maxima growth sufficiently the grazing densities need to be quite high. Certain infrequent species such as Potamogeton berchtoldii and P. trichoides only occurred at heavily grazed sites. This is of benefit to the breeding and wintering waterbirds. The removal of Glyceria maxima during the dredging of ditches produces a habitat suitable for a range of colonizing species. In addition, plant propagules which have been dormant in the mud may be brought to the surface where suitable conditions for growth may be more likely. (Baker-IVI)
W85-00116

TROPHIC IMPORTANCE OF SPARTINA ALTERNIFLORA PRODUCTION AND DECOMPOSITION TO THE MARCH-ESTUARINE ECOSYSTEM,
New Jersey Agricultural Experiment Station, New Brunswick.
A. C. Marinucci.
Biological Conservation, Vol. 22, No. 1, p 35-58 January, 1982. 2 Tab, 142 Ref.

Descriptors: *Estuarine environment, *Plant growth, *Marshes, *Spartina, *Decomposition, Gulf Coast, Coastal waters, Wetlands, Detritus, Salt marshes, Productivity, Nutrients, Tidal effects.

Current estimates of the aerial production of Spartina alterniflora on the East and Gulf Coasts of the United States and Canada range from 550 g/sq m year in Nova Scotia to 2,000 g/sq m /year in the Southern United States. Though production may vary greatly between marshes in the same geographic areas, production is higher in the low marsh where plants exist exclusively because of a variety of morphological and physiological adaptations. Application of the first order decay function to S. alterniflora decay data has shown that decay rates from litter bag studies increase as one moves southward, indicating principally the effect of microbial activity on the process. Decay rates determined by the harvest plot technique are more rapid than the litter bag results for the same area, likely reflecting the influence of tidal transport of litter on the observed decay rate. In many estuaries, net nutrient or energy exchanges from the marsh to adjacent estuarine waters occur, thus eliminating the salt marsh as the cause of the high overall production in the adjacent estuary. In such estuaries an interaction between tide and water density differences recirculates nutrients and detritus back into the estuary from coastal waters, and may thus be responsible for the high estuarine productivity. Processes in salt marshes are threatened by both wholesale destructive practices and subtle pollution. Good economic and political decisions based on the integrated nature of the salt marsh with other ecosystems is needed to preserve the amount and quality of marshlands. (Baker-IVI)
W85-00117

AVIAN UTILISATION ON SIX SALT MARSHES IN NEW JERSEY,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
J. Burger, J. Shisler, and F. H. Lesser.
Biological Conservation, Vol. 23, , No. 3, p 187-212, July, 1982. 9 Fig, 9 Tab, 38 Ref.

Descriptors: *Species diversity, *Birds, *Salt marshes, *New Jersey, Biomass, Marsh management, Gulls, Terns, Waterfowl, Waders, Marsh, Conservation, Habitats.

Use of six salt marshes by birds was measured in New Jersey from 18 April to 18 July 1972. In all impoundments, 2 ditched marshes, and 2 natu

salt marshes were studied in terms of species diversity, numbers of individuals and biomass. Seventy-eight species of birds were noted in all six marshes, but not every species occurred in each marsh. Species diversity was highest on the impoundments, intermediate on the ditched marshes, and lowest in the natural marshes. Species diversity and the number of individuals were directly related to the amount of open surface area. The traditional species typical of salt marshes on the East Coast of North America occurred primarily in the natural salt marshes and were absent from the impoundments. Red winged blackbirds and swallows were the most numerous species, followed by gulls and terns. The impoundments had over five times as many individuals as the natural marshes. Waterfowl, gulls, terns and waders accounted for over 90% of the cumulative biomass in the six marshes, with waterfowl contributing over 50%. Impoundments clearly support the largest biomass, number of species and individuals, and are used extensively by migrant waterfowl and shorebirds. Impoundments can be created where open water areas have disappeared, creating habitats for migrants. It is equally important to preserve natural salt marshes so that the species which nest exclusively in these habitats can continue to do so. The importance of the natural salt marsh ecosystem and its attendant species should not be under valued because of the higher numbers which impoundments, stop-ditch marshes and other managed areas can support. Bird species using managed areas can use a wider variety of habitats while the typical salt marsh species are limited to large expanses of relatively undisturbed salt marshes. (Baker-IVI)
W85-00120

ECOLOGICAL SURVEY OF STANDING WATERS IN NORTH WEST AFRICA: I. RAPID SURVEY AND CLASSIFICATION,
N. C. Morgan, and V. Boy.
Biological Conservation, Vol. 24, No. 1, p 5-44, September, 1982. 8 Fig, 5 Tab, 34 Ref.

Descriptors: *Natural habitats, *Standing waters, *Classification, *Algeria, *Morocco, *Tunisia, Wetlands, Mediterranean, Macrophytes, Invertebrates, Waterfowl, Physical properties, Zooplankton, Conservation.

A simple survey technique was used for covering a broad range of taxa to obtain a rapid assessment of the conservation value of wetlands and open waters around the Mediterranean. The method was employed in Tunisia, Algeria and Morocco and the possibility of using the data to construct a classification of North African standing waters was investigated. It was divided into four sets of data (physical, macrophytes, invertebrates and winter counts of waterflow) and cluster analyses were carried out on these. An analysis of the levels of relationship between all sites, obtained from the different cluster analyses, was then performed to combine the results and to construct natural classes. The existence of these classes was confirmed by ordination analyses. Whereas physical and botanical data alone can be used to construct a simple hierarchical classification of sites, the classification becomes more realistic in terms of the overall conservation value if faunal data are included. Zooplankton are especially valuable as indicators of habitat conditions but other invertebrate groups can be of value, particularly in relation to sites with varying salinity. A classification constructed in this way related to all features of the sites is useful for obtaining an overall assessment of the conservation value of the waterbody. The classification aids the process at the local, national, and international levels when selecting sites to be used as natural reserves. (Baker-IVI)
W85-00121

VEGETATION CHANGES AND WATER CATCHMENT IN A DUTCH COASTAL DUNE AREA,
Dune Water Works of The Hague (Netherlands).
F. van der Meulen.
Biological Conservation, Vol. 24, No. 4, p 305-316, December, 1982. 3 Fig, 5 Tab, 51 Ref.

Descriptors: *Dunes, *Vegetation, *Netherlands, *Catchment areas, *Water table, Infiltration, Nutrients, Catchment areas, Artificial recharge, Groundwater recharge, Water management, Planning, Decision making, Eutrophication.

Studies on vegetation and landscape changes resulting from water catchment in Dutch coastal dunes are briefly reviewed and discussed with special reference to Meijendel, an important catchment area near the city of The Hague. The water works mainly concerns the extraction and artificial replenishment of groundwater. The main ecological impacts involve lowering of the groundwater table after extraction and, after replenishment, the establishment of an unnatural groundwater table and eutrophication. Main vegetation changes include drying out of the dune wetlands, and, after replenishment, increased nitrophilous herb cover associated with a decrease in plant species diversity and life form diversity. Options for management of the area are aimed largely at reducing the nutrient load caused by the infiltration water and at a regeneration of dune slack communities. This could be achieved by cropping the vegetation, improving the quality of infiltration water, establishing natural fluctuations of the water table and also be reducing the area of surface infiltration. Long-term observation of permanent plots are central to all these needs. The use of air photos is an important aid for the study of vegetation changes under similar conditions. (Baker-IVI)
W85-00124

DEVELOPMENT OF LIQUID AND SOLID DISCHARGES OF A SUB-BOREAL ESTUARY: THE ST-JEAN RIVER, QUEBEC (NORTH COAST OF THE GULF OF ST-LAWRENCE) (EVOLUTION DU DEBIT LIQUIDE ET DE LA CHARGE SOLIDE D'UN ESTUARIE SUB-BOREAL: RIVERE ST-JEAN, QUEBEC (COTE NORD DU GOLFE DU ST-LAURENT)),
Quebec Univ., Rimouski. Dept. of Oceanography.
D. Cataliotti-Valdina, and B. F. Long.
Canadian Journal of Earth Sciences, Vol. 20, No. 2, p 184-194, February, 1983. 9 Fig, 1 Tab, 20 Ref.

Descriptors: *Hydrodynamics, *St. Jean River, *Quebec, *Estuaries, *Suspended solids, Flow discharge, Fluvial sediments, Subboreal estuaries, Flood flow, Low flow, Saline water intrusion.

An evaluation was made of the hydrodynamics of the St. Jean River estuary. Particular attention was paid to the flow dynamics and the mixing mechanisms which were studied for fluvial water-marine water. Two series of measurements were made on the solid and liquid discharges. The first took place during the spring flood of May 1980; the second in conditions of lowest level spring tide in August 1980. The average stream discharge is 1035 cu m/s during floods and 85 cu m/s at periods of lowest water level. When the stream discharges exceed 160 cu m/s, the wedge of salt water is pushed out of the estuary and no reversed currents are present. There is only a reduction of current velocity at the mouth of the river. Solid particles in suspension may vary in amount from 96 mg/L during floods to 4.6 mg/L for lowest water levels. In the former case about 65-95% of the solid suspension is mineral matter, and in the latter about 58% is mineral matter. The general behavior of the St. Jean River estuary suggests a new type of environment, the subboreal estuary. (Baker-IVI)
W85-00144

HUDSON BAY RIVER SEDIMENTS AND REGIONAL GLACIATION: II. COMPARISON OF CARBONATE MINERALOGY OF SIZE FRACTIONS FOR ICE MOVEMENT INFERENCE,
Geological Survey of Canada, Ottawa (Ontario). Terrain Sciences Div.
For primary bibliographic entry see Field 2J.
W85-00146

FLUCTUATION OF THE GROUNDWATER LEVEL AND FRESH-SALT WATER INTERFACE IN RESPONSE TO THE TIDE (IN JAPANESE),
Ehime Univ., Matsuyama (Japan). Dept. of Applied Physics.
For primary bibliographic entry see Field 2F.
W85-00192

MISSISSIPPI DELTAIC WETLAND SURVIVAL: SEDIMENTATION VERSUS COASTAL SUBMERGENCE,
Louisiana State Univ., Baton Rouge. Center for Energy Studies.
R. H. Baumann, J. W. Day, Jr., and C. A. Miller.
Science, Vol. 224, No. 4658, p 1093-1095, June, 1984. 2 Tab, 21 Ref.

Descriptors: *Mississippi, *Wetlands, *Deltas, *Sedimentation, *Submergence, Batarataria Bay, Fourleague Bay, Marshes, Storms, Floods, Accretion, Sea level, Aggradation.

The Mississippi deltaic plain is a complex mosaic of delta lobes in various stages of a progradation-deterioration cycle, with most lobes presently reflecting some stage of deterioration. A study of sedimentation was conducted in the marshes surrounding Barataria Bay and Fourleague Bay: Barataria Bay is an interdistributary basin, and Fourleague Bay is an estuary dominated by the Atchafalaya River, an active Mississippi River distributory. Seasonal sedimentation, measured with the aid of artificial marker horizons, was markedly different in deteriorating as compared with stable marshes in the Mississippi River deltaic plain. Deteriorating marshes receive most sediment during storm events, whereas stable marshes receive substantial amounts of sediments during the spring river flood. The deteriorating marshes are accreting at a faster rate (1.5 cm/yr at streamside, 0.9 cm/yr at inland areas) than the stable marshes (1.3 cm/yr at streamside, 0.6 cm/yr at inland areas). Relative to local apparent sea-level rise as measured by tide gauges in each area, the deteriorating marshes are not maintaining their intertidal elevation as well as the stable marshes. It is important to consider accretion relative to submergence. (Moore-IVI)
W85-00221

RESPONSE OF PLANT SPECIES TO BURIAL IN THREE TYPES OF ALASKAN WETLANDS,
Iowa State Univ., Ames. Dept. of Botany.
A. G. van der Valk, S. D. Swanson, and R. F. Nuss.
Canadian Journal of Botany, Vol. 61, No. 4, p 1150-1164, April, 1983. 3 Fig, 7 Tab, 14 Ref, 1 Append. EPA grant R805837010.

Descriptors: *Wetlands, *Burial, *Plants, *Alaska, *Flooding, Plant growth, Carex, Equisetum, Alpine zone, Coastal region, Lowlands, Species composition, Sediments, Seasonal flooding.

At 15 freshwater lowland, 7 coastal, and 6 alpine sites, a burial experiment was set up with four treatments (0, 5, 10, or 15 cm of sediment). Species in alpine wetlands were damaged most by burial and their average shoot density in the 5-, 10-, and 15-cm treatments was reduced 35, 72, and 93% in 1979 and 28, 54, and 81% in 1980, respectively. In coastal wetlands, the average shoot density was 33, 65, and 76% lower in 1979 and 21, 37, and 53% in 1980 in the 5-, 10-, and 15-cm treatments. Species in freshwater lowland wetlands were the least damaged by burial: average shoot density was 17, 33, and 47% lower in 1979 and 10, 7, and 39% lower in 1980 in the 5-, 10-, and 15-cm treatments. The responses of three common species (Carex aquatilis, Carex lyngbyaei, and Equisetum fluviatile) to burial varied from site to site. For example, Equisetum fluviatile responded to burial with a significant increase in shoot density at two permanently flooded sites and with no change in shoot density or with a significant decrease in shoot density at sites flooded seasonally. Only eight species at five sites (mostly alpine sites) were eradicated and only in the 10- and (or) 15-cm treatments at any site. In seed traps in 1979 an average of 2.7, 3.6, and 5.9 species became established at alpine, coastal, and freshwater lowland sites, respectively. In 1980, there were 1.2, 4.1, and 7.3 species, on the average represented in the seed traps in these three types of wetlands. Average seedling density was lowest in the alpine seed traps (6/sq m in 1979 and 7/sq m in 1980) and highest in coastal wetlands (362/sq m in 1979 and 270/sq m in 1980). In freshwater lowland wetlands those with permanent standing water averaged 2.2 and 3.0 species in their

seed traps in 1979 and 1980, respectively, while those only seasonally flooded averaged 8.8 species in 1979 and 9.0 in 1980. Permanently flooded freshwater lowland wetlands had 7 seedlings/sq m in 1979 and 25 in 1980, while those flooded seasonally had 122 seedlings/sq m in 1979 and 69 in 1980. On the average, slightly more than 40% of the taxa in the seed traps at a site in 1980 were taxa that had not been present in 1979, and slightly less than 40% of the taxa present in 1979 were not present in the seed traps at the same site in 1980. Only a few individuals of four species present in the seed traps of coastal wetlands in 1979 were still present in 1980. (Author's abstract)
W85-00248

STATIC AND DYNAMIC ASPECTS OF NITROGEN CYCLING IN THE SALT MARSH GRAMINOID SPARTINA ALTERNIFLORA,
Georgia Univ., Sapelo Island. Marine Inst.
C. S. Hopkinson, and J. P. Schubauer.
Ecology, Vol. 65, No. 3, p 961-969, 1984. 4 Fig, 1 Tab, 54 Ref. EPA contract R 806728020.

Descriptors: *Cycling nutrients, *Salt marshes, *Nitrogen, *Spartina, *Georgia, Primary productivity, Seasonal variation, Plant growth, Leaching, Detritus, Limiting nutrients, Uptake, Translocation.

Processes of nitrogen cycling including root uptake, translocation, leaching, detrital incorporation, and overwinter storage were determined for a medium-height form of Spartina alterniflora in Georgia, USA. Mean concentration of total N in live above- and belowground plant tissues was 0.60% of dry mass. Aboveground concentrations (1.05%) were more than twice the belowground N concentrations. The seasonal patterns of nitrogen concentrations were similar for aerial and subaerial Spartina tissues with maxima observed between December and May. Concentrations were highest in short, young stems and decreased as plants matured, senesced, and died. Seasonal patterns of nitrogen accumulation were out of phase for aerial and subaerial tissues. Maximum accumulation was in midsummer for aboveground plant parts and in late winter for belowground tissue. During winter $>$ 83% of total plant N was in roots and rhizomes. During spring, there was a large net transfer of N from belowground storage to aerial tissues; about 70% of total nitrogen was in aboveground plant parts by May. A nitrogen budget for Spartina alterniflora was constructed by combining organic productivity rates with nitrogen concentrations in plant tissues. Total uptake of N by roots was 34.8 g/sq m/yr. Of this, 43% was lost by death or leaching from aboveground plant parts, while the rest was lost by death of roots and rhizomes. Total transfer of N from below- to aboveground tissues was 33.0 g/sq m/yr, 46% of which was new nitrogen taken up from the soil. Of the N transferred aboveground, 14.4 g was lost to detritus upon culm death, 0.7 g was leached from the living culm, and 17.9 g was translocated from senescing leaves to rhizomes for storage or immediate transfer to actively growing shoots. A large percentage of the total flux into and out of leaves occurred during the period of active growth. The high degree of N conservation in Spartina, low leachability, and retraction from senescent tissue are consistent with the idea that primary productivity in salt marshes is nitrogen limited. (Author's abstract)
W85-00257

BEHAVIOUR OF IRON, MANGANESE, PHOSPHATE AND HUMIC ACID DURING MIXING IN A DELAWARE SALT MARSH CREEK,
Delaware Univ., Newark. Coll. of Marine Studies.
K. W. Eastman, and T. M. Church.
Estuarine, Coastal and Shelf Science, Vol. 18, No. 4, p 447-458, April, 1984. 7 Fig, 3 Tab, 26 Ref. NSF grants OCE-7720770, 7920893, 8201056.

Descriptors: *Salt marshes, *Delaware, *Mixing, *Iron, *Phosphates, *Humic acid, Salinity, Geochemistry, Sediments, Resuspension, Flocculation, Dissolved solids.

The mixing behavior of iron, manganese, phosphate and humic acid in a Delaware salt marsh creek was studied using field data, laboratory mixing experiments, and geochemical mass balance equations. Property-salinity diagrams for field data indicated that the removal of iron is 56-70% in the 0-10 0/00 salinity range. A proposed mechanism of removal is the flocculation of colloidal iron, perhaps with humic acid. Phosphate, however, undergoes 195% addition in the same low salinity region, which may be due to release of phosphate from resuspended sediments. Dissolved manganese is conserved, as is humic acid throughout the salt marsh mixing zone. Within the uncertainty of the data the maximum possible removal of humic acid is 23%. Laboratory mixing experiments that simulated salt marsh mixing along the same salinity gradient as observed in the field (5-25 0/00) showed only small-scale additions and removals compared to the field results. Such small-scale changes occurred largely at salinities $>$ 10 0/00 in the laboratory experiments, whereas most removals and additions occurred at salinities $<$ 10 0/00 in the field. Mixing studies also showed little difference between prefiltered and unfiltered mixes. The studies suggest that simple mixing of salt marsh waters, with or without suspended material, does not strongly influence the observed behavior of dissolved constituents in salt marshes, and that other processes (e.g. sediment or intertidal exchange) must dominate their behavior. (Author's abstract)
W85-00290

EXPERIMENTAL STUDY OF THE STRUCTURE OF A FRESHWATER-SALTWATER INTERFACIAL MIXING (ETUDE EXPERIMENTALE DU MELANGE A L'INTERFACE EAU-SAUMURE),
Hydraulics Research Station, Wallingford (England).
H. O. Anwar, and J. A. Weller.
Houille Blanche, Vol. 36, No. 6, p 405-412, 1981. 9 Fig, 3 Tab, 37 Ref.

Descriptors: *Saline-freshwater interfaces, *Mixing, *Cooling water, Entrainment, Estuaries, Heated water, Thermal pollution, Saline water, Thermal discharge, Path of pollutants, Turbulence, Salinity.

Freshwater was released experimentally from a wide channel onto the surface of stationary saltwater (density 1025 kg/cu m) in a wide deep flume. This type of flow can be observed when heated cooling water is discharged from a power station horizontally onto the surface of a lake or reservoir, or in an estuary where the outflow of freshwater mixes with underlying saltwater (a saline wedge). Experimental cases were studied in which the densimetric Froude number was low, varying between 0.5 and 2, and the depth of freshwater was relatively large, varying between 0.08 m to 0.12 m. The features of the model are similar to a density zone model and consists of three zones: the entrainment zone, the roller region, and the zone of homogenous flow. Mean velocity profile measurements were made dimensionless by taking the maximum velocity occuring at the free surface as a velocity and the depth as a length scale. There was a general movement in the saltwater flume in the mean flow direction. A roller region appeared when Fr $>$ 0.8 and it disappeared when Fr $<$ 0.8; in this case, the flow of the surface layer behaved much like a flooded density jump. The turbulence intensity, being small in the major part of the surface layer, increased rapidly towards the interface behaving much like a two-dimensional channel flow; the turbulence intensity increased as the Reynolds number decreased. There was a rise in water level immediately downstream from the freshwater inlet mainly due to an increase in potential energy caused by the mixing process in the entrainment zone. The salinity measurements for all values of Fr showed that the salt concentration near the surface was very small. The measured coefficient of entrainment was related to the Richardson number. (Collier-IVI)
W85-00387

SEDIMENTATION AND RESUSPENSION IN A NEW ENGLAND SALT MARSH,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 2J.
W85-00405

PLANT AND ANIMAL COMMUNITIES IN BRACKISH SUPRA-LITTORAL POOLS ('DOBBEN') IN THE NORTHERN PART OF THE NETHERLANDS,
Katholieke Univ. Nijmegen (Netherlands).
W. van Vierssen, and J. T. A. Verhoeven.
Hydrobiologia, Vol. 98, No. 3, p 203-221, February, 1983. 9 Fig, 5 Tab, 20 Ref.

Descriptors: *Brackish water, *Aquatic plants, *Aquatic animals, *Netherlands, Chlorinity, Water level fluctuations, Salt marshes, Vegetation.

During summer 1977, 50 supra-littoral pools situated on salt marshes outside the seawalls bordering the Waddenzee (Netherlands) were studied. Most of them were constructed at the turn of the century, to supply the cattle grazing the marshes with fresh (rain) water. When the salinity in a pool becomes elevated, the farmers empty that particular reservoir and refill it. As a consequence, the environments are very dynamic and unstable. Only 7 aquatic macrophyte species were present in the pools. The three most frequently occurring macrophytes display distinct differences with respect to their chlorinity tolerances. Ranunculus baudotii is apparently not as salt tolerant as Potamogeton pectinatus and Zannichellia pedunculata. The growth of macrophytes in many pools may be suppressed by dense phytoplankton populations, probably due to high nutrient concentration in the water. The macrofauna was studied semi-quantitatively. The aquatic Coleoptera had the greatest diversity (24 species). A distinct relationship between the number of Coleoptera species and the percentage of macrophyte coverage was found. The distribution patterns of the most frequent species with respect to chlorinity categories are shown in histograms. Twelve species of aquatic Heteroptera were collected. Vegetation cover and chlorinity influence the distribution of the Heteroptera. Less important macrofaunal groups (the Crustacea, Mollusca and Odonata) occurred in low species numbers. (Moore-IVI)
W85-00408

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

MATHEMATICAL MODEL OF A MECHANICAL-VAPOR COMPRESSION EVAPORATOR. APPLICATION TO THE PRODUCTION OF FRESHWATER BY SEAWATER DESALINATION; PART II - NUMERICAL EXPLOITATION,
Institut de Genie Chimique de Toulouse (France).
D. Aussenac, M. Enjalbert, and S. Domenech.
Desalination, Vol. 49, No. 2, p 117-139, February, 1984. 6 Fig.

Descriptors: *Desalination, *Mathematical models, Vapor compression evaporator, Simulation, Seawater, Mathematical equations.

The performance simulation model of the vapor compression evaporator-condenser previously presented involves an algebraic system of 265 unknowns and 215 equations. This system has to be solved by an iterative numerical algorithm due to the non-linearity of some of the equations. Because these equations come from a modular simulation of the plant, the overall system of equations can be broken down into a number of subsystems, including a reduced number of equations describing the behavior of the module. These subsystems are unique in that they can be solved by a single-variable iteration method. Inside the loop, the system is solved sequentially. The general means of solution is simplified and represents a remarkabley convenient procedure. The model was tested using data from 27 experiments on a prototype plant. The study revealed three parameters of prime im-

portance: the pressure inside the evaporator-condenser, the seawater sprinkling solution flowrate of the evaporator-bundle, and the seawater temperature at the inlet of the evaporating cell. From information on the performance and the results of the experimental tests, an attempt was made to develop a complete model which best describes the plant. In spite of problems encountered during the model identification due to the lack of some experimental data and to the spread of the experimental values, the model describes the overall preformance of the plant in a reasonable way. It was possible to use it in order to study the influence of the main parameters. (Moore-IVI)
W85-00250

MICROPROCESSOR-BASED DATA MONITORING AND CONTROL SYSTEM FOR A CONTINUOUS ION EXCHANGE PLANT,
Cape Town Univ. (South Africa). Dept. of Chemical Engineering.
E. W. Randall.
Desalination, Vol. 49, No. 2, p 169-184, February, 1984. 6 Fig, 1 Tab, 4 Ref.

Descriptors: *Desalination, *Continuous ion exchange, *Monitoring, *Process control, Automation, Microprocessors, Hydrogen ion concentration, Conductivity, Water quality control, Costs.

A microprocessor system was developed for data logging and control of product water quality in a continuous ion exchange desalination pilot plant. The format used for the program structure allows dynamic interaction with the system, via interrupts, and is likely to be generally applicable to microprocessor control software. pH and conductivity measurements were used in the calculation of column cycle times. Establishing of trends in the measured parameters, before initiating control action, resulted in a stable system. The control action ensures the minimum consumption of regenerant chemicals which is the single most important factor in the running costs of an ion exchange plant. (Author's abstract)
W85-00251

3B. Water Yield Improvement

WATER RESOURCES APPRAISAL OF THE COLLEGE OF THE VIRGIN ISLANDS AREA, ST. THOMAS,
Caribbean Research Inst., St. Thomas, VI.
For primary bibliographic entry see Field 6B.
W85-00066

OPTIMIZATION OF THE FILLING AND DRAWDOWN REGIMES OF A REGULATING RESERVOIR OF THE KUBAN' CASCADE,
A. F. Fedosyuk, I. L. Krasnik, and A. B. Kaganovich.
Hydrotechnical Construction, Vol. 16, No. 8, p 470-474, August, 1982. 2 Fig, 2 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 50-53, August, 1982.

Descriptors: *Optimization, *Hydroelectric power, *Kuban River, Powerplants, Efficiency, Reservoirs, Drawdown, Streamflow, Seasonal variation, Floods, Runoff.

The efficiency of using the energy of the water resources of the Kuban River by the hydroelectric stations of the Kuban cascade located on the route of the Great Stavropol Canal in many respects depends on the selection of the filling and drawdown regimes of the Kuban reservoir located at the head of the canal and providing seasonal streamflow regulation. A method is introduced to optimize the filling of the Great regulating reservoir which makes it possible to increase the efficiency of using the flood, which provides additional electric energy production. Optimization of the discharges along the Great Stavropol Canal on the basis of the criterion of minimum specific discharges of hydrostations of the cascade and approximation of the regime of the hydrostations to these conditions additionally increase the effectiveness of using the stream. The conduction of analogous hydropower calculations can be useful in other power systems and cacades of hydroelectric stations. (Baker-IVI)
W85-00485

3C. Use Of Water Of Impaired Quality

WATER QUALITY AND STOCKING DENSITY AS STRESSORS OF CHANNEL CATFISH (ICTALURUS PUNCTATUS RAF.),
Hamburg Univ. (Germany, F.R.). Inst. fuer Hydrobiologie und Fischereiwissenschaft.
For primary bibliographic entry see Field 3F.
W85-00234

3F. Conservation In Agriculture

HYDROLOGIC CONDITIONS IN THE WHEATLAND FLATS AREA, PLATTE COUNTY, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 4B.
W85-00031

WATER QUALITY AND STOCKING DENSITY AS STRESSORS OF CHANNEL CATFISH (ICTALURUS PUNCTATUS RAF.),
Hamburg Univ. (Germany, F.R.). Inst. fuer Hydrobiologie und Fischereiwissenschaft.
H. Klinger, H. Delventhal, and V. Hilge.
Aquaculture, Vol. 30, No. 1-4, p 263-272, January, 1983. 5 Tab, 32 Ref.

Descriptors: *Water quality, *Catfish, *Water reuse, *Recirculated water, Stocking density, Blood, Physiology, Fish, Stress, Aquaculture.

The influences of heated recirculated water and well water on three stocking densities of channel catfish (Ictalurus punctatus Raf.) were compared, based on several physiological and hematological parameters. Controls were kept in well water only. The leukocyte count of fish kept in well water generally decreased, and their thrombocyte, lymphocyte and granulocyte counts were lower at higher stocking densities. In addition, a slight hemoconcentration was observed. The fish kept in recirculated water showed a decrease only in thrombocyte count. Plasma cortisol and blood glucose did not change and in all groups were at a level characteristic of resting fish. In contrast, the blood lactate levels were always high. This may have been caused by the anesthetization. The alterations found are regarded as symptoms of the 'general adaptation syndrome' induced by the stocking rates. High lymphocyte and granulocyte counts among the fish in reused water are signs of local adaptations to reduced water quality. (Author's abstract)
W85-00234

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

CONVEYANCE CHARACTERISTICS OF THE NUECES RIVER, COTULLA TO SIMMONS, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
B. C. Massey, and W. E. Reeves.
Available from the OFSS, USGS, Box 25425, Federal Ctr., Denver, CO 80225. USGS Water Resources Investigations Report 83-4004, 1983. 39 p, 21 Fig, 2 Tab, 9 Ref.

Descriptors: *Water conveyance, *Water loss, *Water management, *Nueces River, Cotulla, Simmons, *Texas.

Analysis of discharge hydrographs for streamflow-gaging stations on the Nueces River at Cotulla, Tilden, and Simmons indicate that significant water losses occur along the 108-mile reach from Cotulla to Simmon during storm-runoff periods. Computed losses along the 83-mile reach from Cotulla to Tilden for 15 storm periods range from 32 to 59 percent of the total runoff volume passing the Cotulla gage. For six storm periods that occurred while the gage at Simmons was in operation, computed losses from Cotulla to Simmons averaged 48 percent of the storm runoff passing the Cotulla gage. Estimates of total-annual losses were made with the aid of a regression model developed to relate monthly rainfall totals to monthly runoff. Total annual water losses, estimated with the aid of the regression model, ranged from 46,000 acre-feet during 1969 to 368,500 acre-feet during 1967, and averaged about 174,000 acre-feet for 1966-77. (USGS)
W85-00033

ASSESSMENT OF TIME SERIES AS A METHODOLOGY TO QUANTIFY IRRIGATION RETURN FLOWS,
Montana State Univ., Bozeman. Dept. of Civil Engineering.
M. E. Nicklin, and R. L. Brustkern.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 190149, Price codes: A03 in paper copy, A01 in microfiche. Montana Water Resources Research Report No. 137, Bozeman, June 1983. 40 p, 11 Fig, 3 Tab, 5 Ref. OWRT Project No. A-136-MONT (1), Contract/Grant No. 14-34-0001-2128.

Descriptors: *Statistical methods, *Time series analysis, Irrigation water, Return flow, Diversion loss return, *Montana, *Irrigation return flows, Return flow quantification, Data requirements, Beaverhead River.

A mathematical technique known as time series analysis was tested as a potential method for return flow quantification. The time series approach for characterizing irrigation return flows offers the advantage of reduced data requirements when compared to finite difference and finite element numerical procedures. Much of the data required for time series analysis is routinely collected. Streamflow records, in particular, are available at numerous locations and constitute a generally reliable network of time series observations. A reach of the Beaverhead River near Dillon, Montana, was selected for this study. Groundwater return flow is the major component of return flow to the Beaverhead River during the irrigation season. The time delay for particular diversions depends upon the application timing, point of application, local aquifer properties, etc. The mean aggregate time delay between diversion and return was calculated as 61 days for the years of 1966 through 1975. Time series analysis was moderately successful as a tool for quantifying the irrigation return flows at the study site. Although the concept of time series analysis is sound, effective application of the concept was hampered by the incompleteness of the diversion records at the Beaverhead site.
W85-00071

INFLUENCE OF SEDIMENT TYPES ON THE SORPTION OF ENDOTHALL,
North Texas State Univ., Denton. Inst. of Applied Sciences.
K. H. Reinert, and J. H. Rodgers, Jr.
Bulletin of Environmental Contamination and Toxicology, Vol. 32, No. 5, p 557-564, April, 1984. 1 Fig, 5 Tab, 18 Ref.

Descriptors: *Sediments, *Sorption, *Endothall, *Herbicides, *Pat Mayse Lake, *Roselawn Cemetery Pond, *Texas, Aquatic weeds, Weed control, Carbon, Clay, Sand, Herbicides, Fate of pollutants.

Predicting the fate of chemicals using mathematical models requires accurate data derived from laboratory measurements of rate coefficients for the controlling processes. Absorption protocol for the determination of sorption partition coefficients

was applied to two different water sediment systems containing endothall. Endothall is a relatively soluble aquatic herbicide used for the control of numerous uubmerged aquatic weed species. Water was obtained from Pat Mayse Lake, a meso-oligotrophic reservoir in northeast Texas. Sediments were obtained from Pat Mayse Lake and Roselawn Cemetery Pond, a small eutrophic pond in north central Texas. The Pat Mayse Lake sediment was predominantly sand with low percent organic carbon, while the Roselawn Cemetery Pond sediment was predominantly clay with more than one percent organic carbon. Sorption of endothall in both systems was relatively low and can be considered as a minor process in the fate assessment of endothall in aquatic systems. The relatively high concentration of endothall required for acute toxicity, a low sorption coefficient, and low environmental persistence combined to make endothall a candidate for the control of nuisance aquatic vegetation. (Baker-IVI)
W85-00133

COST-BENEFIT ANALYSIS OF WETLAND DRAINAGE,
Leeds Univ. (England). School of Economic Studies.
J. K. Bowers.
Environment and Planning A, Vol. 15, No. 2, p 227-235, February, 1983. 14 Ref.

Descriptors: *England, *Drainage, *Cost-benefit analysis, *Wetlands, Conservation, Land use, Flood protection, Flood damage, Agriculture, Resources development.

The wetland areas of England are under imminent threat of drainage for agricultural improvement. The immediate cause is the local drainage surveys produced under the Water Act 1973. Problems identified in these surveys are subjected to cost-benefit appraisal. Examination of a selection shows that these appraisals are technically defective and result in an overstatement of the benefits and in an overinvestment in land drainage. The main defects are: first, a failure to assess amenity and conservation losses; second, use of prices that contain a substantial element of income transfer which is not netted out; third, a failure to properly calculate the rate of land conversion - a crucial variable; fourth, the project appraisal period is arbitrarily chosen or treated as a variable; fifth, the use of theoretical rather than expected agricultural yields; sixth, the level of flood protection aimed at is too high for the stated objective; and, last, anticipated flood losses are not deducted. (Author's abstract)
W85-00278

RIVERS: OUR VANISHING HERITAGE,
National Audubon Society, Washington, DC.
H. Babcock.
Environmental Forum, Vol. 2, No. 10, p 38-41, February, 1984. 2 Fig.

Descriptors: *Rivers, *Water resources development, Conservation, Legislation, Regulations, Federal jurisdiction, Wilderness areas, Water use, Competing use, Wildlife habitats, Dams.

The basic problem with rivers is that everyone wants to use them in different and often mutually exclusive ways. More than 67% of all the water used in 1970 came from rivers. Currently, rivers in their wild state are losing the battle against the consumptive side of society. An increase has been noted lately in applications to dam free flowing rivers. One incentive for such dam building has been the Public Utility Regulatory Policies Act of 1978 which requires utilities to purchase power from small producers of electricity from renewable sources of energy, such as from falling water. While there are environmental benefits from hydroelectric development as these facilities offer clean, safe and cheap energy, there are obvious costs in that dams and diversion projects drown valuable riparian habitats, change the natural temperatures of the waters, increase siltation, concentrate pollutants and affect the amount of oxygen in the water. As long as there is no national water policy, rivers will continue to be at the mercy of random and haphazard development. Presently the only way to prevent federal diversion or impoundment of outstanding rivers is to designate them under the Wild and Scenic Rivers Act of 1968. Lacking effective tools to protect rivers either legislatively or administratively, the conservation community will have to push for strengthening amendments to the Wild and Scenic Rivers Act or to a major overhaul of the Federal Energy Regulatory Commission procedures to balance the scales more evenly between river conservation and river destruction. (Baker-IVI)
W85-00282

AQUIFER MODELING WITH A HANDHELD CALCULATOR - AQMODL,
Ministry of Planning, Riyadh (Saudi Arabia).
F. A. Rayner.
Ground Water, Vol. 21, No. 1, p 84-91, January-February, 1983. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Aquifer characteristics, *Model studies, *Computer models, Water level, Programmable calculators, Geohydrology.

Groundwater resource personnel are often faced with the need to quickly determine what effects a particular aquifer development scheme will have on a geohydrologic regime. AQMODL is an analytical mathematical aquifer modeling program for the HP-41C handheld programmable calculator. No written instructions are required for its use. The operator is guided through the steps and errors generated by the operator are avoided. Anyone only basically familiar with the operation of the HP-41C calculator and with aquifer modeling can use the instrument. No special key assignments exist and no special data preparation or storage operations or any other prior preparation is necessary before running AQMODL, simply XEQ AQMODL and follow the guidance supplied by the calculator. AQMODL can be used to model simple or complex single aquifer situations. It considers any regional change in water level not necessarily associated with the development being modeled. It also models the aquifer's water level gradient. For a 60 active well model the total calculator execution time with the printer attached would be about 6.9 minutes to determine the change in water level and elevation at one observation point. (Baker-IVI)
W85-00362

FRENCH AND EUROPEAN NAVIGABLE WATERWAY SYSTEMS (LES RESEAUX DES VOIES NAVIGABLES FRANCAIS ET EUROPEANS),
R. Tenaud.
Houille Blanche, No. 2/3, p 81-86, 1981. 2 Fig, 2 Tab.

Descriptors: *Navigable waters, *Waterways, *France, *Europe, Regulations, Navigable rivers, Hydraulic engineering, Reviews.

The importance of past waterway engineering accomplishments is highlighted in a brief review. The development of general river equipment and infrastructures is traced and present French classification standards are given for navigable waterways. The lengths and percentages in each major category of West European waterways are tabulated with corresponding traffic figures for 1978 and 1979. The more important developmental projects currently underway are described. (Baker-IVI)
W85-00368

WATER SUPPLY METHODS FOR NAVIGABLE WATERWAYS; OPTIMIZATION OF A PROJECT WITH LOCKS; PUMP STATIONS (LES METHODES D'ALIMENTATION EN EAU DES VOIES NAVIGABLES; OPTIMISATION D'UN PROJET AVEC ECLUSES; LES STATIONS DE POMPAGE),
Pommier, A. Terrier, Le Grand, and Olivier.
Houille Blanche, No. 2/3, p 87-92, 1981. 4 Fig.

Descriptors: *Navigable waters, *Hydraulic engineering, *Gates, *Locks, Navigation, Waterways, Saone-Rhine Canal, Canals, Gravity flow, Water supply, Pumps, Optimization, Systems analysis, Water reuse.

Major problems have always existed in the designing of water supply systems for waterway locks at sill crossings. Due to modern increases in the extent and height of the locks, the problems have magnified. A partial gravity supply system at the dividing reach is provided by the wide gauge Saone-Rhine canal link project. In addition, arrangements for economizing and recycling the water to make up for the deficiency in natural gravity supplies is also a part of this project. The efficiency and optimization of this overall system is analyzed and the advantages and limitations of each of its many components are demonstrated. (Baker-IVI)
W85-00369

HOW THE MAIN-DANUBE LINK FACILITATES NAVIGATION AND SAVES WATER (LA LIAISON MAIN-DANUBE FAVORISE LA NAVIGATION ET L'ECONOMIE DE L'EAU),
B. Rumelin.
Houille Blanche, No. 2/3, p 93-98, 1981. 2 Fig, 4 Tab, 4 Ref.

Descriptors: *Navigable waters, *Locks, *Main-Danube link, Waterways, Design criteria, Hydraulic engineering, Construction, Flood control, Water supply, Water resources development, Pumps.

Locks will be provided for the Main-Danube link with a large differential level and lateral water saving basins designed to reduce their water needs. Water will have to be pumped from the Danube and Altmuhl to a reservoir near the dividing reach by pump stations connected with the locks in order to obtain a sufficient increase to the natural inflows. All pump stations on the southern incline will feature three pumps operating in conjunction with a barrage in addition to the lock operating pumps. This system will improve low water flow in the Main and Regnitz rivers with a view to interregional hydraulic regulation. Flood flows of the river Altmuhl will be retained in a damping basin, from which they will be routed to a further reservoir through a tunnel underneath the Danube-Rhine watershed, and finally into the Regnitz River. (Baker-IVI)
W85-00370

HYDRAULIC CIRCUIT DESIGN AND ITS EFFECTS ON THE CIVIL ENGINEERING FEATURES OF LOCKS (LA CONCEPTION DES CIRCUITS HYDRAULIQUES ET SES REPERCUSSIONS SUR LE GENIE CIVIL DES ECLUSES),
M. A. Petitjean.
Houille Blanche, No. 2/3, p 99-102, 1981. 4 Fig.

Descriptors: *Navigable waters, *Locks, Hydraulic engineering, Design criteria, France, Circuits, Construction, Waterways.

The close dependence of a lock on the hydraulic function for which it is designed is reviewed. Hydraulic circuits of French wide gauge waterways are invariably designed for a locking time which will not exceed 5 minutes. At the same time assurance is given that acceptable conditions for boats in the lock and canal reach will be maintained. A suitable filling and emptying system is chosen from the four available alternatives which is dependent on the differential level across the lock. The choice of system will in turn govern the general lock structure. A brief description is offered of the other lock design developments such as those concerning gates, general equipment and civil engineering features. (Baker-IVI)
W85-00371

LOCKS ON THE WIDE-GAUGE RHONE WATERWAY (LES ECLUSES D'UNE VOIE A GRAND GABARIT: LE RHONE),
R. Pinatel.
Houille Blanche, No. 2/3, p 103-108, 1981. 8 Fig.

Descriptors: *Navigable waters, *Waterways, *Locks, *Rhone Waterway, Hydraulic engineering, Construction, Design criteria.

Between Lyons and the Mediterranean Sea lies the wide gauge Rhone waterway. The waterway features twelve locks which are designed to handle European standard pusher units. The fall across the locks determines the type of hydraulic circuit designed into them. Filling and emptying of the locks is done through the bottom or cross culverts. The effects of some of the aspects of the development of these supply systems on construction requirements are described. The flow cutoff and safety equipment used in the system is also delineated. (Baker-IVI)
W85-00372

WIND AND WAVE REGIMES OF THE KIEV PUMPED-STORAGE STATION RESERVOIR,
M. N. Rubanik, P. D. Gavrish, V. M. Kondrat'ev, and V. F. Kanarskii.
Hydrotechnical Construction, Vol. 16, No. 4, p 199-203, April, 1982. 3 Fig, 2 Tab, 4 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 12-14, April, 1982.

Descriptors: *Pumped storage reservoirs, *Wind, *Waves, *Kiev Pumped Storage Reservoir, *USSR, Reservoirs, Slope stability, Slope, Dikes, Windbreaks.

The reservoirs of a pumped-storage station (PSS) operate in a regime of daily regulation of the volumes and levels of the water, giving rise to certain characteristics of the effect of the wind and wave regime on the dike slopes. The size of the reservoir at the Kiev pumped storage station is 1450 x 450 m, the length of the dike is 4.7 km, depth at normal pool level is 8 m and at dead storage level is 2 m. The average wind speed in the summer is 3.6 m/sec. The most wave-hazardous directions of the winds are east and west. The probability of a calculated wind speed in wave-hazardous directions is supposed to be taken on the basis of a relation obtained by analyzing by a numerical method the data of on-site observations of the operating regime and conditions of operating the Kiev PSS. In the case of operating the PSS in two cycles the conditions of the wind and wave regime are alleviated, and the probability of occurrence of a wave-hazardous situation decreases. In the case of a well adjusted system of regulating the water levels in the reservoir it is expedient to considerably reduce the freeboard, confining oneself just to the value of the design freeboard and installation of an effective limiter of the uprush of waves on the slope. In this case the height of the dike and its cost are reduced. A still greater reduction of the effect of strong winds on the wave regime of the reservoir can be attained by creating in wave hazardous directions, and, better still, around the entire reservoir, forest belts analogous to the windbreaks on farmlands and along highways. (Baker-IVI)
W85-00449

METHOD OF DETERMINING THE MAXIMUM FLOOD INFLOW TO THE MIDDLE ENISEI HYDROELECTRIC STATION,
A. E. Asarin, B. S. Tseitlin, L. Ya. Dzheibo, and M. N. L'vova.
Hydrotechnical Construction, Vol. 16, No. 8, p 427-431, August, 1982. 6 Tab. Translated from Gidrotekhnichkeskoe Stroitel'stvo, No. 8, p 21-23, August, 1982.

Descriptors: *Flood control, *Prediction, *Middle Enisei Hydroelectric Station, Runoff, Hydroelectric plants, Reservoirs, Flow.

A method of determining the maximum inflow to the cascade of hydrostations is described with an illustration of the quantitative calculation results for particular reservoirs. The runoff of the Angara is regulated by reservoirs of the Irkutsk, Bratskm, and Ust'-Ilim hydroelectric stations, and a fourth each of the Angara cascade, the Boguchany hydroelectric station is currently under construction. The volume of stream-gauging data on the runoff of the Angara with its relatively little variability makes it possible to rather reliably establish the statistical parameters of the maximum discharges and discharges of various probabilities at reference sites. The calculated inflow to the cascade-arranged hydrostations is determined as the sum of the discharges being released into the lower pool of the upstream hydrostation and local inflow from the drainage basin between the upstream hydrostation and downstream hydrostation under consideration. The method of constructing the design hydrograph of inflow to the upstream hydrostation or to the first hydrostation under construction is rather simple. In order to establish the admissibility of the method, the stochastic relation between the maximum flood discharge (freshet) and its volume was determined. (Baker-IVI)
W85-00479

EXPERIENCE IN THE OPERATION OF OVERFLOW BUTTRESS DAMS UNDER SEVERE CLIMATIC CONDITIONS,
D. M. Yashkul', and V. V. Belov.
Hydrotechnical Construction, Vol. 16, No. 8, p 474-478, August, 1982. 3 Fig, 5 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 53-56, August, 1982.

Descriptors: *Buttress dams, *Dam construction, *Reservoir operation, *Climate, Overflow, Concrete, Frost resistance, Spillways, Design criteria.

A buttress design of overflow dams makes it possible to substantially reduce the volume of concrete works compared to massive dams. Thin-walled structures require the use of high concrete grade with respect to strength and frost resistance, increased reinforcement, more careful placement of the concrete mix, and high quality of sealing the expansion and horizontal joints, particularly at the points of their intersection. The downstream surface of the dams protects the upstream faces from freezing completely through without additional construction or operating measures. The exposed rock foundation on the hollows between the buttresses not only reduces uplift but also provides free outflow of seepage water and the possibility of more complete checking of the connection of the concrete structures with the foundation. The operating expenses of overflow buttress dams are practically the same as on dams without internal hollows and their maintenance amounts mainly to periodic painting of the inside metal structures, repair of individual sections of the concrete on the spillway surface, warming of the inlet and drainage outlets, and regular inspection. (Baker-IVI)
W85-00486

CONSTRUCTION OF THE FLOOD (FRESHET) HYDROGRAPH OF A GIVEN PROBABILITY WITH CONSIDERATION OF ITS UNFAVORABLE SHAPE,
For primary bibliographic entry see Field 2E.
W85-00489

USE OF SIMPLIFIED ON-SITE CHARACTERISTICS WHEN AUTOMATING WATER ACCOUNTING AT HYDRAULIC STRUCTURES,
I. S. Sarzhinskii, and Yu. K. Zhuskov.
Hydrotechnical Construction, Vol. 17, No. 9, p 477-479, September, 1983. 2 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 52-54, September, 1983.

Descriptors: *Water management, *Computers, *Automation, Water quantity, Water distribution, Hydraulic structures, Irrigation water, Mathematical equations.

Water accounting and distribution can be carried out quite accurately by means of calibrated orifices of the hydraulic structures. The use of on-site calibration characteristics with the use of a computer permits efficient regulation of discharges at hydraulic structures-regulators. The following system for controlling the operation of a water management system with the use of a computer is described. In the center of a cluster of hydraulic structures or irrigation systems a control center with a computer is created, which receives information from all hydraulic strucures and gauging stations: openings of gates, head, storage, etc. On the basis of these data the computer calculates the values of the discharge for each structure, volume of flow, and balance over the entire watercourse. The computer controls also the fulfillment of the water use plan. Input of the characteristics of the hydraulic structures and planned assignments is accomplished in the form of polynomials obtained as a result of mathematical processing of the initial data. (Baker-IVI)
W85-00497

EXPERIENCE IN OPERATING THE STRUCTURES OF THE MANSOUR EDDAHBI HYDROPOWER DEVELOPMENT,
I. F. Blinov, and O. V. Sitnin.
Hydrotechnical Construction, Vol. 17, No. 10, p 512-518, October, 1983. 4 Fig, 3 Tab, 10 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 25-30, October, 1983.

Descriptors: *Arch dams, *Monitoring, *Mansour Eddahbi, *Morocco, *Reservoir operation, Water resources development, Irrigation, Hydroelectric plants, Evaluation.

The ten year experience of operating the structures and equipment of the hydrostation at the Mansour Eddahbi development has shown that the reservoir created by the arch dam provides streamflow regulation for meeting the irrigation needs of 25,000 ha in the Dras River valley and the hydrostation provides the design production of electric energy. The inspection data for the hydrostation indicates a satisfactory condition of the structures and equipment. The monitoring equipment installed in the dam permits operative monitoring of the safe operation of the dam. About 90% of the installed equipment is operating satisfactorily after 10 years. An analysis of long term observation data shows that at the design head the stresses, strains, displacements, and seepage stability of the dam foundation and bank abutments correspond to the design assumptions. (Baker-IVI)
W85-00502

HYDROPOWER UTILIZATION SCHEME OF THE EUPHRATES RIVER IN SYRIA,
V. A. Kozlov.
Hydrotechnical Construction, Vol. 17, No. 10, p 522-526, October, 1983. 1 Fig, 1 Tab, 12 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 32-36, October, 1983.

Descriptors: *Water resources development, *Planning, *Hydroelectric plants, *Euphrates River, *Syria, Evaluation, Decision making, Dam construction, Irrigation.

Runoff of the Euphrates River is formed mainly from snowmelt in the high mountain part of the basin and by rains falling in the period from November to May. The drainage area at the stream gauging station at Keban, located 10 km below the confluence of the Karasu and Murat, is about 65,000 sq km and at the Turkey-Syria border reaching 110,000 sq km. The natural annual runoff of the river in the region of Tabqa during the 40 year period of observation varied from 10.4 to 41.5 cu km, with a mean annual volume of 26.2 cu km. Two variants for using the power potential of the Euphrates were examined: creation of a reservoir by means of a dam constructed at Tabqa with a normal pool level at elevation 320-325 m; or creation of two reservoirs one by a dam constructed at Tabqa with a NPL at 300 m and the second reservoir created by a dam constructed at Yusef Pasha with a NPL at 320-325 m. The higher technicoeconomic indices of the two step variant over the variant of using the river in one step was determined. In 1964 plans for a gravity irrigation of 100,000 ha by constructing a low head dam with a small hydroelectric station in the region of Halebiyah-Zalyabiyah and scheme of irrigation in the basin of the al-Khabur River were drawn up. In 1968 a project plan for irrigating 185,000 ha of the Balikhy area was proposed. At present there are two variants of expanding the power utilization of the Euphrates in the stretch from the boundary with Turkey to the site of the Euphrates project: increase of the normal pool level of the reservoir of the Euphrates project by 20 m to 320 m; or

construction of the Tishrin hydrostation near Yusef Pasha. (Baker-IVI)
W85-00504

4B. Groundwater Management

PROBLEMS OF RISING GROUND-WATER LEVELS IN URBAN AREAS WITH SPECIAL REFERENCE TO THE LOUISVILLE, KENTUCKY AREA,
Geological Survey, Louisville, KY. Water Resources Div.
D. V. Whitesides, R. J. Faust, and D. D. Zettwoch.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Lakewood, CO 80225, USGS Water-Resources Investigations Report 83-4233, 1983. 26 p, 12 Fig, 1 Tab, 35 Ref.

Descriptors: *Potentiometric level, *Water table, Stream-groundwater relations, *Natural recharge, Hydrographs, Precipitation, *Kentucky, Louisville, Jefferson County, *Groundwater levels.

Rising ground-water levels are a problem for cities such as San Bernadino, California; Greely and Fort Collins, Colorado; New York City boroughs of Brooklyn and Queens; and Louisville, Kentucky. Ground-water levels showed a steeply rising trend in the alluvial aquifer underlying Louisville during the early and middle 1970's in response to above average precipitation and a decrease in groundwater withdrawals. This rising trend flattened in 1979 and the water levels are stabilizing at 25 to 45 feet below land surface in the downtown area. Basements are generally 20 to 25 feet below land surface and some utility lines are as much as 40 feet below land surface in this area. Because of the shallow depth to water, any resumption of the upward trend would require preventive measures such as selective dewatering to avoid damage to some structures. (USGS)
W85-00027

HYDROGEOLOGIC AND WATER-QUALITY CHARACTERISTICS OF THE IRONTON-GALESVILLE AQUIFER, SOUTHEAST MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
J. F. Ruhl, R. J. Wolf, and D. G. Adolphson.
USGS Water-Resources Investigations Report 82-4080, (1982). 2 Maps, 15 Fig, 2 Tab, 20 Ref.

Descriptors: *Aquifer characteristics, *Water quality, *Underground waste disposal, Hollandale embayment, Ironton-Galesville aquifer, *Minnesota, *Groundwater.

The (Franconia)-Ironton-Galesville aquifer is part of a sequence of sedimentary bedrock units in southeast Minnesota. The aquifer was deposited from Paleozoic seas that occupied a shallow depression known as the Hollandale embayment. The surface of the Ironton-Galesville aquifer dips toward the interior of the embayment. The aquifer is as deep as 1,000 feet below land surface and as thick as 325 feet. The Ironton and Galesville Sandstones are white and medium grained. They are the most productive units of the aquifer throughout the area. The Franconia Formation is a coarse grained sandstone and interbedded shale. The Franconia Formation is water bearing primarily in the northern and western parts of the area; where it is the uppermost bedrock aquifer, elsewhere it yields little water. Its water quality is generally acceptable for all types of use. Calcium magnesium bicarbonate type water is most common. Confining beds protect the aquifer from surface pollutants, but the water is degraded locally in some places. Dissolved solids are as high as 1,000 mg/L in the southwest because of highly mineralized recharge water from Cretaceous deposits. (USGS)
W85-00028

SUBSURFACE STORAGE OF FRESHWATER IN SOUTH FLORIDA: A PROSPECTUS,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. L. Merritt, F. W. Myer, W. H. Sonntag, and D. J. Fitzpatrick.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4214, 1983. 69 p, 6 Fig, 8 Tab, 75 Ref.

Descriptors: *Injection wells, *Underground storage, *Feasibility studies, Water supply, *Florida, *Cyclic injection, Freshwater injection.

A method of increasing storage capacity for freshwater in south Florida is to use brackish artesian aquifers as reservoirs. In this way, water deficiencies occurring during the annual dry season can be offset by surplus water obtained during the wet season and injected underground. Most of south Florida is underlain by several deep, confined, carbonate waterbearing zones which might be suitable for freshwater storage. These zones are in the Avon Park, Ocala, Suwannee, Tampa, and Hawthorn Formations. Experimental freshwater injection systems have been operated at five locations with promising, but not fully definitive, results. A determination of the feasibility of freshwater injection at a selected site begins with an assessment of the local geologic suitability. Verification of feasibility, however, requires injection and recovery tests to be performed at the site. Recovery efficiency, a measure of the success of the operation, is the amount of potable water, expressed as a percentage of the volume injected, which can be recovered before its salinity, or the concentration of other chemical constituents present in the native aquifer water, increases to the point that the recovered water is no longer useable. (USGS)
W85-00029

WATER RESOURCES OF THE TULALIP INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
B. W. Drost.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Open-File Report 82-648, 1983. 153 p, 22 Fig, 17 Tab, 21 Ref.

Descriptors: *Hydrologic budget, *Groundwater recharge, *Aquifer characteristics, *Saline water encroachment, Low flow, *Tulalip Indian Reservation, *Washington.

An evaluation was made of the water resources of the Tulalip Indian Reservation to aid in decisions regarding future development of the area. Groundwater resources are sufficient to supply several times the 1978 population. Potential problems of salt-water encroachment in coastal areas and septic-tank contamination in shallow wells were identified. The general quality of surface water is adequate to allow for significant expansion of the Tribe's fisheries activities. Ground water is generally suitable for domestic use without treatment, but a serious quality problem is the presence of coliform bacteria in some shallow wells. High values of turbidity and color and large concentrations of iron and manganese are common problems regarding the esthetic quality of the water. In a few places, large concentrations of chloride and dissolved solids indicate the possiblity of saltwater encroachment, but no ongoing trend has been identified. Surface waters have been observed to contain undesirably high concentrations of total phosphorus and total and fecal-coliform bacteria, and to have temperatures too high for fish-rearing. The concentration of nutrients appears to be related to flow conditions. Nitrate and total nitrogen are greater in wet-season runoff than during low-flow periods, and total phosphorus shows an inverse relationship. Total phosphorus and ammonia concentrations are greatest in dry-season storm runoff. Generally, surface-water quality is adequate for fish-rearing and (with treatment) for public supply. (USGS)
W85-00030

HYDROLOGIC CONDITIONS IN THE WHEATLAND FLATS AREA, PLATTE COUNTY, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. A. Crist.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4047, 1983. 36 p, 11 Fig, 7 Tab, 24 Ref.

Descriptors: *Computer models, Simulation, *Irrigation, Water levels, *Aquifer, *Base flow, Surface-groundwater relationship, Pumpage, *Recharge, Hydrographs, *Wyoming, Platte County.

The area includes about 260 square miles in central Platte County that consists of Wheatland Flats and a border region. Wheatland Flats is an area of about 100 square miles that is bounded by Chugwater Creek on the east, the Laramie River on the north, and Sybille Creek on the west. The southern boundary is approximately the southernmost limit of alluvial terrace deposits. Surface water diverted from the Laramie River along with ground water from wells is used to irrigate about 57,000 acres most of which are on and adjacent to Wheatland Flats. More than 200 wells are used for irrigation, industrial, and municipal supplies. The wells are completed in an upper aquifer consisting primarily of shallow alluvial deposits of Quaternary age and a lower aquifer, the Arikaree Formation of early Miocene age. Net water-level decline after approximately 20 years (1958-60 to 1979) generally is less than 10 feet in each aquifer, although declines of as much as 13 feet have occurred in the Arikaree Formation at specific locations. A digital model was used to simulate hydrologic conditions in the Wheatland Flats area. The model indicated that ground-water discharge to streams decreased by 10 percent from 1971 to 1978. Stream-discharge measurements are not available to verify the loss. However, it is reasonable to assume, on the basis of hydraulic-head decline in the aquifers, that there has been some ground-water contribution to the stream. (USGS)
W85-00031

HYDRAULIC CONDUCTIVITY, SPECIFIC YIELD, AND PUMPAGE -- HIGH PLAINS AQUIFER SYSTEM, NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-00032

REGIONAL GEOHYDROLOGY OF THE NORTHERN LOUISIANA SALT-DOME BASIN, PART IV, HYDRAULIC CHARACTERISTICS OF THE WILCOX-CARRIZO AQUIFER,
Geological Survey, Baton Rouge, LA. Water Resources Div.
G. N. Ryals.
Available from the OFSS, USGS, Box 25425, Federal Ctr., Denver, CO 80225. USGS Water Resources Investigations Report 83-4132, 1983. 9 p, 3 Fig, 1 Tab, 27 Ref.

Descriptors: *Hydraulic conductivity, Permeability, *Aquifer characteristics, Storage coefficient, Northern Louisiana salt-dome basin, *Louisiana, Vacherie salt dome, Wilcox-Carrizo aquifer.

The Wilcox Group of Paleocene-Eocence age and the Carrizo Sand of Eocene age compose the Wilcox-Carrizo aquifer. Results of 25 aquifer tests and permeability determinations from 43 sidewall cores show that the hydraulic characteristics of the aquifer are variable. Studies of the Carrizo showed that hydraulic conductivity increased as sand-bed thickness increased. Hydraulic conductivity averaged 29 feet per day for sand beds 25 to 100 feet in thickness and 40 feet per day for sand beds 100 to 200 feet in thickness. Based on the aquifer tests and sidewall core analyses, hydraulic conductivity does not increase with increased thickness for the Wilcox part of the aquifer. Permeabilities determined from sidewall cores ranged from less than 1 to more than 3,000 millidarcies (less than 0.002 to more than 7.3 feet per day). Values of hydraulic

conductivity determined from aquifer tests ranged from less than 1 to 35 feet per day. (USGS)
W85-00034

ASSESSMENT OF TIME SERIES AS A METHODOLOGY TO QUANTIFY IRRIGATION RETURN FLOWS,
Montana State Univ., Bozeman. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W85-00071

HYDROLOGY OF THE NEWBERRY VOLCANO CALDERA, OREGON,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-00084

PUMPING TESTS IN PATCHY AQUIFERS,
Institute of Geological Sciences, London (England). Hydrogeology Unit.
J. A. Barker, and R. Herbert.
Ground Water, Vol. 20, No. 2, p 150-155, March-April, 1982. 4 Fig, 6 Ref, 1 Append.

Descriptors: *Patchy aquifers, *Pumping tests, *India, Mathematical equations, Simulation, Drawdown, Aquifers, Groundwater storage, Transmissivity.

A numerical simulation and analytical study of a constant-rate pumping test, for a well situated at the center of a disc of anomalous transmissivity and storage coefficient, have been used to aid in the interpretation of tests performed in a 'patchy' aquifer in India. Equations describing the long-time behavior of drawdown show that Jacob's method can be employed to estimate the regional transmissivity from drawdowns measured at any point in the aquifer or in the pumping well. However, the equations also show that an average storage coefficient should be calculated from drawdowns measured outside the aquifer discontinuity. The results of this study support the hypothesis that the average transmissivity of a heterogeneous aquifer can be calculated from rates of drawdown observed after long periods of pumping. (Author's abstract)
W85-00300

PROGRAMMABLE HAND CALCULATOR PROGRAMS FOR PUMPING TEST ANALYSES BY LEAST SQUARES' METHOD USING JACOB'S MODIFICATION OF THEIS' EQUATION,
King Abdulaziz Univ., Jeddah (Saudi Arabia). Faculty of Earth Sciences.
A. S. Sayed.
Ground Water, Vol. 20, No. 2, p 156-161, March-April, 1982. 1 Tab, 13 Ref, 3 Append.

Descriptors: *Pumping tests, *Mathematical analysis, *Calculators, Drawdown, Transmissivity, Storativity.

Pumping test analysis methods commonly used are graphical, although statistical approaches and the direct computation of transmissivity and storativity by the least squares' method have been made in recent years. Two programs are given for the CASIO FX-502 programmable calculator for direct computation of transmissivity and storativity from time-drawdown and distance-drawdown data. These aquifer parameters are calculated from Jacob's modification of the Theis equation by the least squares' method. The programs also calculate drawdowns at various times and distances using the computed transmissivity and storativity. A number of pumping tests were analyzed by these programs and the results were quite close to those obtained by graphical methods. (Moore-IVI)
W85-00301

HYDRAULIC CONDUCTIVITY OF A GLACIAL TILL IN ALBERTA,
Department of Agriculture, Lethbridge (Alberta). Irrigation Div.
J. Hendry.
Ground Water, Vol. 20, No. 2, p 162-169, March-April, 1982. 6 Fig, 2 Tab, 22 Ref.

Descriptors: *Glacial tills, *Alberta, *Permeability coefficient, Irrigation effects, Geohydrology, Drainage, Tritium, Geologic fractures.

Soils underlain at shallow depths (less than 1 m, 3 ft) by glacial till are generally considered undesirable for irrigation because of their unfavorable internal drainage characteristics. In some areas of southern Alberta, Canada, soils developed upon shallow tills have been irrigated successfully for over 60 years with no adverse effects on the soil. An investigation was conducted to describe the hydrogeological properties of till under one of these areas and to assess the properties with regard to drainage. Study techniques consisted of detailed test drilling and sampling, excavation of test pits, installation and monitoring of ground-water instrumentation, field and laboratory hydraulic conductivity testing and tritium analyses of ground-water samples. Two fracture sets were found in this till. Both sets of fractures produce secondary permeabilities which mask the low hydraulic conductivity of the till matrix (10 to the -10 m/s). Small-scale fractures which have a fracture spacing of approximately 10 mm (0.4 in.) have an apparent mean hydraulic conductivity of 5 x 10 to the -9 m/s, whereas large-scale fractures which have fracture spacings from 20 mm (0.8 in.) to over 630 mm (2 ft) have an apparent mean hydraulic conductivity of approximately 2 x 10 to the -7 m/s. The high hydraulic conductivity of the large-scale fractures was corroborated by tritium analyses of ground-water samples. Tritium analyses also indicate the presence of recent water at depth in the till. The large-scale fractures, which control the bulk hydraulic conductivity of this till, provide conduits through which infiltrating water can be transmitted to the ground-water regime. These fractures are believed to be the reason why this land has remained irrigable for over 60 years. (Author's abstract)
W85-00302

LOWER HAWTHORN AQUIFER ON SANIBEL ISLAND, FLORIDA,
Law Engineering Testing Co., Marietta, GA.
L. H. Motz.
Ground Water, Vol. 20, No. 2, p 170-178, March-April, 1982. 11 Fig, 2 Tab, 15 Ref.

Descriptors: *Sanibel Island, *Florida, *Hawthorn aquifer, *Groundwater potential, Brackish water, Water supply development, Dissolved solids, Transmissivity, Groundwater storage, Pumping tests, Geohydrology, Saline water intrusion.

In 1977, the Island Water Association (IWA) on Sanibel Island, Florida, was concerned that the total dissolved solids concentrations in several wells in its well field were increasing and might cause the blended raw water to exceed the design capacity of its electrodialysis plant. Test wells were drilled several miles west of the existing well field, and two pumping tests, one at the site of the test wells and the other in the existing well field were run. Average values for the transmissivity (T), storage coefficient (S), and leakance (K'/b') of the lower Hawthorn aquifer were determined to be T = 1,290 sq ft/d (119 sq m/d), S = 0.000027, and K'/b' = 0.00000747 (l/d). The results of the pumping tests and other findings indicated that pumpage from the lower Hawthorn aquifer was being derived from artesian storage in the aquifer and from vertical leakage into the aquifer from adjacent formations. It was estimated that the IWA would be able to recover usable water from the lower Hawthorn aquifer for about 5 more years by drilling new wells in the vicinity of the test wells and in other nearby areas that might be determined to yield usable water. After this period of time, it likely would become increasingly difficult, if not impossible, to obtain large quantities of usable water from the lower Hawthorn aquifer, unless significant quantities of water could be found in areas in which few data were then available. The principal recommendations, which subsequently were acted upon by the IWA, were to conduct drilling and testing in the lower Hawthorn aquifer several miles west of the test wells and to investigate the underlying Suwannee aquifer and deeper zones as sources of large quantities of brackish water. (Author's abstract)
W85-00303

RISING GROUND WATER - PROBLEM OR RESOURCE,
Louisville Univ., KY. Dept. of Civil Engineering.
D. J. Hagerty, and K. Lippert.
Ground Water, Vol. 20, No. 2, p 217-223, March-April, 1982. 7 Fig, 1 Tab, 14 Ref.

Descriptors: *Groundwater, *Water table, *Louisville, *Kentucky, Urban areas, Pumping rates, Precipitation.

An accelerated rise of the groundwater table in in Louisville, Kentucky has caused concern to municipal officials and building owners in the central urban area. An average rise of more than 11 m (35 feet) occurred between 1969 and 1980. In central Louisville, rising ground water could create: slight but significant possibilities of structural settlement problems; high possibilities of damage to basement floors and walls; and very high possibilities for disruption of utility conduits. Historical data indicated that ground-water levels in a system undisturbed by man could reach ground surface elevations in central Louisville. There is a strong relation between average ground-water levels and changes in pumping rates and incident precipitation. An extremely high correlation (R = 0.995) was found between average ground-water levels in 1966-1980 and cumulative departures in precipitation and pumping rates from 1950-1965 average precipitation and pumping rates. (Moore-IVI)
W85-00307

CYCLIC STORAGE: A PRELIMINARY ASSESSMENT,
Washington Univ., Seattle. Dept. of Civil Engineering.
D. P. Lettenmaier, and S. J. Burges.
Ground Water, Vol. 20, No. 3, p 278-288, May-June, 1982. 6 Fig, 2 Tab, 17 Ref.

Descriptors: *Cyclic storage, *Groundwater storage, *Conjunctive use, Storage reservoirs, Flow buffering, Aquifer management, Artificial recharge, Model studies, Simulation, Cost analysis.

Cyclic groundwater storage represents an alternative which can reduce or eliminate the necessity for surface storage. Such a system may be operated in conjunction with a surface reservoir. The performance of a simplified water resource system consisting of a single surface reservoir and adjacent aquifer storage operated as a coupled flow buffering device is investigated on an annual scale to provide insight into the most important physical and climatic (streamflow) parameters governing cyclic storage performance. The hypothetical system is fully characterized by aquifer capacity, pumping and recharge capacity, surface storage size, annual demand, and reservoir inflow statistics, including annual mean, coefficient of variation, skew coefficient, lag one correlation coefficient, and Hurst coefficient. System performance under a range of these parameters is reviewed via Monte Carlo simulation; for the cases considered system performance is almost always limited by total system storage (sum of surface and aquifer storage). The cost of providing flow buffering via development of subsurface storage is about an order of magnitude less than for surface storage in the cases considered. (Moore-IVI)
W85-00311

SULFATE-REDUCING BACTERIA IN GROUND WATER FROM CLOGGING AND NONCLOGGING SHALLOW WELLS IN THE NETHERLANDS RIVER REGION,
Keuringsinstituut voor Waterleidingartikelen, Rijswijk (Netherlands).
C. G. E. M. van Beek, and D. van der Kooij.
Ground Water, Vol. 20, No. 3, p 298-302, May-June, 1982. 3 Fig, 3 Tab, 16 Ref.

Descriptors: *Netherlands, *Clogging, *Wells, *Sulfate reducing bacteria, *Groundwater, Bacteria, Anaerobic conditions, Iron sulfide.

In the Netherlands, the majority of well fields in the river region, where anaerobic water is withdrawn from the shallow aquifer, have problems with well clogging. When this type of clogging occurs, usually all wells in a given field are involved. This indicates that the cause of clogging is connected with the geohydrochemical or geomicrobiological characteristics of the aquifer. It has been suggested that well clogging may be due to iron sulfide formation induced by sulfate reducing bacteria. In order to test the supposition that sulfate-reducing bacteria play a role in this clogging process, sulfate-reducing bacteria in water from wells in well fields with and without the occurrence of clogging were enumerated. Numbers of sulfate-reducing bacteria were estimated by using the MPN technique. The sulfate-reducing bacteria count varied from less than 2/100 ml to 920/100 ml. In water withdrawn from nonclogging wells, the MPN of sulfate-reducing bacteria averaged 5 per 100 ml, whereas in wells subject to clogging, the number averaged 25 per 100 ml. A statistical analysis by Wilcoxon's order test confirmed that a significant difference exists between the numbers of sulfate-reducing bacteria in clogging and nonclogging wells. No causal relation has been proven to exist between this type of well clogging and the presence of sulfate-reducing bacteria. (Moore-IVI)
W85-00313

REPRESENTATION OF MULTIAQUIFER WELL EFFECTS IN THREE-DIMENSIONAL GROUND-WATER FLOW SIMULATION,
Geological Survey, Reston, VA.
G. D. Bennett, A. L. Kontis, and S. P. Larson.
Ground Water, Vol. 20, No. 3, p 334-341, May-June, 1982. 6 Fig, 11 Ref.

Descriptors: *Groundwater movement, *Simulation, *Well effects, *Multiaquifer wells, Multilayer wells, Mathematical models, Aquifers, Geohydrology, Well hydraulics.

A problem exists with respect to the simulation of multiaquifer or multilayer wells (wells which penetrate and are open to several different aquifers or layers). Such wells, whether or not they are pumped, can have a major effect on the hydraulics of the system. The presence of multiaquifer or multilayer wells changes the nature of the equations which must be solved in a three-dimensional ground-water flow simulation and, in effect, alters the stencil of computation. A method has been devised which takes this changes into consideration by allowing simulation of the hydraulic effects of a multiaquifer well on the aquifer system. It also allows for calculation of the water level and individual aquifer discharges in such a well. The method is satisfactory for the case of a single well located exactly at a node, in a model utilizing a square-mesh spacing, where radial symmetry is not disturbed by anisotropy, heterogeneity, or hydrologic boundaries. Application of the method to other situations is more difficult to rationalize, and depends in part upon whether a meaningful estimate of r sub a can be obtained for those situations. (Moore-IVI)
W85-00316

EVALUATING AND IMPROVING EXISTING GROUND-WATER SYSTEMS,
California Univ., Davis. Dept. of Civil Engineering.
O. J. Helweg.
Ground Water, Vol. 20, No. 4, p 402-409, July-August, 1982. 6 Fig, 7 Tab, 10 Ref.

Descriptors: *Pump efficiency, *Well efficiency, *Groundwater, Energy, Drawdown, Specific capacity, Pumping tests.

Considerable energy savings are available from improving well and pump efficiencies. One major problem is evaluating the well and pump inefficiencies over prolonged periods of time, because these efficiencies are erratic unless normalized. A new well should be tested at different discharges to construct a relationship between specific capacity and drawdown. Future well efficiency tests should compare the specific capacity with the original curve at the test discharge. The departure from the original curve indicates the loss in well efficiency. Similarly, pump efficiency needs to be normalized, so that the tested efficiency may be compared with the original efficiency at the test discharge. (Author's abstract)
W85-00319

ADVECTION-DISPERSION INTERPRETATION OF TRACER OBSERVATIONS IN AN AQUIFER,
Stanford Univ., CA. Dept. of Applied Earth Sciences.
E. Hoehn, and P. V. Roberts.
Ground Water, Vol. 20, No. 4, p 457-465, July-August, 1982. 4 Fig, 3 Tab, 25 Ref. Swiss NSF grant 82.816.0.80, EPA grant R-804431, OWRT grant 14-35-0001-8824.

Descriptors: *Advection, *Dispersion, *Tracers, *Artificial recharge, *California, Mathematical models, Simulation, Injection wells, Wastewater renovation, Aquifers, Tailing, Reclaimed water.

An advanced wastewater treatment facility and a well field operated for artificial recharge in the Palo Alto Baylands (California) have been previously used to evaluate whether direct injection of municipal effluents is a reliable and feasible strategy for producing reclaimed water. To complement this work, field experiments using conservative tracers have been carried out at the same site to evaluate the adequacy of an advection-dispersion model. A stimulus-response approach based on chemical reactor theory was applied. Two different pulse stimuli at an injection well resulted in responses in two observation wells located at distances of 8 and 17 m, respectively from the injection well. The wells are perforated over the entire aquifer thickness of 1-2 m. The behavior of the two conservative tracers agreed closely with each other. Breakthrough response curves revealed extended trailing edges (tailing), especially at the nearer well. A two-domain model is employed to extend the simple advection-dispersion equation to account for the observed tailing. Response curves of concentrations were fitted with finite-difference simulations using the two-domain model. The simulations using the two-domain model agreed well with the field observations. The responses at the more distant well were characterized by values of dispersivity equal to or slightly smaller than those at the nearer well. The amount of field data required to simulate the observations was justified in the light of the overall purpose of gaining insight into the transport behavior of water and solutes during recharge operations. (Moore-IVI)
W85-00326

UNRELIABILITY OF OPEN OBSERVATION BOREHOLES IN UNCONFINED AQUIFER PUMPING TESTS,
Birmingham Univ. (England). Dept. of Civil Engineering.
K. R. Rushton, and K. W. F. Howard.
Ground Water, Vol. 20, No. 5, p 546-550, September-October, 1982. 7 Fig, 1 Tab, 5 Ref.

Descriptors: *Water table aquifers, *Pumping tests, *Observation wells, Aquifers, Boreholes, Mathematical models, Groundwater movement, Piezometers.

The estimation of the transmissivity and storage coefficients in unconfined aquifers from pumping tests often proves to be difficult. For tests, an additional 200 mm diameter borehole was constructed at 34.5 m from the main pumping well. Pumping tests were carried out initially using the new borehole as an observation well. The regional aquifer response over a long time period indicated a specific yield of 10% to 15% but pumping tests did not appear to support these estimates. When separate piezometers were installed along a vertical section, there were significant differences in groundwater head. These differences suggest that rather than providing an average groundwater head, the open borehole provides a means of flow between the different elevations and therefore produces misleading results. Readings from open observation wells should be used with caution. When a number of piezometers are provided on a vertical section, a detailed picture can be obtained of the vertical components of flow. Using a numerical model for pumping test analysis it is possible to reproduce the observed aquifer behavior both at the free surface and at depth within the aquifer. (Moore-IVI)
W85-00331

HAND CALCULATOR PROGRAM FOR EVALUATING THEIS PARAMETERS FROM A PUMPING TEST,
Electronic Associates, Inc., West Long Branch, NJ.
J. Paschetto, and C. D. McElwee.
Ground Water, Vol. 20, No. 5, p 551-555, September-October, 1982. 2 Tab, 9 Ref.

Descriptors: *Pumping test, *Computer programs, Transmissivity, Storativity, Drawdown, Theis equation.

Automated techniques for analyzing pumping test data published recently usually require the services of a computer. With the advent of more sophisticated hand-held calculators, it is possible to implement these techniques on calculators. The program TFIT, originally written in FORTRAN, was adapted for use on the HP-41C hand-held calculator. With two memory modules, up to 44 drawdown-time pairs can be handled simultaneously. Given experimental pump test data, the program will yield approximations for aquifer transmissivity and storage coefficient, together with the rms error for drawdown. The complete Theis equation is used so there is no time or distance limitation. (Moore-IVI)
W85-00332

ECONOMICS OF IMPROVING WELL AND PUMP EFFICIENCY,
California Univ., Davis. Dept. of Civil Engineering.
O. J. Helweg.
Ground Water, Vol. 20, No. 5, p 556-562, September-October, 1982. 6 Fig, 4 Tab, 6 Ref.

Descriptors: *Well efficiency, *Pump efficiency, *Economic efficiency, Energy costs, Pump testing, Cost analysis, Drilling, Design criteria.

Significant savings are frequently achieved from increasing well and pump efficiency by repair or replacement. The energy savings from rehabilitating wells and pumps may be modest for systems that are only slightly inefficient; the costs of the replacement analysis (cost of pump tests and time to analyze them) are usually even less. Groundwater users almost always realize greater savings from conducting a replacement analysis than the cost of the analysis. If significant inefficiencies are discovered, energy savings will be substantial. Pumping costs over tha life of a well are usually much greater than the well construction cost. When drilling a new well, the most economical design should be chosen instead of the cheapest, if it is financially feasible. (Moore-IVI)
W85-00333

NUMERICAL SIMULATION OF THERMAL ENERGY STORAGE EXPERIMENT CONDUCTED BY AUBURN UNIVERSITY,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
J. F. Sykes, R. B. Lantz, S. B. Pahwa, and D. S. Ward.
Ground Water, Vol. 20, No. 5, p 569-576, September-October, 1982. 14 Fig, 2 Tab, 13 Ref.

Descriptors: *Thermal energy storage, *Mathematical models, *Aquifers, *Mobile, *Alabama, Simulation, Water temperature, Thermal convection, Anisotrophy, Thermal conduction, Isotherms, Injection wells.

A multidimensional, finite-difference model for ground-water flow and heat transport is used to analyze the thermal energy storage experiment conducted by Auburn University in Mobile, Alabama. The experiment consisted of three stages - namely, injection, storage and recovery occurring for 80, 51 and 41 days, respectively. This application demonstrates the validation evidence that the model adequately and accurately simulates the field experiment. The numerical model includes the effects of hydraulic anisotrophy, thermal convection and conduction, and heat loss to the adjacent confining strata. Observed aquifer isotherms at the end of each stage are compared with predicted values on a cylindrical grid situated about the well. The degree of vertical discretization used in the model is shown to impact the predicted temperature profiles at each stage, but has minimal effect on the recovery water temperature. (Author's abstract)
W85-00335

PREDICTION OF ECONOMIC POTENTIAL FOR IRRIGATION USING A GROUND-WATER MODEL,
Oklahoma State Univ., Stillwater. Dept. of Geology.
D. C. Kent, J. W. Naney, and F. E. Witz.
Ground Water, Vol. 20, No. 5, p 577-585, September-October, 1982. 10 Fig, 5 Tab, 13 Ref.

Descriptors: *Irrigation requirements, *Economic evaluation, *Groundwater depletion, *Mathematical models, Land use, Water potentials, Simulation, Cost-benefit analysis, Cotton, Alfalfa.

The objective of this study is to demonstrate the application of a predictive ground-water potentiometric-head model to estimate the profitability of irrigation in contrast to that of dry-land farming. Unit cost per acre-foot of water required for a variety of crops is used to determine the distributive impact of predicted aquifer depletion at 5-year intervals during 20 years of simulated pumping. A land-use planning scheme is proposed for identifying areas (one square mile or less) where various crop types can be irrigated based on benefit-cost criteria for two arbitrary pumping rates as well as on future energy and well development costs. Maps showing areas of profitable production are presented for cotton and alfalfa as examples of crops requiring as much as 1 and 2 ac-ft/ac/yr (0.30 and 0.60 ha-m/ha/yr), respectively. Irrigation-water needs and related profitability are presented as examples for several crops by using the model. (Author's abstract)
W85-00336

PROSPECT RISK ANALYSIS APPLIED TO GROUND-WATER RESERVOIR EVALUATION,
For primary bibliographic entry see Field 6B.
W85-00341

HYDROGEOLOGIC CONTROL OF LOCALIZED IRON-ENRICHED GROUND WATER, LIMA, OHIO,
S. I. Strausberg.
Ground Water, Vol. 20, No. 6, p 663-667, November-December, 1982. 3 Fig, 7 Ref.

Descriptors: *Groundwater, *Iron, *Lima, *Ohio, Hydrogeology, Carbonate aquifers, Permeability, Glacial aquifers, Cooling water, Hardness.

Groundwater pumped from a Silurian carbonate aquifer in northwestern Ohio has been use for industrial cooling at the Lima, Ohio plant of Vistron Corporation. Lateral flow from saturated glacial deposits in an entrenched buried valley under the southwestern part of the Vistron plant site causes localization of high iron concentrations in the groundwater pumped from the carbonate aquifer. The high iron concentrations combined with the hardness of the water have caused deposits on heat exchange surfaces leading to inefficient operations. Pumpage in the Lima region has remained stable from 1971 to 1981 at about 6.6 mgd. Production wells are open to the carbonate aquifer, having higher permeability than glacial deposits. Pumping from Vistron's southwesterly operating wells has created a sink that apparently prevents the iron-enriched water, pulled from saturated glacial deposits, from moving towards pumping wells in the central and northern portions of the area. Iron concentrations in water from the southwestern wells are about one order of magnitude higher than in the water from central wells. Iron concentrations in the central and northern wells are not expected to increase as long as about 20% of the plant's groundwater is withdrawn from at least two of the southwestern wells. (Baker-IVI)
W85-00342

IMPACT OF LAKE MICHIGAN ALLOCATIONS ON THE CAMBRIAN-ORDOVICIAN AQUIFER SYSTEM,
Illinois State Water Survey Div., Champaign.
A. P. Visocky.
Ground Water, Vol. 20, No. 6, p 668-674, November-December, 1982. 3 Fig, 3 Tab, 15 Ref.

Descriptors: *Water allocation, *Lake Michigan, *Chicago, *Illinois, *Wisconsin, *Cambrian-Ordovician Aquifer, *Groundwater depletion, Water supply, Groundwater supply, Groundwater level, Water shortage, Water demand, Computer models.

Overpumping of the Cambrian-Ordovician aquifer in the Chicago area has caused severe water level declines in portions of Cook, DuPage, Kane, and Will Counties. Recent changes in the accounting procedure for diversion of Lake Michigan water have released more water for public supplies. As communities which have been allocated Lake Michigan water shut off their deep wells, recovery of water levels will occur. The regional cone of depression will continue to spread outward, especially to the west and south. Major cones of depression will shift to Joliet and to the Fox River Valley. At least six pumping centers will experience critical water stages along with reduced pumping capacity during the 1980-2020 period. With the additional drawdowns anticipated from Wisconsin pumpages, superimposed on declines predicted by a computer model, it is possible that other areas, especially large pumping centers closer to the State line, might also experience reduced pumping capacity. Computer runs using withdrawals totaling 65 mgd tend to confirm the estimate that even with reduction in deep pumpage brought about through lake allocations, projected withdrawals will still exceed the sustained yield by 43 mgd. Projected Illinois pumpages will cause as much as 130 feet of additional drawdown along the State line between 1980 and 2020. Wisconsin pumpage is expected to cause an additional 80 feet of decline at the State line over the same period. (Baker-IVI)
W85-00343

METHODS OF FORECASTING AND MAPPING OF GROUND-WATER TABLES IN THE USSR,
Morton and Partners, Rexdale (Ontario).
E. Zaltsberg.
Ground Water, Vol. 20, No. 6, p 675-679, November-December, 1982. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Forecasting, *Groundwater level, *Water table, *Mapping, *USSR, Water supply, Mathematical equations, Hydrogeology.

A short description is offered of extensive USSR experience in the field of hydrogeological forecasting in large territories. The composition of the forecast consists of the following stages: collection and analysis of relevant information; choice of predicted tables; calculations of the forecast equations; and extrapolating the forecast in the territory. Periodic hydrological forecasts began to be composed in the USSR about 10 years ago. During this period considerable experience was accumulated in the field of application of various statistical methods of groundwater table forecast purposes, including mapping of existing and predicted regimes. This practice was approved and forecasts were applied by many construction, agricultural, forestry and hydrological organizations and offices. (Baker-IVI)
W85-00344

NUMERICAL MODEL STUDY OF GROUND-WATER CONTAMINATION FROM PRICE'S LANDFILL, NEW JERSEY - II. SENSITIVITY ANALYSIS AND CONTAMINANT PLUME SIMULATION,
Princeton Univ., NJ. Dept. of Civil Engineering.
W. G. Gray, and J. L. Hoffman.
Ground Water, Vol. 21, No. 1, p 15-21, January-February, 1983. 10 Fig, 1 Tab, 2 Ref.

Descriptors: *Sensitivity analysis, *Groundwater pollution, *Atlantic City, *New Jersey, Landfills, Price's Landfill, Plumes, Simulation, Model studies, Mathematical models, Groundwater movement.

A numerical model of flow and transport in the vicinity of Price's Landfill and the Atlantic City public water supply wells is used to estimate the extent of the existing contamination problem. Model parameters such as boundary conditions, pumping rates, permeability and dispersivity are varied to demonstrate the sensitivity of the model to these quantities. A historical simulation of the past ten years of contamination is obtained and two schemes of remediation of the contamination problem are compared. Besides providing some insight into the particulars of that specific problem, some of the adequacies and difficulties in applying a numerical simulator have been pointed out. The design of field studies in cooperation with numerical studies will reduce many existing problems of simulation. Finally, the numerical models are not to be confused with tools to be used in place of field studies, but as complements to well designed data collection efforts. (Baker-IVI)
W85-00354

APPLICATION OF A MICROCOMPUTER IN THE ANALYSIS OF PUMPING TEST DATA IN CONFINED AQUIFERS,
Water Surveys (Nigeria) Ltd., Bauchi.
J. P. Dumble, and K. T. Cullen.
Ground Water, Vol. 21, No. 1, p 79-83, January-February, 1983. 5 Fig, 1 Tab, 7 Ref.

Descriptors: *Drawdown, *Computers, *Confined aquifers, *Pumping tests, Groundwater management, Pumping, Microcomputers, Transmissivity, Water storage, Storage capacity.

By using microcomputers it is possible to rapidly generate the theoretical time drawdown data for a pumping test in a confined aquifer at constant or varying pumping rates for a variety of T (aquifer transmissivity) and S (aquifer storage coefficient) values and including boundary conditions. The ability to graphically display both field and theoretical data on a monitor screen removes the need for manual curve matching, thereby improving the overall interpretation of the test. The capacity of the computer system to quickly treat data gives the hydrogeologist the capability to investigate a large number of possible field conditions, thereby affording a greater insight into the limitations of a solution. (Baker-IVI)
W85-00361

LABORATORY EVALUATION OF GROUND WATER SAMPLING MECHANISMS,
Illinois State Water Survey Div., Champaign. Aquatic Chemistry Section.
For primary bibliographic entry see Field 5A.
W85-00364

4C. Effects On Water Of Man's Non-Water Activities

EFFECTS OF URBANIZATION ON PHYSICAL HABITAT FOR TROUT IN STREAMS,
Montana State Univ., Bozeman. Dept. of Biology.
For primary bibliographic entry see Field 6G.
W85-00070

RIPARIAN FORESTS AS NUTRIENT FILTERS IN AGRICULTURAL WATERSHEDS,

Georgia Coastal Plain Experiment Station, Tifton.
For primary bibliographic entry see Field 2I.
W85-00127

HYDROLOGICAL REGIME OF UNDISTURBED MIXED EVERGREEN FORESTS, SOUTH NELSON, NEW ZEALAND,
New Zealand Forest Service, Rotorua. Forest Research Inst.
A. J. Pearce, L. K. Rowe, and C. L. O'Loughlin.
Journal of Hydrology, Vol. 21, No. 2, p 98-116, 1982. 7 Fig, 1 Tab, 21 Ref.

Descriptors: *Forest hydrology, *Hydrological regime, *New Zealand, *Evergreen forests, Catchments, Forest watersheds, Runoff, Storm runoff, Hydrologic budget, Seasonal variation, Evaporation, Transpiration, Interception.

The water balance, flow frequency, summer low flows, and storm runoff response of four small catchments covered with undisturbed Nothofagus spp.-podocarp-hardwood forest in south Nelson, New Zealand are described. Hard beech and red beech are the dominant forest species, with kamahi, miro, rimu and silver beech as subdominant species. Rainfall gradients across the terrain underlain by Moutere Gravel are quite large. Under natural forested conditions, the dissected hill country is only moderately hydrologically responsive compared with similar forested terrain in higher rainfall climates. The influence of the evergreen forest is most predominant in the evaporative components of the water balance, and then principally in the high losses by evaporation of intercepted rainfall. Nearly 30% of gross rainfall is evaporated from interception. Of the estimated 1550 mm mean annual rainfall about 375 mm is cycled between only the exterior of the tree canopy and the atmosphere. Estimated annual transpiration forms only 40-45% of the total annual evaporation and is less than the annual net interception loss. The thick, stratified regolith, which provides substantial catchment storage is important in apportioning net rainfall between quickflow and delayed flow and is probably the major factor in moderating the storm runoff response of the Big Bush catchments compared to that in other similar forests. Mechanisms for generating rapid-response runoff are important in small hydrographs and in the early parts of most large hydrograph responses, but such processes yield much less than half the annual quickflow from the Big Bush catchments and possibly as little as one quarter of the annual quickflow. Rapid response runoff mechanisms generate small hydrographs, but much of the storm runoff in large events is generated by slower response mechanisms, so that much storm runoff delivered to the stream channels lags 6-24 hours after storm rainfall. (Baker-IVI)
W85-00179

4D. Watershed Protection

FLOODPLAIN MANAGEMENT HANDBOOK.
Flood Loss Reduction Associates, Palo Alto, CA.
For primary bibliographic entry see Field 6F.
W85-00059

CAUSES, CONSEQUENCES AND REMEDIES OF SOIL EROSION IN KENYA,
Kungliga Vetenskapsakademien, Stockholm (Sweden). Beijerinstitutet.
P. O'Keefe.
Ambio, Vol. 12, No. 6, p 302-305, 1983. 2 Fig, 1 Tab, 16 Ref.

Descriptors: *Erosion control, *Kenya, *Soil erosion, Land management, Semiarid lands, Agricultural runoff, Top soil, Tillage, Farm management, Developing countries.

Erosion problems in Kenya are aggravated by a semi-arid climate over much of the interior of the land, cutting of forests for fuelwood and charcoal-making, and poor land management and agricultural practices. In attempts to come to grips with mounting top soil losses, officials are introducing better crop management techniques, coupled to simple terracing in erosion-prone areas. Critical to the prevention of soil erosion are the protection of soil against direct rain impact and the maintenance of organic matter. In Kenya, subsistence farmers account for some 80% of the population. In most areas, over 50% of these peasants depend on off-farm income opportunities for the major part of their income. The absence of the men on the farms at certain critical times of the crop year has created labor hardships and reduced the number of individuals able to assist in making changes in agricultural practices. Much future hope is placed in the efforts of zero tillage agriculture. Untilled production reduced erosion by 98% in Nigeria and significantly reduced water runoff. Zero tillage also requires less than 10% of the energy and labor input. Zero tillage, however, requires the development of two technologies. Appropriate herbicides and applicators for both pre and post-planting applications are needed as well as punch or injector planters to penetrate the soil. The real issue is a political one: will African governments and donor agencies support these moves which, because they guarantee successful production, will also guarantee a more vociferous peasantry. (Baker-IVI)
W85-00129

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

QUALITY OF GROUND WATER IN SOUTHERN BUCHANAN COUNTY, VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W85-00025

WATER RESOURCES OF THE TULALIP INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W85-00030

INVESTIGATION OF MERCURY-AMINO ACID COMPLEXES IN THE AQUEOUS ENVIRONMENT,
Maryland Univ., College Park. Dept. of Chemistry.
C. Ponnamperuma.
Available from the National Technical Information Service, Springfield, VA 22161, as PB84 190412, Price codes: A02 in paper copy, A01 in microfiche. Maryland Water Resources Research Center, College Park, Publication No. 75, August, 1983. 13 p, 3 Tab, 20 Ref. OWRT Project No. A-063-MD (1), Contract/Grant No. 14-34-0001-2122.

Descriptors: Mercury, Sulfhydryl groups, Cysteine, *Oysters, Fluorescence, Heavy metals, Amino acids, Water pollution effects, Toxicity, *Mercury cysteinate, Chromatography, *Pollutant identification.

Mercury is a toxic pollutant which can even at very low levels pose serious environmental problems. Since mercury in solution is known to have a marked chemical affinity for sulfhydryl groups, we explored the possibility of mercury entering the biosphere as a mercury-cysteine complex. With the aid of a modified high-pressure-liquid chromatography system, using a fluorescing detection agent, we have established that mercury cysteinate is present in oysters. Most of the mercury was found in the form of mercury cysteinate.
W85-00077

NEW MEDIUM FOR IMPROVED RECOVERY OF COLIFORM BACTERIA FROM DRINKING WATER,
Montana State Univ., Bozeman. Dept. of Microbiology.
M. W. LeChevallier, S. C. Cameron, and G. A. McFeters.
Applied and Environmental Microbiology, Vol. 45, No. 2, p 484-492, February, 1983. 2 Fig, 4 Tab, 45 Ref.

Descriptors: *Coliforms, *Drinking water, *Membrane filter medium, Bacterial analysis, Filters, Membrane processes, Escherichia, Klebsiella, Citrobacter, Enterobacter.

A new membrane filter medium was developed for the improved recovery of injured coliforms from drinking water. The new medium, termed m-T7, consists of 5.0 g of Difco Proteose Peptone no. 3, 20 g of lactose, 3.0 g of yeast extract, 0.4 ml of Tergitol 7 (25% solution), 5.0 g of polyoxyethylene ether W-1, 0.1 g of bromthymol blue, 0.1 g of bromcresol purple, and 15 g of agar per liter of distilled water. In laboratory studies, m-T7 agar recovered 86-99% more laboratory-injured coliforms than did m-Endo agar. m-T7 agar also recovered an average of 43% more verified coliforms from 67 surface and drinking water samples than did the standard m-Endo membrane filter technique. From drinking water, m-T7 agar recovered nearly three times more coliforms than did m-Endo agar. Less than 0.5% of the colonies on m-T7 agar gave false-negative reactions, whereas over 70% of the typical yellow colonies from m-T7 agar produced gas in lauryl tryptose broth. Most of the verified coliforms isolated on m-T7 agar belonged to one of the four common coliform genera: Escherichia, 17.6%; Klebsiella, 21.7%; Citrobacter, 17.3%; Enterobacter, 32.3%. The results demonstrate that m-T7 agar is superior to m-Endo agar, especially for the isolation of injured coliforms from drinking water. There was no problem with excessive background colonies on m-T7 agar with the 44 drinking water samples examined. There was some crowding of colonies on the filters of both types of medium when surface water samples containing sewage effluent were examined. The single step membrane filter technique may be used with m-T7 agar for analysis of coliforms in all waters, but anaerobic incubation may facilitate the recovery of coliforms from highly contaminated surface waters. (Baker-IVI)
W85-00103

STATISTICAL VIEW OF HEAVY METAL POLLUTION INDEX OF RIVER SEDIMENT,
Nippon Inst. of Tech., Saitama. Dept. of Applied Statistics.
H. Nishida, and S. Suzuki.
Bulletin of Environmental Contamination and Toxicology, Vol. 32, No. 5, p 503-509, April, 1984. 1 Fig, 4 Tab. 7 Ref.

Descriptors: *Pollution index, *Heavy metals, *Japan, *River sediments, Sediments, Statistical methods, Pollutant identification.

How to set up a standard method for judging as to whether or not river sediment is polluted by heavy metal is essential to the definition of polluted sediments. A new pollution index is proposed which is distributed as noncentral chi-square in most of the cases of practical application. The fundamental philosophy of the method is based on the statistical idea that the upper 1% of the distibution formed by the normalized group of upstream sediment falls within the critical region. The method was tested by studying random samples of upstream sediment not polluted by wastewater and of polluted downstream sediment by means of an Ekman-Burge dredge at ten points from both sides of 92 rivers in Japan. (Baker-IVI)
W85-00122

PROBLEMS IN COLLECTION OF REPRESENTATIVE SAMPLES FOR DETERMINATION OF TRIBUTOXYETHYL PHOSPHATE IN POTABLE WATER,
Environmental Health Directorate, Ottawa (Ontario).
G. L. LeBel, and D. T. Williams.
Journal of the Association of Official Analytical Chemists, Vol. 66, No. 1, p 202-203, January, 1983. 1 Tab, 8 Ref.

Descriptors: *Pollutant identification, *Tributoxyethyl phosphate, *Potable water, *Sampling, Raw water, Water analysis, Organic compounds, Phosphates, Flame retardants.

Tributoxyethyl phosphate (TBEP) is used as a flame retardant plasticizer in many products. Results of a brief investigation on tributoxyethyl phosphate in tap water are presented to illustrate the difficulties in obtaining representative samples and to alert analysts to the importance of designing suitable sampling protocols. Samples were taken of raw water at the intake bay of a treatment plant and of tap water. Large volume samples and extraction were carried out using the AD-2 macroreticular resin method. Grab samples were extracted with methylene chloride. Highly variable levels of TBEP were detected in water sampled from a laboratory tap. Grab samples of water from this tap, after a weekend of non-use, showed very high TBEP levels that decreased as the tap was flushed with water. Potable water grab samples collected from 2 private residences showed increased levels of TBEP in the first-draw samples, a third residence did not show higher TBEP levels. Flushing the taps with 60 L water decreased the TBEP levels to those found in raw water at the treatment plant and in treated water at a pumping station in the distribution system. To provide adequate data for estimating exposure to certain organic compounds it is necessary to analyze both first draw and well flushed tap water samples. (Baker-IVI)
W85-00164

DETERMINATION OF TRACE AZAARENES IN WATER BY GAS CHROMATOGRAPHY AND GAS CHROMATOGRAPHY-MASS SPECTROMETRY,
Kitakyushu Municipal Inst. of Environmental Health Sciences (Japan).
R. Shinohara, A. Kido, Y. Okamoto, and R. Takeshita.
Journal of Chromatography, Vol. 256, No. 1, p 81-91, January, 1983. 10 Fig, 2 Tab, 20 Ref.

Descriptors: *Azaarenes, *Aza heterocyclic hydrocarbons, *Gas chromatography, *Resin column, Detection limits, Selected ion monitor, Flame thermionic detectors, Dohkai Bay, Japan, Seawater, Pollutant identification, Mass spectrometry.

Various chromatographic techniques have been unsuccessfully employed to detect aza heterocyclic hydrocarbons (azaarenes) in water samples; a detection method with high specificity and sensitivity and a method for concentrating azaarenes in water are required due to their low environmental concentrations. Utilization of a gas chromatography mass spectrometry selected ion monitor detector (GC-MS-SIM) was very useful for the determination of trace azaarenes in environmental samples. Azaarenes in sea water taken from Dohkai Bay in Kitakyushu City were concentrated with an Amberlite XAD-2 resin column and separated into azaarenes with two and three rings and those with five rings by a solvent extraction, followed by a clean-up procedure using an alumina column. The azaarenes thereby separated were determined by GC with a flame thermionic detector (GC-FTD) and GC-mass spectrometry with a GC-MS-SIM. Detection limits of the azaarenes by GC-FTD were in the range 0.5-3 ng and those by GC-MS-SIM were in the range of 0.02-0.5 ng. (Collier-IVI)
W85-00165

MULTI-ELEMENT ANALYSIS OF TRACE METALS IN SOME ENVIRONMENTAL SAMPLES BY SOLVENT EXTRACTION AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY OF METAL CHELATE COMPLEXES,
Thames Polytechnic, London (England). School of Chemistry.
A. B. Edward-Inatimi.
Journal of Chromatography, Vol. 256, No. 1, p 253-266, February, 1983. 8 Fig, 7 Tab, 17 Ref.

Descriptors: *Trace metals, *High-performance liquid chromatography, *Solvent extraction, *Chelates, Metal complexes, Effluents, River Thames, England, Plaice, Flounder, Shrimp, Atomic absorption spectrophotometry.

The use of high-performance liquid chromatography (HPLC), after preliminary solvent extraction, for the complete separation of trace amounts of metal chelates prior to their non-selective determination was investigated. A UV detector set to the most intense absorbance peak of the reagent was used as a universal detector for all of the metal chelates at approximately the same sensitivity. Sulfur-containing reagents such as dithizone and diethyldithiocarbamate were used owing to their high absorptivities and because they tend to form strong complexes with toxic metalloids. The absorption mode of HPLC was used, because metal chelates are typically very soluble in non-polar solvents such as chloroform. The high distribution ratios of the complexes in such solvents made possible the use of small volumes for extraction and hence obviated the need for evaporation prior to direct HPLC injection. A buffer medium of pH 8.5 + or - 0.1 gave optimum response for the best multi-element extraction and HPLC determination. Twenty-eight samples of non-ferrous effluent from 19 different manufacturing plants were analyzed using the HPLC method and also using the recommended atomic-absorption spectrometry (AAS); HPLC can be carried out in 20-30 min, whereas the AAS requires over 90 min due to the extensive sample treatment involved. Water samples were taken from the River Thames at several sampling points; with very little sample preparation, trace metal profiles were obtained and the trace metals present were determined. Concentrations in aquatic biota (plaice, flounder, and shrimps) and in standard kale (Brassica oleracea) as determined by HPLC (preceded by a rapid wet-ashing procedure with nitric acid-hydrogen peroxide) agreeded well with values determined by AAS. (Collier-IVI)
W85-00166

RAPID, SENSITIVE, GAS CHROMATOGRAPHIC DETERMINATION OF DIETHYL MALONATE AND DIETHYL SUCCINATE IN WATER FACILITATED BY SORBENT-TUBE PRECONCENTRATION,
Southern Research Inst., Birmingham, AL.
D. R. Coleman, L. M. Rose, W. E. Meyers, and W. K. Fowler.
Journal of Chromatography, Vol. 256, No. 2, p 363-367, February, 1983. 1 Fig, 7 Ref.

Descriptors: *Gas chromatography, *Diethyl malonate, *Diethyl succinate, Preconcentration, Extraction, Dialkyl alkanedioates, Chromatography, Plasticizers.

Dialkyl alkanedioates (esters of dibasic acids) are used as plasticizers in the coatings and plastics industry and consequently their presence in the environment must be monitored. A relatively simple, rapid method for the determination of diethyl malonate and diethyl succinate in water was developed based on the vapor-phase pre-concentration of solvent extracts on solid sorbent preconcentrator tubes and the subsequent thermal desorption of these tubes into a gas chromatograph. At levels corresponding to aqueous sample concentrations of approximately 3 ng/ml, in order to maximize the sensitivity of the method, the entire sample extract is pre-concentrated. Down to approximately 25 ng/ml, in order to reduce the analysis time and the complexity of routine sample manipulations, only a small portion of the extract is pre-concentrated. The efficiency of extraction was essentially 100% for both analytes using diethyl ether. The relative standard deviation of replicate determinations is typically less than 5% at analyte concentrations ten (or more) times higher than the working lower limit for quantitative determinations. (Collier-IVI)
W85-00167

ANALYSIS OF TRACE HALOCARBONS IN NATURAL WATERS BY SIMPLIFIED PURGE AND CRYOTRAP METHOD,
International Science Consultants, Ringwood (England).
P. G. Simmonds.
Journal of Chromatography, Vol. 289, p 117-127, April, 1984. 3 Fig, 5 Tab, 47 Ref.

Descriptors: *Halogenated hydrocarbons, *Gas chromatography, Cryoloops, Adsorption traps, Permeation dryer, Henry's law, Electron capture detectors, Carbon tetrachloride, Trifluoromethane, Methyl chloroform, Rain, Seawater, Air pollution.

A simplified purge and cryotrap method for the analysis of trace aqueous halocarbons is described. The usual Tenax adsorption trap is replaced with a cryoloop preceded by a permeation dryer which selectively removes water vapor and thereby prevents freezing in the cryoloop. This 'one-step' method reduces potential contamination and is highly sensitive when coupled with capillary electron capture detector analysis of the purged volatiles. Using this method several previously unreported halocarbons have been observed in natural waters (including rain water); many additional halocarbons are observed in all of the water samples compared with samples of the associated ambient air. Henry's law constants were calculated directly by analyzing both water and ambient air samples collected at the same time. In most cases the water samples were supersaturated with the exception of the following halocarbons: the water/air phases of carbon tetrachloride are close to equilibrium in all water samples analyzed; methylchloroform is close to equilibrium in rain-water; and trifluoromethane is in equilibrium in sea-water. (Collier-IVI)
W85-00168

EXISTENCE OF ANIONIC SURFACTANTS IN RIVER (IN JAPANESE),
Kao Corp., Tochigi (Japan). Research Labs.
K. Yoshimura, K. Hayashi, J. Kawase, and K. Tsuji.
Japanese Journal of Limnology, Vol. 45, No. 1, p 51-60, January, 1984. 5 Fig, 8 Tab, 19 Ref.

Descriptors: *River sediments, *Water analysis, *Sulfonates, *Anionic surfactants, *Japan, Fatty acids, Fats, Surface water, Sediments, Linear alkylbenzene sulfonates, Tama River, Ta River, Kinu River, Tenpaku River.

Surface water and sediment samples were taken from several Japanese rivers to analyze for the presence of linear alkylbenzene sulfonates (LAS), fatty acids and fats. Rivers studied include the Tama, Ta, Kinu, and Tenpaku Rivers. LAS determination was carried out by Abbot's methylene blue method and reversed phase high performance liquid chromatography with a fluorimetric detector. After prelabeling of the fatty acids, fatty acids and fats were measured by a reverse phase HPLC with a fluorimetric detector. All river water and sediment samples showed the presence of methylene blue active substances, while LAS was not determined in the Tama and Ta Rivers. The concentrations of LAS detected in the river water and sediments of the Tama River were trace-0.38 mg/l and 1.79-10.72 ppm respectively. The concentrations of fatty acids in river water and sediment were 0.005-0.052 mg/l and 7.7-426 ppm, respectively, and river sediments contained 8-19 ppm of fats. These fatty acids and fats were estimated to be derived from organisms such as algae and bacteria. (Baker-IVI)
W85-00191

REEF-BUILDING CORAL SKELETONS AS CHEMICAL POLLUTION (PHOSPHORUS) INDICATORS,
Nova Univ. Oceanographic Center, Dania, FL.
R. E. Dodge, T. D. Jickells, A. H. Karp, S. Boyd, and R. P. M. Bak.
Marine Pollution Bulletin, Vol. 15, No. 5, p 178-187, 1984. 7 Fig, 4 Tab, 29 Ref. NOAA grant NA 80 RAD 00045.

Descriptors: *Phosphorus, *Corals, *Bioindicators, *Bermuda, *St. Croix, *Curacao, Montastrea, Diploria, Calcium, Reefs, Water pollution effects, Seawater, Wastewater pollution, Endolithic algae.

The inorganic and total phosphorus concentrations of the skeleton of reef-building corals have been determined on specimens from Bermuda, St. Croix, and Curacao. Concentrations determined on subsamples dated by density band growth increments

indicate that a record of seawater phosphorus is preserved which, in certain cases, is consistent with the location and time history of sewage and other phosphorus pollution episodes. Concentrations are low with some differences over wide geographic areas and between the two species examined, Montastrea annularis and Diploria strigosa. The record in some specimens shows year to year variability which appears to be related to sewage pollution influence. The method of inclusion of the phosphorus within the skeleton is uncertain. A possibility may be tissue content of endolithic algae. Other sources include trapped detritus, trapped coral tissue and/or organic matrix, and primary deposition. Data from Bermuda suggest that coral phosphorus to Ca ratio is similar to seawater ratios. (Baker-IVI)
W85-00200

USE OF MICROORGANISMS AS GROUNDWATER TRACERS: A REVIEW,
Texas Univ. Medical School at Houston.
B. H. Keswick, D.-S. Wang, and C. P. Gerba.
Ground Water, Vol. 20, No. 2, p 142-149, March-April, 1982. 4 Tab, 49 Ref.

Descriptors: *Groundwater pollution, *Microorganisms, *Tracers, *Bacteriophages, Reviews, Groundwater movement, Path of pollutants, Bacteria, Viruses, Yeasts, Spores, Public health.

The microbial contamination of groundwater is a serious problem that has resulted in large outbreaks of waterborne disease. The ability to trace microbial movement in grounwater is essential in recognizing the potential for transmission of disease-causing microorganisms. Chemical tracers do not always reflect the movement of microorganisms in ground water. Bacteria, viruses, yeasts and lycopodium spores have been used for this purpose and to trace underground movement of water in much the same manner as chemical tracers are used. The use of certain bacteria and animal viruses is undesirable due to their pathogenic potential and difficulties in their differentiation from background, naturally-occurring organisms. Bacterial viruses appear to be the microorganisms most suited as a microbial tracer because of their size, ease of assay and lack of pathogenicity. Bacteriophages have been used to trace ground-water movement over distances of 1,600 meters and can be used under a variety of conditions. Because of host specificity, phages can be mixed, injected together, then distinguished on different hosts. (Moore-IVI)
W85-00299

BAILING AND CONSTRUCTION CONSIDERATIONS FOR DEEP AQUIFER MONITORING WELLS ON WESTERN OIL SHALE LEASES,
Kaman Tempo, Denver, CO.
K. E. Kelly.
Ground Water, Vol. 20, No. 2, p 179-185, March-April, 1982. 6 Fig, 3 Tab, 5 Ref. EPA contract 68-0302449.

Descriptors: *Monitoring wells, *Oil shales, *Bailing, *Well design, *Piceance Creek Basin, *Colorado, Geohydrology, Water quality, Sampling, Groundwater.

Water quality data collected from monitoring wells in the Piceance Creek Basin (Colorado) oil shale area can be significantly influenced by well design and sampling techniques. Many of these influences can be attributed to hydrogeologic complexities, which can have notable variations on a fairly local scale. To adequately address these complexities, a site-specific characterization of the hydrogeology is necessary. This is particularly important for specifying well construction details of monitoring wells for a ground-water quality monitoring program. Data collected during the bailing of deep aquifer wells on Federal Prototype Oil Shale Lease Tract C-a indicates the need for consistent and representative sample collection depths. Appreciable changes in water quality can be induced by variations in sample collection depths. In addition, unrepresentative data can be obtained due to the incorrect selection of intervals to be samples in the well. Care must be taken to sample consistently from the same depth and aquifer interval during each and every sampling effort. Studies such as these provide necessary background information for developing ground-water monitoring guidelines in the oil shale region. Sampling procedures must be consistent to assure representative data collection. In addition, wells should be designed and completed according to the local hydrogeology and the specific goals of the monitoring program. (Author's abstract)
W85-00304

VADOSE ZONE MONITORING CONCEPTS FOR HAZARDOUS WASTE SITES,
Kaman Tempo, Santa Barbara, CA.
L. G. Everett, L. G. Wilson, and L. G. McMillion.
Ground Water, Vol. 20, No. 3, p 312-324, May-June, 1982. 2 Fig, 6 Tab, 13 Ref. EPA contract V-7724-NALX.

Descriptors: *Monitoring, *Vadose water, *Hazardous materials, *Waste disposal, Sampling, Groundwater pollution, Water pollution sources.

The implementation of the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) may be enhanced by wider applications of vadose zone monitoring. More than 50 different vadose zone monitoring techniques are referenced. Fourteen different criteria are established for selecting alternative vadose zone monitoring methods. These monitoring methods are categorized according to premonitoring techniques, sampling methods and nonsampling methods which could be applied in the vadose zone. Two conceptual cases are presented covering vadose zone monitoring at a hazardous waste disposal impoundment. The rationale for the monitoring program at a new impoundment and for an active impoundment is presented. The material constitutes the first phase of a vadose zone monitoring manual. (Author's abstract)
W85-00314

NEW METHOD FOR SIMULTANEOUS MEASUREMENT OF CL(-), BR(-), NO3(-), SCN(-), AND I(-) AT SUB-PPM LEVELS IN GROUND WATER,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
K. J. Stetzenbach, and G. M. Thompson.
Ground Water, Vol. 21, No. 1, p 36-41, January-February, 1983. 7 Fig, 1 Tab, 6 Ref. Nuclear Regulatory Commission contract NRC-04-78-275.

Descriptors: *Groundwater pollution, *Anions, *Pollutant identification, Inorganic compounds, Chromatography, Chlorides, Bromides, Nitrates, Iodides, Thiocyanides, Tracers, Chemical analysis.

Ion-exchange high pressure liquid chromatography coupled with a variable wavelength UV detector has proven to be an extemely sensitive and precise method for measurement of a variety of common anions found in natural waters. Sensitivity of measurement is approximately 50 ppb for NO2(-), NO3(-), Br(-), I(-), and SCN(-), while Cl(-) has a detection limit in the one to ten ppm range. Chromatograms require 8 to 13 minutes to complete. Analyses are performed on either of two stationary phases (Whatman SAX 10 microm or Brownlee anion exchange) depending on the anions of interest in the analysis and their interferences. It has been used extensively to measures SCN(-) as a tracer in waters ranging from potable water to chloride-saturated brines. The procedure described has been used very successfully, although to a lesser degree, to measure the remaining anions in natural waters. The analytical equipment has proved to be easily adaptable to field use when operated from a small portable generator. Thus the technique has been ideal for monitoring tracer experiments where real-time data is needed to determine sampling frequencies and to schedule other aspects of the tracing test. By simply changing columns and eluants, this HPLC instrumentation can be used for making measurements of a large variety of organic compounds. (Baker-IVI)
W85-00356

COMPUTER PROGRAM FOR A TRILINEAR DIAGRAM PLOT AND ANALYSIS OF WATER MIXING SYSTEMS,
Kent State Univ., OH. Dept. of Geology.
M. D. Morris, J. A. Berk, J. W. Krulik, and Y. Eckstein.
Ground Water, Vol. 21, No. 1, p 67-78, January-February, 1983. 10 Fig, 4 Tab, 2 Ref.

Descriptors: *Groundwater, *Trilinear diagram, *Mixing, *Computers, Water analysis, Path of pollutants, Iron, Aluminum, Silica.

The Piper trilinear diagram (Piper, A. M. 1953. US Geological Survey, Water Res. Div. Ground Water Notes, Geochemistry, No. 12, 14 pp.) has been widely used to graphically represent the dissolved constituents of natural waters and to test for apparent mixtures of waters from different sources. Due to the time needed to plot points and calculate the proportional values of mixing, this treatment of data is often quite tedious, particularly so in studies involving large numbers of chemical analyses. The PIPER program was written in BASIC to be run on a Hewlett-Packard desktop computer with an X-Y plotter. Data input is in ppm units. The program plots points in all three fields of the trilinear diagram, draws at each point within the central diamond field a circle with a radius corresponding to the concentrations expressed in meq/l, checks for points that fall on a straight line representing postulated mixtures with two end members, and/or within a triangle representing mixtures of three end members. The program does a numerical analysis of the mixing ratios of the constituents for postulated mixing systems according to the methodology as presented by Piper. The computer program is based on Piper's original assumptions: all of the major constituents have been included in the calculations; all ions are assumed to remain in solution; all the Fe, Al, and Si are present in the water in a colloidal state as oxides and are not in chemical equilibrium with the ionized constituents thus making it unnecessary to include these elements in calculations of total concentration; minor constituents of ground water are summed with the six major constituents to which they are respectively related in chemical properties; and water consisting of substantial quantities of free acid cannot be fully represented on the diagram. (Baker-IVI)
W85-00360

LABORATORY EVALUATION OF GROUND WATER SAMPLING MECHANISMS,
Illinois State Water Survey Div., Champaign. Aquatic Chemistry Section.
M. J. Barcelona, J. A. Helfrich, E. E. Garske, and J. P. Gibb.
Ground Water Monitoring Review, Vol. 4, No. 2, p 32-41, Spring, 1984. 4 Fig, 10 Tab, 11 Ref.

Descriptors: *Groundwater, *Sampling, Reviews, Pumps, Monitoring, Chemical compounds, Water analysis, Pollutant identification.

The task of obtaining representative samples of ground water in both research and compliance monitoring programs must be carefully approached. Most pumping mechanisms may be expected to perform satisfactorily for well purging and the measurement of solution parameters. Sampling for gas sensitive and volatile chemical constituents can be significantly biased by degassing and loss of volatiles during sample collection. Significant bias and poor precision may be expected in shallow ground water sampling with gas displacement, positive displacement mechanical, and suction mechanisms, unless extraordinary care is taken in sample retrieval, transfer and collection. Bladder (no gas contact) pumps are superior for most applications. The performance of grab samplers, particularly bailers, is heavily dependent on both the expertise of sampling personnel and field conditions. The ideal controlled conditions under which these performance data were collected represent an optimum situation for the observance of minimal sampling error. Field conditions and solution composition are complicating factors that must be evaluated on a case by case basis. (Baker-IVI)
W85-00364

INDICATOR BACTERIA IN FRESHWATER AND MARINE MOLLUSCS,
Mosul Univ. (Iraq). Dept. of Biology.
M. M. Al-Jebouri, and D. R. Trollope.
Hydrobiologia, Vol. 111, No. 2, p 93-102, April, 1984. 1 Fig, 7 Tab, 26 Ref.

Descriptors: *Mollusks, *Indicator bacteria, Mussels, Clams, Cockles, Coliforms, Fecal bacteria, Water pollution effects, Marine enviroment, Bioindicators.

The freshwater mussel Anodonta cygnea and four marine shellfish (mussels, Mytilus edulis; cockles, Cerastoderma edule; clams, Mya arenaria; Scrobicularia plana) from a total of six sites were surveyed for Escherichia coli, Clostridium perfringens, fecal streptococci, 25 and 37 C coliforms, 25 C and 37 C total viable numbers and fluorescent pseudomonads. The A. cygnea from an urban lake contained greater numbers of the fecal indicator bacteria than animals from a rural lake. There were also differences in the other bacterial counts and these were discussed with respect to bacterial parameter and animal characteristics. When freshwater mussels were transferred from the city site to the rural site for 24 h the load of fecal indicator bacteria was eliminated or significantly reduced. Other bacterial types took longer to become stabilized. Loss of indicator bacteria from Anodonta was also demonstrated using cleansing in the laboratory. Very high bacterial numbers were found in some marine molluscs notably Scrobicularia plana and most shellfish contained significant numbers of the three fecal indicator bacteria at every sampling occasion. The relationship between bacterial types was discussed and it was concluded that in both freshwater and marine animals the bacterial numnbers were determined more by sampling site than by species of shellfish. (Author's abstract)
W85-00416

COLIFORM CONCENTRATIONS IN LAKE ERIE - 1966 TO 1970,
Canada Centre for Inland Waters, Burlington (Ontario).
S. R. Esterby, and A. H. El-Shaarawi.
Hydrobiologia, Vol. 111, No. 2, p 133-146, April, 1984. 4 Fig, 5 Tab, 16 Ref.

Descriptors: *Lake Erie, *Coliforms, *Spatial distribution, *Temporal distribution, Fecal coliforms, Water pollution, Indicator bacteria, Clustering, Seasonal variation.

Total coliform concentrations obtained from cruises of Lake Erie, conducted from the Canada Centre for Inland Waters between 1966 and 1970, have been analyzed to determine the spatial and temporal distribution of total coliforms in the lake. Although year to year comparisons were made on a qualitative level due to the limitations in the data, some consistent seasonal feature of the spatial distribution are evident. The location of zones of higher concentration have been attributed to proximity to large urban areas and lake currents. The contribution of fecal coliforms to the total coliform concentration has been examined with the conclusion that, at the low total coliform concentrations (< or = 30 per 100 ml) observed in much of the lake, there is not relationship between the two concentrations but, over a broader range, fecal coliforms increase with total coliform concentrations and, at very high total coliform concentrations (> or = 1000 per 100 ml), fecal coliforms are always present. The analysis demonstrates 1) the value of examining observed and fitted distributions to compare subsets of a large collection of data and 2) a clustering procedure which is generally applicable to data consisting of counts. (Author's abstract)
W85-00419

5B. Sources Of Pollution

LINCOLNSHIRE LIMESTONE - HYDROGEOCHEMICAL EVOLUTION OVER A TEN-YEAR PERIOD,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2F.
W85-00017

NITROGEN-ISOTOPE ANALYSIS OF GROUNDWATER NITRATE IN CARBONATE AQUIFERS: NATURAL SOURCES VERSUS HUMAN POLLUTION,
Texas Univ. at Austin. Bureau of Economic Geology.
C. W. Kreitler, and L. A. Browning.
Journal of Hydrology, Vol. 61, No. 1-3, p 285-301, February, 1983. 7 Fig, 3 Tab, 25 Ref. NSF grant DES 74-13560.

Descriptors: *Edwards aquifer, *Texas, *Ironshore Formation, *Grand Cayman Island, *Groundwater pollution, *Nitrates, *Nitrogen isotopes, *Water pollution sources, Isotope studies, Septic tanks, Cesspools, Carbonate aquifers, Aquifers, Animal wastes, Groundwater recharge, Wastewater.

The natural variation of the nitroger isotopes, N-14 and N-15, of groundwater nitrate in two carbonate aquifers in different climatic regimes was used as an indicator of groundwater contamination from septic tanks; nitrates derived from different sources are isotopically distinguishable. Results of nitrogen-isotope analyses of nitrate in the waters of the Cretaceous Edwards aquifer in Texas, the sole water supply for the city of San Antonio, indicate that the source of the nitrate is naturally-occurring nitrogen compounds in the recharge streams. In contrast, nitrogen isotopes of nitrate in the fresh waters of the Pleistocene Ironshore Formation on Grand Cayman Island, West Indies, indicate that human wastes are the source of the nitrate. Recharge is primarily by streams crossing the fault zone. The delta N-15 of 73 samples of nitrate from Edwards waters ranged from +1.9 to +10 0/00 with an average of +6.2 0/00. This delta N-15 range is within the range of nitrate in surface water in the recharge streams (delta N-15 range = +1 to +8.3 0/00) and within the range of nitrate in surface water from the Colorado River, Texas, (delta N-15 range = +1 to +11 0/00). No sample was found to be enriched in N-15, which would suggest the presence of nitrate from animal waste (delta N-15 range = +10 to +22 0/00). The Edward's thick unsaturated section and the rapid dilution in the very porous aquifer may be preventing any increased concentration of pollutants. The Ironshore Formation contains a small freshwater lens that is recharged entirely by percolation through the soil. The delta N-15 of four nitrate samples from water samples of the Ironshore Formation ranged from +18 to +23.9 0/00, which indicates a cesspool/septic-tank source of the nitrate. Limestone aquifers in humid environments that are recharged by percolation through the soil appear to be more susceptible to contamination by septic tanks than are aquifers in subhumid environments that feature thick unsaturated sections and are recharged by streams. (Collier-IVI)
W85-00023

ESTIMATION OF NONPOINT SOURCE LOADINGS OF PHOSPHORUS FOR LAKES IN THE PUGET SOUND REGION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
R. J. Gilliom.
For Sale by Distr. Br., USGS, 604 S. Pickett St., Alex., Va. 22304. USGS Water Supply Paper 2240, 1983. 24 p, 3 Fig, 7 Tab, 28 Ref.

Descriptors: Lakes, *Eutrophication, Phosphorus modeling, Phosphorus loading, *Mass-balance model *Nutrients, Lake-water quality, Land-use/water-quality relationships, Nonpoint phosphorus loading, *Washington, Puget Sound region, Pacific Northwest.

Control of eutrophication of lakes in watersheds undergoing development is facilitated by estimates of the amounts of phosphorus (P) that reach the lakes from areas under various types of land use. Using a mass-balance model, P-loadings were calculated from present-day P concentrations measured in lake water and from other easily measured physical characteristics in a total of 28 lakes in drainage basins that contain only forest and residential land. The P-loadings from background sources to each of the lakes were estimated by methods developed in a previous study. Differences between estimated present day P-loadings and loadings from background sources were attributed to changes in land use. The mean increase in annual P yield resulting from conversion of forest to residential land use was 7 kilograms per square kilometer, not including septic-tank system contributions. Calculated P-loadings from septic systems varied, and were found to correlate best with the number of lakeshore dwellings around each lake in 1940. The regression equation expressing this relationship explained 36 percent of the sample variance. For lakes in basins that contain agricultural land, the P-loading attributable to agriculture can be calculated as the difference between the estimated total loading and the sum of estimated loadings from all other (nonagricultural) sources. A comprehensive system for evaluating errors in all loading estimates is presented. The empirical relationships developed allow preliminary approximations of the cumulative impact that development has had on P-loading and the amounts of P-loading from generalized land-use categories for Puget Sound lowland lakes. All the estimates are most suitable for use in developing water-quality goals, setting priorities for lake studies, and designing studies of individual lakes. (USGS)
W85-00038

GROUNDWATER: AN INVENTORY OF WELLS AND CONTAMINATION POTENTIAL WITHIN THE SILURIAN AQUIFER OF CALUMET COUNTY,
Fox Valley Water Quality Planning Agency, Menasha, WI.
For primary bibliographic entry see Field 5G.
W85-00055

LONG ISLAND SEGMENT OF THE NATIONWIDE URBAN RUNOFF PROGRAM,
Long Island Regional Planning Board, Hauppauge, NY.
L. E. Koppelman.
December 1982. 134 p, 32 Fig, 75 Tab, 49 Ref, 8 Append.

Descriptors: *Urban runoff, *Recharge basins, *Sediment, *Storm water, *Runoff cycles, *Pollution load, Runoff, Natural recharge, Replenishment, Nonpoint pollution sources, Storm runoff, Urban watersheds, Vegetation effects, *New York, Long Island.

The question of whether the continued use of the Long Island recharge basin, a device for the disposal of runoff and its recharge to groundwater, poses a threat to the quality of the bi-county water supply has caused increasing concern. There was some evidence that the basins were also devices for the concentration of pollutants in runoff and their swift transmission to Long Island's only source of water supply. The results of an investigation into these questions have proved to be largely positive. Coliform and fecal streptococcal bacteria were found in runoff but not in the groundwater beneath the recharge basins. The concentrations of other pollutants, which were generally relatively low in runoff, were even lower in the groundwater beneath the basins. It appears that infiltration through the soil is an effective mechanism for the attenuation of some of the heavy metals and organic compounds. These findings were as true for the unlined basins as for the recharge basin at Centereach, which was built with a plastic lining. It also appears that, contrary to the widely held view, the removal of vegetation from the basin floor is not necessary, and that the vegetation may actually facilitate the infiltration of storm waters. The findings indicate that some control measures are complex, costly and of questionable effectiveness, and that preventative action precluding degradation is preferable. (Garrison-Omniplan)
W85-00058

OCCURRENCE OF ORGANIC COMPOUNDS IN WATER AND STREAM SEDIMENTS DUE TO THE MT. ST. HELENS ERUPTIONS,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
E. Hindin.

Available from the National Technical Information Service, Springfield, VA 22161 as PB8 190446, Price codes: A06 in paper copy, A01 in microfiche. Washington Water Research Center Report 52, October 1983. 91 p, 9 Fig, 42 Tab, 16 Ref, 3 Append. OWRT Project No. C-10108-V (1458)(1), Contract/Grant No. 14-34-0001-1458 (1).

Descriptors: *Organic compounds, Mudflows, Organic carbon, Water quality, Phenols, Volcanic effects, Sediments, *Mount St. Helens, Water pollution sources, Path of pollutants, Pollutant identification, Gas chromatography, *Washington, *Cowlitz River basin.

Surface and groundwater obtained from the Mount St. Helens area fifteen months after the May 18, 1980, eruption were analyzed by gas chromatography for phenol chlorophenols, polycyclic aromatic hydrocarbons, terpenes, and the haloform potential. Groundwaters outside of the mudflow plain of the North and South Forks and main stem of the Toutle River and of the lower Cowlitz River, showed no measureable quantities (less than one nanogram per liter) of the specific compounds under study. However, wells located on the mudflow plain were found to contain measurable concentrations of phenols, chlorophenols, and total dissolved organic carbon. Surface waters contained a multitude of dissolved organics. The nature and magnitude of these organics depended on the location within the affected area. Mudflow deposits were found to contain traces of phenols, while the aged ash did not have detectable amounts of organic material. Continuous leaching column studies of the mudflow deposits revealed a rapid elution of dissolved organic compounds followed by the tailing of the dissolved organic carbon compounds.
W85-00061

DISSOLVED SOLIDS HAZARDS IN THE SOUTH PLATTE BASIN, VOL. II: SALT BALANCE ANALYSIS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
C. D. Turner, and D. W. Hendricks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 190099, Price codes: A07 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute Completion Report No. 129, December 1983. 151 p, 14 Fig, 14 Tab, 8 Ref, 3 Append. OWRT Project No. A-051-COLO (3), Contract/Grant No. 14-34-0001-1106 and 2106.

Descriptors: *Salt balance, *Salinity, Dissolved solids, South Platte, River basin, *Colorado, Salt flows, Salt transport.

The first year of this project assessed the salt flows at five stations of the South Platte River between Henderson and Julesburg, and of the three main tributary streams, the St. Vrain, the Big Thompson, and the Cache la Poudre. The analysis of 15 years of data from 1965-1979 showed that salt is lost from the river between Kersey and Julesburg. The objective of the second year of the project was to explain the negative salt balance in the Kersey-Balzac reach and to understand better the mass flows of salt within the system. Another objective was to develop basic data in preparation for development of a salt balance model involving the major components of the lower South Platte system, the long-range objective. Study of the canal diversions in the Kersey-Balzac reach indicated that the reason for the salt imbalance is due to two major canal diversions. These canals transport salt from the Kersey-Balzac reach to agricultural lands adjacent to the Balzac-Julesburg reach which, as shown in this analysis, are accumulating salts. This is indicated also by the USBR Narrows study which determined that a water deficit exists for these lands. This would corroborate that these lands may be accumulating salts. Given that these lands have potential for good drainage, which is the general assessment of the USBR, the problem should be alleviated by application of sufficient irrigation water, an objective of the Narrows Project.
W85-00063

MEASUREMENTS TO QUANTIFY WASTEWATER FIELDS PRODUCED BY OUTFALL DIFFUSERS,
Michigan State Univ., East Lansing. Dept. of Civil Engineering.
R. B. Wallace, and B. B. Sheff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 190156, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research Completion Report, August, 1984. 28 p, 12 Fig, 1 Tab, 13 Ref, 1 Append. OWRT Project No. A-123-MICH (1), Contract/Grant No. 14-34-0001-2124.

Descriptors: *Diffusion, Coefficient, Outfall sewers, *Plumes, Wastewater disposal, Stratification, *Stratified flow, Dispersion, Effluents, Path of pollutants.

The behavior of two-dimensional plumes rising through an ambient fluid with a density discontinuity was studied. This system is characteristic of the situation where the ambient stratification has a strong thermocline. Dimensional analysis was used to obtain asymptotic equations which describe plume behavior. A dimension-less parameter relating the location and strength of the density discontinuity and the initial buoyancy flux was found to measure the ability of the density discontinuity to stop plumes rise. Experimental measurements showed the range of values of this parameter where density discontinuity is strong or weak and provided unknown constants for the asymptotic equations so that spreading layer thickness, location, and effluent concentration can be predicted. The experimental measurements are compared to estimates made using integral equations and the entrainment concept.
W85-00067

NONPOINT SOURCE LOADING OF TOXIC SUBSTANCES FROM DECOMPOSING CROP RESIDUE,
Maryland Univ., College Park. Dept. of Agronomy.
S. Glenn.
Available from the National Technical Information Service, Springfield, VA 22161, as PB84 190198, Price codes: A02 in paper copy, A01 in microfiche. Maryland Water Resources Research Center Publication No. 76, August, 1983. 14 p, 5 Tab, 14 Ref. OWRT Project No. A-057-MD (1), Contract/Grant No. 14-34-0001-2122.

Descriptors: *Agricultural runoff, Runoff rates, Runoff volume, Cultivation, *Phytotoxicity, Phenols, *Decomposing organic matter, Decomposition, Agricultural watersheds, Maryland, *Path of pollutants, Water pollution sources.

Two adjacent, but separate watersheds were equipped to estimate total volume of runoff water and to collect an integrated water samples. One watershed was planted with corn (Zea mays L.) using no-tillage (NT) management and barley (Hordum vulgare L.) as a cover crop. The other watershed was planted with corn using conventional tillage (CT) management. Runoff water sampled between 1979 and 1983 were analyzed for phenolic acids and phytotoxicity to turnip (Brassica rapa L.). The volume of runoff water was reduced with NT management, but the concentration and total loading to phenolic acids were greater in runoff water from the NT watershed compared to that found in runoff water from the CT watershed. The greatest concentration of phenolic acids were found in runoff water from the NT watershed sampled on 6/18/79 (65.4 ppm, w/v). This sample inhibited radicle growth of turnip 32%. Ferulic acid, caffeic acid, p-hydroxybenzoic acid, o-hydroxyphenylacetic acid, and mandellic acid were isolated and identified from runoff samples.
W85-00075

MERCURY IN SWEDISH LAKES - ITS REGIONAL DISTRIBUTION AND CAUSES,
National Swedish Environment Protection Board, Solna. Water Pollution Research Lab.
I. Bjorklund, H. Borg, and K. Johansson.
Ambio, Vol. 13, No. 2, p 118-121, 1984. 6 Fig, 38 Ref.

Descriptors: *Mercury, *Lakes, *Sweden, *Water pollution sources, Heavy metals, Sediment contamination, Fate of pollutants, Public health, Forest lakes, Air pollution, Pike, Lake acidification.

The general mercury situation in 220 Swedish Lakes is discussed. None of the lakes receives direct discharges of industrial or municipal sewage effluents. The mercury content of pike, Esox lucius L. was markedly elevated in lakes situated in forest areas in southern and central Sweden. The mean values varied between 0.68 and 0.86 mg Hg/kg for these regions. The highest mean values were found in two areas with major mercury emissions to the air. The natural background level of mercury in fish had been estimated to be 0.05-0.2 mg/kg, but values close to this level were found only in the northern part of Sweden. The generally high mercury content of fish in southern and central Sweden may be caused by an elevated load on the lakes from increased airborne deposition. Analyses of lake sediments indicated mercury concentrations five times higher than the natural load expected in non-polluted areas. This increase seems to have started during the 19th century, though the highest increase has taken place in the 20th century. The advancing acidification of the waters causes an additional increase of the mercury content of fish. It is estimated that the total number of Swedish lakes in which the mercury content in fish exceeds 1 mg/kg is very large, in all probability several thousand. Restrictions on emissions of both mercury and acidifying substances may be effective in reducing the mercury content of fish in the lakes. (Baker-IVI)
W85-00087

INFLUENCE OF SPATIAL AND TEMPORAL VARIATIONS ON ORGANIC POLLUTANT BIODEGRADATION RATES IN AN ESTUARINE ENVIRONMENT,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
G. W. Bartholomew, and F. K. Pfaender.
Applied and Environmental Microbiology, Vol. 45, No. 1, p 103-109, January, 1983. 3 Fig, 3 Tab, 16 Ref.

Descriptors: *Estuarine environment, *Biodegradation, *Water pollution effects, *Temporal distribution, *Spatial distribution, Newport River Estuary, Microorganisms, Cresol, Trichlorobenzene, Chlorobenzene, Nitrilotriacetic acid.

The heterotrophic uptake method of biodegradation assessment was used to evaluate the influence of spatial and temporal variations on pollutant metabolism by natural microbial communities in the Newport River Estuary, located near Morehead City, North Carolina. Three sites were used for the study, representing the gradient from freshwater to estuarine to marine systems. Radiolabeled compounds used as substrates for biodegradation assessments included cresol, chlorobenzene, nitrilotriacetic acid, and 1,2,4-trichlorobenzene. In general the freshwater site demonstrated the highest uptake rates, with somewhat lower rates at the estuarine site. Rates at the marine site were much lower than at the other sites, except during the winter. Metabolic rates at both the freshwater and estuarine areas were significantly decreased during periods of low water temperature. Rates at the marine sites were relatively uniform throughout the year. Linear regression analysis was used to compare m-cresol biodegradation rates to characteristics of the microbial community, which included direct microscopic counts, CFU counts, and cellular incorporation of amino acids. The observed rates did not consistently correlate well with any of the measured characteristics of the microbial community. Findings indicate that for the compounds used, direct measurements of biodegradation rates are needed if the inherent variability of the environment is to be reflected in assessments of pollutant breakdown. (Baker-IVI)
W85-00097

ACCUMULATION OF SEDIMENT-ASSOCIATED VIRUSES IN SHELLFISH,

Brookhaven National Lab., Upton, NY. Dept. of Energy and Environment.
E. F. Landry, J. M. Vaughn, T. J. Vicale, and R. Mann.
Applied and Environmental Microbiology, Vol. 45, No. 1, p 238-247, January, 1983. 1 Fig, 5 Tab, 20 Ref.

Descriptors: *Viruses, *Sediments, *Shellfish, Clams, Oysters, Poliovirus, Bioaccumulation, Biological magnification, Human diseases, Public health.

Epifaunal (Crassostrea virginica) and infaunal (Mercenaria mercenaria) shellfish, placed on or in cores, were exposed to either resuspended or undisturbed sediments containing bound poliovirus type 1 (LSc 2ab). Consistent bioaccumulation by oysters was noted only when sediment bound viruses occurred in the water column. Virus accumulation was noted in only one instance where sediments remained in an undisturbed state. While the incidence of bioaccumulation was therefore higher with resuspended rather than undisturbed contaminated sediment, the actual concentration of accumulated viruses was not significantly different. In the first study with clams, they were placed on inoculated cores containing a total of 5980 PFU where they failed to completely burrow into the sediments, leaving their siphons with little proximity to the sediments, being some 6 to 8 cm above the sediment surface. Even so, when pools of four clams were analyzed they contained viruses in average concentrations of 1.60 PFU/50 g. Clams residing in two other inoculated cores failed to accumulate any viruses. In a second trial the clams were pushed to the desired depth before virus seeding. After an equilibration period, during which they resumed their normal pumping activities, cores were agitated causing the clams to retract their siphons, and then challenged with virus-seeded sediments. Assay of pooled homogenates again indicated the presence of poliovirus in the clams, suggesting that some potential existed for sediment mediated virus uptake. A 10-fold increase in virus uptake was noted over the first trial, and relegated to the availability of higher concentrations of sediment-bound viruses. In a final trial clams were exposed to sediments containing 1,860 PFU/100 g and no viruses were found in any clam extracts, indicating that proximity to virus infected sediments does not guarantee bioaccumulation. (Baker-IVI)
W85-00099

DISTRIBUTION OF PSEUDOMONAS AERUGINOSA IN A RIVERINE ECOSYSTEM,

Wisconsin Univ.-La Crosse. River Studies Center.
S. Pellett, D. V. Bigley, and D. J. Grimes.
Applied and Environmental Microbiology, Vol. 45, No. 1, p 328-332, January, 1983. 3 Tab, 34 Ref.

Descriptors: *Pseudomonas, *Public health, *Mississippi River, Ecosystems, Epibacteria, Human diseases, Sediments, Sediment-water interfaces, Antibiotic sensitivity.

The distribution of Pseudomonas aeruginosa in navigation pool 8 of the upper Mississippi River was studied by acetamide broth enrichment of water, sediment, and swab (solid-water interface) samples. A total of 152 of the 316 samples collected (48.1%) contained P. aeruginosa. Serological type 1 was predominant (34/2%), followed in order by types 4, 2, 7, 3, 5, and 6. An analysis of pyocin typing data was equivocal. It showed that isolates with similar susceptible indicator strains were clustered in certain serological types and that P. aeruginosa strains in pool 8 were not homogeneous. Antibiotic sensitivity testing revealed that only 20 isolates (13.2%) were resistant to carbenicillin and that 1 (0.6%) was resistant to polymyxin B. None was resistant to gentamicin or to bramycin, and none was multiply resistant. Visible pigmentation on Mueller-Hinton agar was limited to 91 of the 152 isolates. Of these, 68 (44.7%) elaborated typical blue-green pigmentation, 14 (9.2%) produced red pigment, and 9 (5/9%) produced a yellow-green pigment. None of the isolates produced pyomelanin, and 61 (40.1%) were nonpigmented. P. aeruginosa was most commonly isolated from sediment, with solid-water interfaces (auf-wuchs samples) also exhibiting high frequencies of isolation. Current velocity, oxygen and nutrient availability, surface tension, dessication, and negative phototropism were important factors in the riverine distribution of this epibacterium. (Baker-IVI)
W85-00100

LEGIONELLA INCIDENCE AND DENSITY IN POTABLE DRINKING WATER SUPPLIES,

Oregon State Univ., Corvallis. Dept. of Microbiology.
D. L. Tison, and R. J. Seidler.
Applied and Environmental Microbiology, Vol. 45, No. 1, p 337-339, January, 1983. 1 Tab, 22 Ref.

Descriptors: *Legionella, *Drinking water, *Water quality, Public health, Human diseases, Water treatment, Chlorination, Filtration, Legionnaires disease, Pontiac fever, Flocculation, Potable water, Raw water, Water temperature.

The incidence and density of Legionella spp. in raw water, water at various stages of treatment, and in potable distribution water were determined by direct immunofluorescence. The four basic states of treatment included water receiving only chlorination and stored in closed reservoirs, water receiving chlorination and stored in open reservoirs, slow sand filtration with chlorination, and water receiving flocculation, mixed media filtration and chlorination. The number of cells reacting with Legionella-specific fluorescent antibody conjugates in raw waters ranged from about 10,000 to 100,000 cells/liter, whereas the concentration of fluorescent antibody-positive cells in the distribution waters were generally 10- to 100-fold lower than in the raw source waters. No viable or virulent Legionella strains were isolated from either the source or distribution waters. However, Legionella spp. are infrequently isolated from water at temperatures below 15 degrees C as was the case in the systems surveyed in this study. The lack of Legionella isolation from the cool water specimens collected during this survey does not preclude occurrences of viable virulent cells in drinking water of higher temperatures. (Baker-IVI)
W85-00101

ADAPTATION OF NATURAL MICROBIAL COMMUNITIES TO DEGRADATION OF XENOBIOTIC COMPOUNDS: EFFECTS OF CONCENTRATION, EXPOSURE TIME, INOCULUM, AND CHEMICAL STRUCTURE,

Environmental Research Lab., Gulf Breeze, FL.
J. C. Spain, and P.A. Van Veld.
Applied and Environmental Microbiology, Vol. 45, No. 2, p 428-435, February, 1983. 7 Fig, 1 Tab, 9 Ref. EPA contract 68-D1-5043.

Descriptors: *Fate of pollutants, *Degradation, *Microbiological studies, *Xenobiotics, Trifluralin, 2,4-Dichlorophenoxyacetic acid, p-Cresol, Mineralization, Estuarine environment, Marine environment, Biodegradation.

Adaptation of microbial communities to faster degradation of xenobiotic compounds after exposure to the compound was studied in ecocores. Radiolabeled test compounds were added to cores that contained natural water and sediment. Adaptation was detected by comparing mineralization rates or disappearance of a parent compound in preexposed and unexposed cores. Microbial communities in preexposed cores from a number of freshwater sampling sites adapted to degrade p-nitrophenol faster; communities from estuarine or marine sites did not show any increase in rates of degradation as a result of preexposure. Adaptation was maximal after 2 weeks and was not detectable after 6 weeks. A threshold concentration of 10 ppb was observed. Below this concentration no adaptation was detected. With concentrations of 20 to 100 ppb the biodegradation rates in preexposed cores were much higher than the rates in control cores and were proportional to the concentration of the test compound. Trifluralin, 2,4-dichlorophenoxyacetic acid, and para-cresol were tested to determine whether preexposure affected subsequent biodegradation. Microbial communities did not adapt to trifluralin. Adaptation to 2,4-dichlorophenoxyacetic acid was similar to adaptation to nitrophenol. p-Cresol was mineralized rapidly in both preexposed and unexposed communities. These results would be useful in predicting the fate of the four test compounds if the compounds were released in the river. Trifluralin would biodegrade slowly and at a relatively constant rate, depending on the concentration. p-Cresol would degrade rapidly and immediately, whereas PNP and 2,4-D would persist during adaptation of the microorganisms and then biodegrade rapidly. For PNP and p-cresol the mineralization rates closely parallel rates of parent compound disappearance. This is probably true in most cases where the initial step is rate limiting in a bioegradation sequence that involves complete mineralization. (Baker-IVI)
W85-00102

BACTERIAL ACTIVITY ASSOCIATED WITH THE DECOMPOSITION OF WOODY SUBSTRATES IN A STREAM SEDIMENT,

Oregon State Univ., Corvallis. Dept. of Microbiology.
J. H. Baker, R. Y. Morita, and N. H. Anderson.
Applied and Environmental Microbiology, Vol. 45, No. 2, p 516-521, February, 1983. 1 Fig, 3 Tab, 23 Ref.

Descriptors: *Decomposing organic matter, *Stream sediments, *Wood, *Bacteria, Bark, Nitrogen fixation, Microflora, Tannins.

Ground bark and heartwood from Alnus rubra and Pseudotsuga menziesii were added to a muddy sediment from a small Oregon stream and incubated in situ. Carbon dioxide and methane production rates were increased by all amendments, the largest increase being shown with A. rubra wood. Except for sediment amended with A. rubra wood, nitrogen fixation rates from all treatments were approximately 0.1 nmol/g per h throughout the 6 month study. Contrary to expectations, neither bark had a noticeable adverse effect on microbial activity, but the A. rubra wood promoted nitrogen fixation. From the combined carbon dioxide and methane evolution rates, A. rubra wood appeared to decay at four times the rate of A. rubra bark, P. menziesii wood, and P. menziesii bark. The hypothesis that the slower decomposition of cetain woods is due to the presence of inhibitory substances is not support by these findings. Faster decomposition of A. rubra wood may be related to enhanced N fixation, and tannins in P. menziesii bark were ineffectual. (Baker-IVI)
W85-00105

ESTIMATED POLLUTION LOADINGS FROM NORWEGIAN FISH FARMS. I. INVESTIGATIONS 1978-1979,

Direktoratet for Jakt, Viltstell og Ferskvannsfiske, Aas (Norway).
A. Bergheim, A. Sivertsen, and A. R. Selmer-Olsen.
Aquaculture, Vol. 28, No. 3/4, p 347-361, July, 1982. 2 Fig, 8 Tab, 15 Ref.

Descriptors: *Fish farming, *Water pollution sources, *Norway, Nutrients, Organic matter, Suspended solids, Decomposition, Carbon dioxide, Respiration, Oxygen, Nitrogen, Phosphorus, Sodium, Potassium, Magnesium, Calcium.

Water pollution was studied at four inland fish farms in the southeastern part of Norway which produced fingerlings of brown trout and rainbow trout. Concentrations of organic matter, suspended solids and nutrients increased when water passed through the fish tanks and ponds. The loadings per unit fish biomass varied considerably, mainly as a result of different operational conditions with regard to fish size, feeding routine, water flow and cleaning procedure. The single farm represented a loading corresponding to 30-1260 population equivalents. Production of carbon dioxide due to respiration and decomposing processes may cause decreased pH in fish ponds and tanks. Reductions of 0.1 to 0.4 pH units were registered. Conductivity was little affected under routine conditions. The lowered concentration of dissolved oxygen at one farm was probably a result of respiration of fish

and increasing water temperature. The biochemical oxidation course of effluent from fish farms using dry feed is not unlike that of sewage. Concentrations of organic components in the effluent are closely associated with feeding and cleaning operations. Suspended solids, total N, total P and phosphate-P were also markedly influenced at the farms investigated and the concentrations altered with organic matter. Increased concentrations of total N were noted when water passed through fish farms and was caused by contributions of organic N and ammonia. Concentrations of major cations Na, K, Mg, and Ca were realistic in comparison with the feed supply. Calculations of daily loading indicated considerable pollution potentials due to farming activities. (Baker-IVI)
W85-00114

DISSOLVED SOLIDS HAZARDS IN THE SOUTH PLATTE BASIN, VOL. I: SALT TRANSPORT IN THE RIVER,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. V. Gomez-Ferrer, and D. W. Hendricks.
Colorado Water Resources Research Institute Completion Report No. 128, December 1983. 186 p, 59 Fig, 25 Tab, 41 Ref, 7 Append. OWRT Project No. A-051-COLO (2), Contract/Grant No. 14-34-0001-1106 and 2106.

Descriptors: *Salt balance, *Salinity, *Salt transport, South Platte, River basin, *Colorado, Dissolved solids, Salt flow, Return flows.

This work demonstrates how river salinity may be characterized, in terms of both time and space variations. Fifteen years of daily and monthly salinity and flow data have been reduced to monthly, seasonal, and annual statistical characterizations for five river stations and three tributary stations for the lower South Platte River. From these characterizations distance profiles were plotted for flow, TDS, and salt mass flows. The distance profiles and measurements of diversion flows, tributary flows, and point source discharges were the basis for a reach-by-reach materials-balance analysis for four reaches of the South Platte River between Henderson and Julesburg. Return flows and return salt mass flows were computed as residuals. The analysis showed that there is not a salt balance in the lower South Platter River. A net salt loss to the land of 380 tons per day occurs by irrigation. The analysis provided can be the basis for a more comprehensive materials balance model. But the results can be used to estimate the impact of new water resources developments upon the salinity regime of the lower South Platte River.
W85-00115

INFLUENCE OF SEDIMENT TYPES ON THE SORPTION OF ENDOTHALL,
North Texas State Univ., Denton. Inst. of Applied Sciences.
For primary bibliographic entry see Field 4A.
W85-00133

DEPOSITION OF FINE AND COARSE SAND IN AN OPEN-WORK GRAVEL BED,
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 2J.
W85-00148

GEOCHEMICAL PATHWAYS AND BIOLOGICAL UPTAKE OF RADIUM IN SMALL CANADIAN SHIELD LAKES,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
R. H. Hesslein, and E. Slavicek.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 3, p 459-468, March, 1984. 4 Fig, 8 Tab, 32 Ref.

Descriptors: *Experimental Lakes Area, *Ontario, *Radium, *Geochemistry, *Bioaccumulation, Calcium, Discrimination factors, Macrophytes, Crayfish, Fish, Sediment contamination, Trout, Sucker, Whitefish, Minnows, Dace, Shield lakes.

Ra-236 occurs naturally in aquatic systems at low concentrations. Its behavior is of concern because of its high radiotoxicity, 1600 yr half-life, and its potential release from uranium mining and nuclear waste materials. The sediment-water interactions and biological uptake of Ra-226 in four small Canadian Shield lakes at the Experimental Lakes Area, Kenora, Ontario were studied. A single addition of Ra-226 was made to each lake between 1970 and 1976. Approximately 90% of the added Ra-226 initially sorbed to the sediments. Outflow from the lakes showed losses of only 5-11% Ra-226 per year. Long-term loss of Ra-226 can be expected to be on the order of 0.5-2% per year as predicted by a water renewal model. Biological uptake and long-term Ra-226 concentrations were measured in three species of macrophytes, crayfish, and five species of fish. Bioaccumulation ranged from 1100 to 5000 in macrophytes, 750 in crayfish, from 30 to 80 in large adult lake trout (Salvelinus namaycush), white sucker (Catostomus commersoni), and lake whitefish (Coregonus clupeaformis), and from 230 to 1200 in fathead minnows (Pimephales promelas), pearl dace (Semotilus margarita), and northern redbelly dace (Chrosomus eos). Observed Ratio (OR) discrimination factors, (Ra/Ca-sample)/(Ra/Ca-water), in fish fell between 0.011 and 0.032, with the exception of higher values for two dace species and fathead minnows which have higher dietary Ra intake. Ra-236 is favored versus calcium by macrophytes and crayfish. Due to the low Ca concentration in Canadian Shield lakes, and relatively long water residence times, biota have a high potential for radium uptake from mining of uranium deposits that are common in the formation. (Collier-IVI)
W85-00153

FATE OF KEPONE AND MIREX IN THE AQUATIC ENVIRONMENT,
Columbia National Fisheries Research Lab., MO.
J. N. Huckins, D. L. Stalling, J. D. Petty, D. R. Buckler, and B. T. Johnson.
Journal of Agricultural and Food Chemistry, Vol. 30, No. 6, p 1020-1027, November-December, 1982. 8 Fig, 2 Tab, 21 Ref.

Descriptors: *Kepone, *Mirex, *Sediment contamination, *Bioaccumulation, Tissue analysis, Soil bacteria, Minnows, Degradation products, Biodegradation, Pesticide residues, Flame retardants, Little Dixie Reservoir, James River, Missouri, Virginia.

The discovery of Kepone as a degradation product of mirex in the environment has prompted concern about the widespread use of mirex as a flame retardant and pesticide. Fathead minnows were continuously exposed to three concentrations of C-14 Kepone (4, 41, and 380 ng/L) and C-14 mirex (0.04, 3.8, and 33 micro g/L) in flow-through dilutor systems and then placed in fresh water for elimination phases. After 56 days C-14 Kepone residues were concentrated 16,600 times by fathead minnows. However, only 1-5% or 0.1-0.23 micro g/g of these residues was C-14 Kepone. Several observations suggested that some C-14 Kepone residues present in fathead minnows were chemically bound to biogenic compounds. Similar exposures of fathead minnows to C-14 mirex resulted in bioconcentration factors as high as 51,400 times. The half-life of C-14 mirex was greater than 28 days in fathead minnows, and no degradation products were detected in whole body samples; concentration factors of C-14 mirex from water varied inversely with mirex water concentration. Hydrosoil samples were obtained from two Kepone contaminated sources: the Little Dixie Reservoir, Columbia, MO, and a tributary of the James River in VA (Bailey Creek). Environmental Kepone residues determined by electron capture gas chromatography averaged 0.38 and 0.54 micro g/g (dry weight) respectively. No evidence of C-14 Kepone or C-14 mirex degradation by hydrosoil microorganisms was observed in anaerobic and aerobic hydrosoil exposures. (Collier-IVI)
W85-00160

DEGRADATION OF NICLOSAMIDE (2',5-DICHLORO-4'-NITROSALICYLANILIDE) IN SEDIMENT AND WATER SYSTEMS,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. C. G. Muir, and A. L. Yarechewski.
Journal of Agricultural and Food Chemistry, Vol. 30, No. 6, p 1028-1032, November-December, 1982. 2 Fig, 5 Tab, 11 Ref.

Descriptors: *Niclosamide, *Bayluscide, *Sorption, *Degradation, *Fate of pollutants, Adsorption, Sediment-water systems, Molluscicides, Piscicides, Pesticides, Persistence.

Niclosamide (2',5-dichloro-4'-nitrosalicylanilide) formulated as its ethanolamine salt (Bayluscide) has been used in the Great Lakes for the control of the sea lamprey (Petromyzon marinus), and in tropical regions for control of freshwater snails. C-14 niclosamide degraded rapidly in river and pond sediments (water to sediment ratio 10-20:1) incubated under aerobic and anaerobic conditions over a 128-day period (25 degrees C); half-lives ranged from 1.1 to 3.9 days. Degradation in autoclaved samples occured at a very slow rate, suggesting microbial dependent degradation. The major degradation product was aminoniclosamide (2',5-chloro-4'-aminosalicylanilide), which represented more than 50% of the radioactivity extractable from sediments. Greater amounts of aminoniclosamide were formed under anaerobic conditions (redox potential < 350 mV) than in aerobic systems. A hydrolysis product of niclosamide, 2-chloro-4-nitroaniline, was also detected but 5-chlorosalicylic acid was not detected in sediment or water extracts. Studies on the adsorption of niclosamide to five different sediments gave an average sediment sorption coefficient (Koc) of 3111 + or - 1552. Only 0.3 to 1.7% of the sorbed radioactivity could be desorbed by shaking with water for 24 h. Due to the rapid degradation of niclosamide in sediment-water systems, the sorption that was measured represented the sum of niclosamide and aminoniclosamide adsorption. Sorption of niclosamide or aminoniclosamide is unlikely to play a dominant role in the environmental fate of niclosamide under field conditons. (Collier-IVI)
W85-00161

BEHAVIOR AND DEGRADATION OF CHLORPYRIFOS-METHYL IN TWO AQUATIC MODELS,
Forest Pest Management Inst., Sault Sainte Marie (Ontario).
S. Y. Szeto, and K. M. S. Sundaram.
Journal of Agricultural and Food Chemistry, Vol. 30, No. 6, p 1032-1035, November-December, 1982. 4 Tab, 12 Ref.

Descriptors: *Chloropyrifos-methyl, *Fate of pollutants, *Degradation, Sorption, Sediment-water studies, Pesticide residues, Pesticide kinetics, Persistence.

At 15 degrees C, the movement, persistence, and degradation of 400 ppb of chlorpyrifos-methyl in the top 1.5-cm layer of flooded sandy loam soil (model I) and the behavior and degradation of 200 ppb of this chemical in natural water (model II) were investigated for a period of 90 days. In model I chlorpyrifos-methyl was strongly adsorbed on the flooded soil; very little was desorbed and then dissolved in the water. The maximum concentration in the water was 1 ppb, detected after 0.7 day (16.5 h) of incubation. Chlorpyrifos-methyl degradated readily in the flooded soil. The toxic breakdown product was 3,5,6-trichloro-2-pyridinol, which reached a maximum concentration in about 27 days and declined thereafter. The pyridinol was never detected in the water. Both compounds had almost completely disappeared in 90 days. In model II chlorpyrifos-methyl moved rapidly from the water to the flooded clean soil. After incubation for 13 days, its concentration increased from nondetectable to a maximum of 560 ppb in the top 1.5-cm layer of the soil but decreased from 200 to 40 ppb in the water. Both the parent compound and its breakdown product were degraded readily in soil and water; only 0.1 and 10 ppb remained in the water and in the flooded soil, respectively, after incubation for 83 days. (Author's abstract)
W85-00162

ANALYSIS OF TRACE HALOCARBONS IN NATURAL WATERS BY SIMPLIFIED PURGE AND CRYOTRAP METHOD,
nternational Science Consultants, Ringwood England).
For primary bibliographic entry see Field 5A.
W85-00168

TEMPORAL MOMENTS AT LARGE DISTANCES DOWNSTREAM OF CONTAMINANT RELEASE IN RIVERS,
Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
. Smith.
ournal of Fluid Mechanics, Vol. 140, p 153-174, Iarch, 1984. 10 Fig, 18 Ref, 2 Append.

Descriptors: *Path of pollutants, *Temporal moents, *River flow, Temporal distribution, Water ollution control, Discharge siting, Moment equaons, Advection, Diffusion, Wastewater disposal, Iathematical equations.

emporal moments provide a tractable alternative spatial moments for the theoretical study of ntaminant dispersion in rivers, even when the ow is longitudinally non-uniform. Exact analytil results are derived for the time-of-arrival, temral variance and skewness far downstream of a dden contaminant release. When the channel ries markedly, there can exist optimal discharge es which are better than all nearby sites upeam, downstream, or across the flow; it is only a substantial upstream relocation of the disarge that the peak concentration level at the onitoring position can be further improved. The vection-diffusion equation is taken to have a m which neglects longitudinal diffusion and erages out the vertical structure. The asymptotic ue of the dosage depends only on the volume of ntaminant and the river flow rate, so is indedent of either the discharge profile or the disrge location. It is only by reducing the volume contaminant released into the flow that the ages experienced far downstream can be ameated. The lowest pollution levels can be expectwhen the monitoring (or freshwater extraction) es place near the bank, even compared with s slightly downstream. The optimal discharge can be regarded as taking as much advantage possible of the downstream region along the llow bank of low velocity and high shear in ch the shear-dispersion process is most effit. The determination of an optimal site for the raction of water from the river may take advane of the protection afforded by the efficient tion along an upstream region of shallow er. There is no worst position for water extrac-, nor for discharge; for each cross-section, e is a constrained worst position, but there is rovement if downstream displacement is pered. (Collier-IVI)
5-00174

TRIBUTION OF 137-CS IN SURFACE INTIDAL SEDIMENTS FROM THE SOLWAY TH,
ine Research and Training Center, Piran goslavia).
. Jones, J. M. Miller, and P. D. Roberts.
ine Pollution Bulletin, Vol. 15, No. 5, p 187-1984. 7 Fig, 30 Ref.

criptors: *Radioactive wastes, *Cesium radioopes, *Solway Firth, *Sediment contamination, tland, *England, Fuel reprocessing, Estuarine ronment, Water pollution sources, Intertidal .

distribution of 137-Cs from the Sellafield dscale) nuclear fuel reprocessing plant has examined in detail in the surface intertidal ents of the inner Solway Firth by means of a rcraft-borne radiometric survey. This survey e used to identify areas for further in depth tigation based on sampling. Results from the Solway Firth show the 137-Cs content of the ents to be generally in the range of 2-30 pCi/ ith values locally exceeding 50 pCi/g. The st activities are usually associated with fined mud flat and salt marsh sediments, most widely developed in sheltered coastal embayments. Levels of 137-Cs in inner Solway sediments reflect the falloff of radionuclide content with distance from Sellafield, over 100 pCi/g having been recorded in the outer Solway while intertidal muds from the Ravenglass estuary, about 10 km south of Sellafield, have yielded in excess of 500 pCi/g. (Baker-IVI)
W85-00201

HEAVY METALS IN BOTTOM SEDIMENTS FROM THE SAW MILL RIVER, WEST CHESTER COUNTY, NEW YORK, 1981,
Geological Survey, Albany, NY.
R. J. Rogers.
Northeastern Environmental Science, Vol. 2, No. 3/4, p 188-197, 1983. 3 Fig, 4 Tab, 9 Ref.

Descriptors: *Bottom sediments, *Heavy metals, *Saw Mill River, *West Chester County, *New York, Grain size, Spatial distribution, Fate of pollutants, Copper, Iron, Zinc, Water pollution sources, Industrial wastes.

Bottom sediments were collected at 20 sites between February and September 1981 to assess the concentration and distribution of heavy metals in the Saw Mill River, which drains a largely urban and industrial area adjacent to New York City. Bottom sediments from six sites were separated into six size fractions to determine the relationship between grain size and metal concentration. Concentrations of seven or more acid-soluble heavy metals were determined in each fraction. Metal concentrations were typically greatest in the less than 63-micrometers (micro m) sediment and decreased with increasing grain size. However, metal concentrations in 1,000- to 2,000-micro m sediment were, in general, higher than in the 250- to 500-micro m and 500- to 1,000-micro m sediment. The 1,000- to 2,000-micro m sediment fraction was selected to study the spatial variation in heavy-metal concentrations because this fraction is least subject to transport and, therefore, a better indicator of source areas. Bottom sediments in the lower 3.0 miles of the river were enriched with copper, lead, and zinc compared to upstream sediments and are considered contaminated. No significant enrichment with iron or manganese was detected. Significant correlations were found between copper and iron, zinc and iron, and copper and zinc in upstream sediments but not in sediments below river mile 3.7, which suggests that the sources of metals in the upstream part of the basin differ from those downstream. Concentrations of arsenic, cadmium, chromium, cobalt, mercury, and nickel were, in general, at or below the analytical detection limits in the size fraction studied and therefore could not be evaluated. The sediments enriched with copper, lead, and zinc are in the most heavily industrialized part of the basin. (Author's abstract)
W85-00206

SPATIAL VARIATIONS IN PRECIPITATION CHEMISTRY OVER NATAL, SOUTH AFRICA,
Hereford Sixth Form Coll. (England).
A. L. Murgatroyd.
South African Journal of Science, Vol. 79, No. 10, p 408-410, October, 1983. 3 Fig, 1 Tab, 29 Ref.

Descriptors: *Precipitation chemistry, *Spatial variation, *South Africa, *Natal, Sodium, Manganese, Calcium, Potassium, Chorides, Specific conductivity.

Daily samples of precipitation were collected at five locations in Natal over a six month period during the rainy season from October 1979 to March 1980. Two of the localities, the Mouth Edgecombe Sugar Research Station near Durban and the University of Zululand near Empangeni are both about 5 km air distance from the coast. The Cedara Agricultural College near Pietermaritzburg is in central Natal, 80 km from the coast. The remaining two localities are furthest from the coast in western Natal. The Ntabamhlope Agricultural Research Station is near Eastcourt at 160 km from the coast and the Cathedral Peak Forest Research Station is at the foot of the Drakensberg Escarpment 200 km from the coast. A total of more than 200 samples from the five sites were collected during the summer. Results show a marked decline in the total solute concentration of precipitation away from the coast. No significant difference between the mean specific conductance of precipitation at Mt. Edgecombe and that at Zululand University was noted even though the two stations are 120 km apart and have very different site conditions. All five of the ions tested (Na, Mg, Ca, K and Cl) declined in concentration away from the coast, but the rate of decline varied in each case. Calcium and potassium increased in relative importance to sodium, chloride, and magnesium away from the coast. On a broad regional scale, distance from the coast appears to be the principal factor determining spatial variations in precipitation chemistry. (Baker-IVI)
W85-00213

COMPARISON OF WATER AND DILUTE ACID TREATMENT ON ORGANIC AND INORGANIC CHEMISTRY OF LEACHATE FROM ORGANIC-RICH HORIZONS OF AN ACID FOREST SOIL,
Connecticut Agricultural Experiment Station, New Haven. Dept. of Soil and Water.
E. C. Krug, and P. J. Isaacson.
Soil Science, Vol. 137, No. 5, p 370-378, May, 1984. 2 Fig, 4 Tab, 38 Ref.

Descriptors: *Acid rain, *Leaching, *Forest soils, *Acidic soils, Hydrogen ion concentration, Organic matter, Calcium, Magnesium, Aluminum, Soil horizons, Water pollution sources.

Most watersheds considered highly sensitive to acidification by acid rain have high proportions of extremely acid, organic-rich lithic soils and peats. The organic and inorganic chemistry of leachate produced by treating organic-rich horizons of an acid forest soil with distilled-deionized water or with water acidified to pH 3 with H_2SO_4 was studied. Each soil horizon imparted considerable free and total acidity to the distilled-deionized water through the solubilization of organic matter; the amount and acidic nature of solubilized organic matter was a function of horizon. The amounts of Ca, Mg, and Al in solution were related to the amount of organic matter solubilized. After extensive leaching, material from the Oi horizon was allowed to equilibrate with water, which resulted in considerable further solubilization of organic matter and inorganic constituents and acidification of solution. Leaching with pH 3 H_2SO_4 produced complex changes in both the organic and inorganic composition of leachate. The amount of Al solubilized was related to soluble organic matter, depending upon the horizon leached. Although it is generally considered that soil organic matter buffers against strong acid additions only by exchange of bases and aluminum for H(+), a number of other mechanisms related to the solubilization of soil organic matter also act to consume H(+). The understanding of the effects of acid precipitation on shallow, organic-rich soils requires analyses of changes in the chemistry of soluble organic components. (Moore-IVI)
W85-00219

INFLUENCE OF URBAN RUNOFF ON THE WATER POLLUTION OF THE VISTULA IN THE REGION OF CRACOW AGGLOMERATION,
Instytut Ksztaltowania Srodowiska, Krakow (Poland).
I. Skoczen.
Acta Hydrobiologica, Vol. 23, No. 3, p 195-210, 1981. 3 Fig, 5 Tab, 13 Ref.

Descriptors: *Vistula, *Krakow, *Poland, *Urban runoff, *Water pollution sources, Urban areas, Biochemical oxygen demand, Precipitation, Pollution load, Rainfall runoff.

The Vistula in the Krakow area has an unacceptable level of pollution. Investigations on the influence of urban runoff on the Vistula in the Krakow urban area (agglomeration) were carried out from 1971 to 1976 in 69.1 km of the river course. The BOD5 index was adopted as the basis for the investigation. About 1500 BOD5 determinations

were made during the six years of the investigation. The annual set of concentrations and loads is not homogenous and does not exhibit a normal distribution. The results obtained during a year were arranged into sets according to meteorological and hydrobiological criteria. A statistical analysis of the set for dry periods showed that the results are homogenous and exhibit a normal distribution; sets of loads for precipitation periods do not exhibit a normal distribution. The lowest pollutant load (about 7 thousand tons/year) was found in 1973, a year with low total precipitation. The highest pollutant loads (about 19 thousand tons/year and 17 thousand tons/year) were found in 1974 and 1975, years with high total precipitation. Runoff pollution constituted from 30 to 50% of the total pollution of the Vistula. (Moore-IVI)
W85-00222

HEAVY METALS IN THE AQUATIC ENVIRONMENT OF SOME WATER BODIES OF THE LUBLIN COAL BASIN,
Akademia Rolnicza, Lublin (Poland). Dept. of General Chemistry and Agricultural Technology.
M. Bubicz, L. Kozak, M. Mikos, and Z. Warda.
Acta Hydrobiologica, Vol. 24, No. 2, p 125-138, 1982. 6 Tab, 20 Ref.

Descriptors: *Heavy metals, *Water analysis, *Sediments, *Plants, *Poland, *Lublin Coal Basin, Water pollution effects, Mercury, Cadmium, Lead, Copper, Cobalt, Manganese, Iron, Nickel, Wieprz River, Thysmienica River, Municipal Lake.

The content of Hg, Pb, Cd, Ni, Co, Cu, Zn, Mn, and Fe in water, bottom sediments, and aquatic plants was determined. The samples of water taken from the rivers Wieprz and Tysmienica and the Municipal Lake contained Hg, Pb, Ni, Co, and Fe in amounts corresponding to concentrations admissible for waters of the purity class I, while the concentration of Cd, Cu and Zn corresponded with values admissible for water of the purity class II. The concentration of the investigated heavy metals in bottom sediments was positively correlated with the content of organic matter. The content of heavy metal implants was highly variable and depended both upon the environment and the species. Some aquatic plants are capable of highly selective accumulation of heavy metals, chiefly of Mn, Fe and Zn. These plants can serve to help clean waters which are polluted with heavy metals and can also be regarded as natural regulators of the concentration of these metals in the aquatic environment. Of the elements determined in plants, only mercury and cadmium were positively correlated with the concentration in water and bottom sediments. (Baker-IVI)
W85-00232

SHORT STUDY OF THE INFLUENCE OF A VALLEY ON THE COMPOSITION OF RAINWATER,
Central Electricity Generating Board, Ratcliffe-on-Soar (England). Scientific Services Dept.
A. Martin.
Atmospheric Environment, Vol. 16, No. 4, p 785-793, 1982. 6 Fig, 2 Tab, 15 Ref.

Descriptors: *Wales, *Rain, *Valleys, *Hills, Air pollution, Water pollution sources, Nitrates, Sulfates, Sodium, Hydrogen ion concentration, Ammonia, Topography.

Rainwaters have been sampled weekly for 78 weeks at 6 sites near the sea in mid-Wales, 3 in valley bottoms, 3 on adjacent hilltops. The results were examined for any significant elevational effects and also compared with similar results from a site on the flat east coast of England. Statistically significant evidence was found of regularly increased sea-salt deposition on the hilltops relative to the open ends of the valleys and of spasmodic increased acid deposition in a deep valley bottom relative to a hilltop. On average, 30% less sodium ion was deposited in rain at the open ends of the two valleys compared with the hilltops. It is consistent with the concept of a layer of air carrying sea-salt aerosols lifting from the sea surface to cross the mountains, in contact with the hilltops. On average, 15% more hydrogen ion was deposited in a deep narrow valley than on the adjacent hillside, 250 m above and 600 m away. In seven of the 13 weeks in which this occurred most clearly, the excess hydrogen ion was accompanied by its equivalent of sulfate ion, and in two weeks by its equivalent of nitrate ion. This is consistent with the concept of air rich in sulfur and nitrogen compounds being held below the valley tops until washed out by rain. In the remaining four weeks, there was excess ammonia in the hilltop samples, which reduced the rainwater acidity there but not in the deep valley bottom. Concentrations of ions in rainwater were low in mid-Wales compared with eastern England but the larger rainfall amounts in Wales led to a greater deposition of ions there. (Moore-IVI)
W85-00238

FACTORS INFLUENCING TRACE METAL, SULFATE AND HYDROGEN ION CONCENTRATIONS IN RAIN,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 2K.
W85-00241

ATMOSPHERIC TRACE METALS IN THE SNOW LAYERS DEPOSITED AT THE SOUTH POLE FROM 1928 TO 1977,
Laboratoire de Glaciologie et Geophysique de l'Environnement, Grenoble (France).
For primary bibliographic entry see Field 2K.
W85-00244

ACIDITY OF RAIN IN EUROPE,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
For primary bibliographic entry see Field 2K.
W85-00245

ANALYSIS OF THE CHEMICAL PROPERTIES OF RAIN IN MINNESOTA,
Minnesota Univ., St. Paul. Dept. of Plant Pathology.
For primary bibliographic entry see Field 2K.
W85-00246

INVESTIGATION OF ACID PRECIPITATION IN QINGHAI PROVINCE, CHINA,
East-West Environment and Policy Inst., Honolulu, HI.
J. Harte.
Atmospheric Environment, Vol. 17, No. 2, p 403-408, 1983. 1 Fig, 2 Tab, 15 Ref.

Descriptors: *Acid precipitation, *China, *Qinghai Province, *Amne Machin Mountains, Urban areas, Hydrogen ion concentrations, Coal combustion, Nitrates, Sulfates, Air pollution, Calcium.

Precipitation and surface water samples from the Tibetan Plateau in Qinghai Province, China, were collected in June 1981, in both small cities with intensive coal burning and highly visible air degradation and in the remote and sparsely populated Amne Machin Mountains on the eastern Tibetan Plateau. A pH measurement in one urban precipitation sample indicated extremely acidic precipitation, with a pH of 2.25. The major acid in the observed event was nitric acid, despite the fact that coal combustion was the major source of local air pollution. The high nitrogen and low sulfate content (0.82% N and 0.08% S) of coal from this region may account partially for the high nitrate-to-sulfate ratio in the precipitation in Machin. In the remote Amne Machin mountains, precipitation pH's did not vary significantly from a value of approximately 6, but levels of calcium, nitrate and sulfate were unexpectedly high. They could have arisen for any of several possible sources, including local dust, pollution from Machin and Xining, pollution from eastern China's industrial and populated areas, and very long distance transport of pollutants from other countries. In all samples for which major anions were measured, including the very acidic urban sample, nitrate concentrations exceeded sulfate concentrations by a wide margin, despite the dominance of coal burning in the region. (Moore-IVI)
W85-00247

INFLUENCE OF HYDROLOGIC CONDITIONS AND SUCCESSIONAL STATE ON DISSOLVED ORGANIC CARBON EXPORT FROM FORESTED WATERSHEDS,
Georgia Univ., Athens. Inst. of Ecology.
C. M. Tate, and J. L. Meyer.
Ecology, Vol. 64, No. 1, p 25-32, February, 1983. 4 Fig, 4 Tab, 25 Ref. NSF grants 79-04537 and 80-12093.

Descriptors: *Organic carbon, *Succession, *Forest watersheds, Runoff, Dissolved solids, Pine, Hardwoods, Watershed hydrology, Nutrient export, Forest management.

Concentration and export of dissolved organic carbon (DOC) were compared in streams draining four southern Appalachian watersheds with different treatment histories in 1969-1970 and again in 1979-1980. In 1969-1970 the watersheds were: old field (1 yr old), hardwood coppice (7 yr old), white pine (13 yr old), and mature hardwood (undisturbed for at least 45 yr). DOC concentrations in 1969-1970 were three to four times greater than in 1979-1980 on all watersheds, and the differences among watersheds were consistent both years: old field > hardwood > pine > coppice. Concentrations were always greater during the growing season. Annual runoff was 50% greater in 1979-1980, and annual DOC export in 1979-1980 was half the 1969-1970 value in all watersheds. Annual export was greatest from the hardwood and old field watersheds and least from the pine and coppice watersheds during both years. Although there appears to be a trend toward decreasing DOC concentration and export over the first two decades of secondary succession, differences caused by periodic variations in runoff are far more significant than any successional changes observed. (Author's abstract)
W85-00254

EFFECTS OF WATERSHED DISTURBANCE ON DISSOLVED ORGANIC CARBON DYNAMICS OF A STREAM,
Georgia Univ., Athens. Inst. of Ecology.
J. L. Meyer, and C. M. Tate.
Ecology, Vol. 64, No. 1, p 33-44, February, 1983. 3 Fig, 3 Tab, 42 Ref. NSF grants 79-04537 and 80-12093.

Descriptors: *Clear-cutting, *Forest watersheds, *Organic carbon, *North Carolina, Forest management, Streams, Ecosystems, Dissolved solids, Baseflow, Throughfall, Leaching, Storm seepage, Storm water.

The response of a stream ecosystem to disturbance in its watershed was investigated by comparing mass balances of dissolved organic carbon (DOC) for a stream draining an undisturbed watershed with a stream draining a watershed that was clear-cut 2 yr before the study began. These second-order streams are in the Coweeta Hydrologic Laboratory, North Carolina. Both streams had similar elevated DOC concentrations (from < 1 to 5 mg/L) during storms. Rising and falling limbs of the hydrograph also had similar DOC concentrations. During the growing season DOC concentration increased from headwater seep to the weir in the undisturbed stream under baseflow conditions. No significant longitudinal change was observed in the stream draining the clear-cut watershed. Hence concentration was consistently lower in baseflow samples during the growing season in the stream draining the clear-cut watershed. As a result annual DOC export from the clear-cut watershed was less (9.8-11.5 kg/ha) than from the reference watershed (14.6-15.1 kg/ha). The lower DOC export was partly due to reduced DOC input from throughfall and leaching of fresh litter, but most importantly to lower DOC inputs in subsurface water and probably also less in-stream generation of DOC. The rate of recovery of this stream from disturbance is therefore dependent on the rat

at which the terrestrial system recovers. (Author's abstract)
W85-00255

NON-EQUILIBRIUM APPROACH TO MODELING TOXIC METAL SPECIATION IN ACID, AQUATIC SYSTEMS,
Savannah River Ecology Lab., Aiken, SC.
T. D. Fontaine, III.
Ecological Modelling, Vol. 22, No. 1-4, p 85-100, 1983-1984. 2 Fig, 22 Ref.

Descriptors: *Heavy metals, *Mathematical models, *Heavy metals, *Chemical speciation, Simulation, *Acidic water, Acid streams, Acid lakes, Kinetics, Fate of pollutants, Path of pollutants, Cadmium, Mercury, Sorption, Cation exchange.

A general algorithm (NONEQUI) was developed to simulate the kinetics of sorption and cation exchange processes among heavy metals and substrates in acid (pH < 6.5) lake or stream environments. Because the model is formulated in a kinetic framework, both fast and slow (relative to both the time frames of biological metal uptake and adsorption as well as hydrological residence time) metal substrate reactions can be simulated without incurring computational errors due to the assumption of chemical equilibrium at all times. The model is useful in that it predicts temporal and spatial concentrations of both bound and unbound metals. This is particularly important because it is commonly the unbound species of a metal (e.g., a free divalent cation of cadmium, Cd(2+)) that is its most toxic form. The model was developed for predicting the fate and transport of any divalent cation including mercury. Important transformations of mercury were included that other cations do not significantly experience: methylation, demethylation, volatilization, and humic acid reduction of Hg(2+) to Hg(0). The latter reaction has potential for significantly affecting the fate, transport, and effects of heavy metals in waters of the southeastern U.S. (Author's abstract)
W85-00258

APPLICATION OF RISK AND UNCERTAINTY ANALYSIS TECHNIQUES TO A HEAVY METAL SPECIATION MODEL,
Savannah River Ecology Lab., Aiken, SC.
T. D. Fontaine, III.
Ecological Modelling, Vol. 22, No. 1-4, p 101-108, 1983/1984. 7 Fig, 1 Tab, 2 Ref. DOE contract DE-AC09-76SR00819.

Descriptors: *Risks, *Uncertainty, *Model studies, *Heavy metals, *Chemical speciation, Simulation, Toxicity, Sorption, Cation exchange, Water pollution effects.

Every model there is a degree of uncertainty associated with every coefficient that controls the rate of material from one state variable to another. Because of this source of uncertainty, many simulations, each with different (but reasonable) estimates of coefficient settings should be made so as to approximate the probable behavior space of the system of interest. Deterministic models do not account for variability in output response caused by uncertain estimates of coefficients. This can make their predictions to be of limited value in certain instances. One such instance occurs when trying to simulate the potential risk to the environment that might be incurred as a result of toxic chemical inputs. If the uncertainty in coefficients that govern the kinetics of metal sorption and cation exchange reactions with particulate and dissolved substrates is accounted for, a range of values for the joint concentrations of unbound (toxic) metal species would be expected. Each individual end-point concentration from the range of simulated results can be tested against a pre-specified threshold concentration level that if exceeded is said to constitute a risk to the environment. If the threshold concentration is not exceeded, then no risk can be said to have occurred. By noting the number of times out of the total number of simulations that a threshold level is exceeded, the probability of risk can be calculated. Conversely, making an assessment of risk based on one endpoint concentration from a deterministic model gives little insight into the probability of a risk occurring. The degree of risk should be expected to change as our certainty in coefficient estimates increases or decreases. (Author's abstract)
W85-00259

FATES OF AROMATICS MODEL (FOAM): DESCRIPTION, APPLICATION, AND ANALYSIS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
S. M. Bartell, R. H. Gardner, and R. V. O'Neill.
Ecological Modelling, Vol. 22, No. 1-4, p 109-121, 1983/1984. 2 Fig, 2 Tab, 22 Ref. DOE contract W-7405-eng-26.

Descriptors: *Fate of pollutants, *Hydrocarbons, *Polycyclic aromatic hydrocarbons, *Model studies, Bioaccumulation, Degradation, Lotic environment, Lentic environment, Dissolution, Volatilization, Photolysis, Sorption, Anthracene, Naphthalene, Benzo(a)pyrene, Simulation.

The Fates of Aromatics Model (FOAM) evaluates the hypothesis that transport, degradation, and bioaccumulation of polycyclic aromatic hydrocarbons (PAH's) in aquatic systems can be forecast from fundamental chemical characteristics of this homologous series of compounds. Molecular weight, ring number, melting point, octanol:water partition coefficient, and a light absorption spectrum are used to calculate rates of dissolution, volatiilization, photolytic degradation, sorption, and bioaccumulation of specific PAH's in lotic and lentic environments. FOAM forecast spatial and temporal concentrations of dissolved anthracene within 15 percent of concentrations measured in lotic microcosms. The model overestimated periphyton accumulation of anthracene by 425 percent, but was within 40-50 percent of measured concentrations in stream sediments and papershell clams. Patterns of naphthalene and benzo(a)pyrene flux simulated by FOAM agreed qualitatively with results reported for lentic microcosms. Monte Carlo error analysis of FOAM identified 7 parameters that contributed importantly to imprecision in forecasts of anthracene fate. The rank order of correlation of these parameters with prediction error changes during the course of a simulation. (Author's abstract)
W85-00260

MODELING TRANSPORT PROCESSES AND DIFFERENTIAL ACCUMULATION OF PERSISTENT TOXIC ORGANIC SUBSTANCES IN GROUNDWATER SYSTEMS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
C. G. Uchrin.
Ecological Modelling, Vol. 22, No. 1-4, p 135-143, 1983/1984. 2 Fig, 20 Ref.

Descriptors: *Organic compounds, *Groundwater pollution, *Path of pollutants, *Mathematical models, Sorption, Soil matrix, Differential equations.

The ability to predict the potential spread of groundwater pollution resulting from past and existing sources is of paramount interest for ensuring the potability of this important resource. Trace organic substances are, in general, hydrophobic and do not behave as conventional pollutants. Their potential for selective association with the particulate matter comprising the soil matrix is quite high. Since the processes of adsorption and desorption are dynamic and not completely reversible, modeling difficulties arise. The conceptual development of several dynamic sorption models is presented, and their relationship to the classical equilibrium partitioning assumption is demonstrated. A numerical algorithm for solving time variable pollutant liquid phase and solid phase concentrations in a soil matrix in three dimensions is formulated so as to be useful for both saturated as well as unsaturated conditions. The technique consists of segmenting the control volume into N segments for which N simultaneous, first-order, ordinary differential equations can be formulated for solute/liquid phase mass balances. Another N simultaneous ordinary differential equations can be developed for the solute/solid phase mass balances. The liquid phase/solid phase equations are coupled through the reaction term in the liquid phase equations. The resultant is a set of 2N simultaneous ordinary differential equations which can be solved by classical numerical techniques. The algorithm is also useful for multi-dimensional cases, as the segments do not have to be oriented in series. (Moore-IVI)
W85-00262

PHYSIO-CHEMICAL AND ECOLOGICAL MODELING THE FATE OF TOXIC SUBSTANCES IN NATURAL WATER SYSTEMS,
Manhattan Coll., Bronx, NY. Environmental Engineering and Science Graduate Program.
R. V. Thomann.
Ecological Modelling, Vol. 22, No. 1-4, p 145-170, 1983/1984. 9 Fig, 3 Tab, 19 Ref.

Descriptors: *Mathematical models, *Fate of pollutants, *Toxic substances, Lake sediments, Food chains, Lakes, Streams, Ecological effects, Ecosystems.

The basic mathematical modeling framework for the fate of chemicals discharged into the environment is a complex interaction of chemical kinetics, particle sorption and desorption, sediment interactions, and uptake and transfer in the aquatic ecosystem. The fully time-variable equations do not present any significant insight into the general behavior of chemical fate. Under a steady state assumption and including bottom sediment interactions, relatively simple formulations result that permit rapid calculation of the maximum concentrations that might be expected. For a completely mixed lake, the ratio of the areal loading rate of the toxicant to the water column concentration is determined by the hydraulic overflow rate and the net loss rate of the toxicant from the water column. The steady state food chain model of the accumulation of a toxic chemical from both water and food sources is a means for estimating the parameters of loss and sediment interaction for a lake. The steady state case of the discharge of a chemical into a stream provides a simple means for estimating net loss rates under some reasonable assumptions. Coupling the food chain model to the physio-chemical model permits the use of chemical concentrations in the fish to estimate the net loss of toxicant in a stream. Examples using data for cadmium in the Sajo River in Hungary and PCB in the Shiawassee fish and sediment appear to confirm the basic model. (Moore-IVI)
W85-00263

MODELLING CONCEPTS FOR HYDROPHOBIC ORGANIC POLLUTANTS IN LAKES,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
R. P. Schwarzenbach, and D. M. Imboden.
Ecological Modelling, Vol. 22, No. 1-4, p 171-212, 1983/1984. 4 Fig, 4 Tab, 42 Ref, 1 Append.

Descriptors: *Hydrophobic compounds, *Organic compounds, *Fate of pollutants, *Lakes, *Mathematical models, Mixing, Gas exchange, Sorption, Desorption, Particulates, Organic carbon, Photochemical reactions, Limnology.

A simple model concept is developed to evaluate the behavior of hydrophobic organic compounds in lakes. Hydrophobic compounds, defined as being readily soluble in nonpolar organic solvents but only sparingly soluble in water, include important environmental pollutants such as halogenated hydrocarbons, fuel and mineral oil compounds, polycyclic aromatic, hydrocarbons plasticizers, non-ionic detergents, etc. Simple physico-chemical concepts are employed to portray the relevant transfer and reaction processes: gas exchange is described by the two-film model, sorption/desorption on particulate organic carbon (POC) by a reversible, instantaneous linear sorption isotherm and hydrolysis and photochemical transformations by linear reaction kinetics. Based on the estimation of typical time and length scales for mixing in lakes, the aquatic environments are described

either by a completely mixed water body (1-box model), or by a annual cycle between stratification (two-box model, consisting of epilimnion and hypolimnion) and overturn (1-box model). Two test lakes (schematic representations of Lakes Zurich and Biel, Switzerland) and several model compounds, which represent a wide range of typical reaction characteristics, serve to demonstrate how the spatial distribution pattern depends on the relative importance of mixing versus reaction rates. The model is applied to the distribution of tetrachloroethylene (PER) and hexachlorobenzene (HCB) and compared to measured data of PER in Lake Zurich. For compounds dominated by adsorption and removal on particles, a more sophisticated model is needed which includes the exchange between sediments and water. (Author's abstract)
W85-00264

ERROR ANALYSIS AND SIMULATION OF MIREX BEHAVIOUR IN LAKE ONTARIO,
Canada Centre for Inland Waters, Burlington (Ontario).
E. Halfon.
Ecological Modelling, Vol. 22, No. 1-4, p 213-252, April, 1983/1984. 18 Fig, 6 Tab, 61 Ref.

Descriptors: *Error analysis, *Lake Ontario, *Simulation, *Fate of pollutants, *Mirex, Public health, Bioaccumulation, Model studies, Niagara River, Oswego River, Lake sediments, Sedimentation, Resuspension, Adsorption.

Mirex enters Lake Ontario from two major sources, the Niagara River and the Oswego River. Since 1968 most has come from the former source. Simulation models are employed to quantify the behavior of Mirex in the water column in the biota and in the bottom sediments of the lake. Error analysis was used to indicate areas which need to be investigated with field experiments. Such analysis has indicated environmental and chemical characteristics which control Mirex behavior in the lake. The most important are the bulk density of the sediments and the water sediment exchange processes of sedimentation and resuspension. Adsorption on sediments is also important but because the adsorption constant is so large, variations make relatively little difference. Over the long term, one thousand years and longer, volatilization is an important process of Mirex removal. Mirex is bioconcentrated. Living organisms influence the medium term distribution (100 years or less). Mirex is very persistent in the lake and most likely will not be removed but only buried in the sediments. An exposure analysis demonstrated that even if heavy loading of Mirex stopped, the exposure of living organisms, particularly in the benthos, would remain high. Long term predicted persistance causes it to remain a chronic hazard. The risk to environmental health will continue. Coverage of Mirex contaminated bottom sediment by clean sediments will not be a solution for at least the next 200-500 years. A bioconcentration exposure is definitely evident, whereas biomagnification in the food chain has not been proven. (Baker-IVI)
W85-00265

PRELIMINARY MODEL OF THE DISPERSAL AND BIOLOGICAL EFFECT OF TOXINS IN THE TAMAR ESTUARY, ENGLAND,
Institute for Marine Environmental Research, Plymouth (England).
J. R. W. Harris, A. J. Bale, B. L. Bayne, R. F. C. Mantoura, and A. W. Morris.
Ecological Modelling, Vol. 22, No. 1-4, p 253-284, 1983/1984. 16 Fig, 3 Tab, 29 Ref. UK Department of the Environment contract DGR 480/683.

Descriptors: *Tamar Estuary, *England, *Fate of pollutants, *Hydrocarbons, *Cadmium, Toxic substances, Estuarine environment, Simulation, Tidal effects, Mussels, Toxicity, Particulates, Adsorption.

A preliminary model of the axial dispersal of toxic substances in Tamar Estuary, a partially-mixed macrotidal estuary in southwest England, is described. The model is based upon a one-dimensional simulation of net solute and particulate fluxes between mid-tidal values. Within this framework, the losses and partition between dissolved and particle-adsorbed phases of selected aromatic hydrocarbons are calculated. Aromatic hydrocarbons ranging from benzene to benzo(a)pyrene are considered, together with cadmium. As an indicator of biological impact, toxic effects on the mussel, Mytilus edulis, are simulated. Solute dynamics are treated as an advection-diffusion process. Modelling of particle dynamics incorporates deposition and resuspension and simulates the observed turbidity maximum at the limit to saline intrusion and the effect of runoff and tidal range on the suspended load of particulates. Hydrocarbon losses by volatilization, photo-oxidation and bacterial action are incorporated. The partition of toxic substances between dissolved and particle-adsorbed phases is assumed in all cases to be reversible and to achieve equilibrium. Chemical speciation of cadmium is treated similarly; competetive binding of humics and particulates by protons and major cations is taken into account. Toxic effects are simulated as acting on the energy balance of Mytilus edulis, via its rates of respiration and absorbtion. The distribution of toxic substances within the simulated estuary depends critically on the balance between water flows and tidally-driven particle movement, and hence on the partition between dissolved and particle-adsorbed phases. (Moore-IVI)
W85-00266

MODELING HEAVY METALS TRANSPORT IN AN ARCTIC FJORD SYSTEM POLLUTED FROM MINE TAILINGS,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
N. Nyholm, T. K. Nielsen, and K. Pedersen.
Ecological Modelling, Vol. 22, No. 1-4, p 285-324, 1983/1984. 18 Fig, 5 Tab, 20 Ref.

Descriptors: *Heavy metals, *Fate of pollutants, *Agfardlikavsa Fjord, *Greenland, *Mine wastes, Particulates, Suspended solids, Sedimentation, Dissolution, Fjords, Mathematical models, Wastewater treatment, Pollution load, Water pollution control.

A computerized mathematical model has been used to describe the dissolution and transport of lead, zinc, and cadmium in the Agfardlikavsa Fjord, Marmorilik, West Greenland, where tailings from the Greenex A/S lead/zinc mine and concentrator are being deposited. The hydraulic model basis is a quasi-stationary box model representation which has been calibrated using salinity profiles. The superimposed metals model assumes equilibrium between dissolved and particulate metal forms using Langmuir adsorption isotherms to calculate particulate concentrations from concentrations of dissolved metals and suspended solids, respectively. Calibration of the model parameters (sedimentation rates and dissolution rates) has been made observing quite narrow constraints established by field observations and laboratory experiments. In the course of the time period being modeled, 1978-1980, the pollution with heavy metals has been mitigated significantly. The abatement measures undertaken include: (1) alteration of the lead flotation process and lime addition to tailings by June/July 1978; (2) alum coagulation of the effluent by January 1979; and (3) establishment of a new tailings discharge system in December 1979. The model has been used to estimate the reductions brought about in inputs of dissolved metals as well as to quantify the dynamics of the heavy metals transport in the fjord system. A particular important objective was to estimate the net outflow of metals to the adjacent Quamarujuk Fjord and to predict how the outflow responded to a decreased pollution load. A further result from the model study was the finding that routine monitoring of soluble metals in the discharged tailings as assayed by a specific method did in fact approximate model estimates of metals discharge rates if pH in the test was changed from pH 7.0 to pH 8.0. (Author's abstract)
W85-00267

INVESTIGATION OF THE HEAVY METAL CONTENT OF SEDIMENTS AND ALGAE FROM THE RIVER NIGER AND NIGERIAN ATLANTIC COASTAL WATERS,
Benin Univ., Benin City (Nigeria). Dept. of Chemistry.
C. L. Ndiokwere.
Environmental Pollution (Series B), Vol. 7, No. 4, p 247-254, 1984. 1 Fig, 3 Tab, 25 Ref.

Descriptors: *Heavy metals, *Sediments, *Algae, *River Niger, *Nigeria, Coastal waters, Water pollution sources, Arsenic, Gold, Cadmium, Mercury, Nickel, Lead, Tin, Zinc, Oil pollution, Industrial wastes, Urban areas.

Trace heavy metals in sediments and green algae from the River Niger and the Nigerian Atlantic coastal waters were examined at four locations: Onitsha, Port Harcourt, Forcados and Warri. The samples, analyzed for As, Au, Cd, Hg, Mn, Ni, Pb, Sb and Zn by NAA (thermal-neutron activation) and AAS (atomic absorption spectrophotometer) techniques, showed varying degrees of contamination of the sediments by some of the heavy metals. The measured concentrations of As, Cd, Hg and Sb were higher in sediments from the coastal waters than from the River Niger. The sediments from the River Niger contained higher Mn, Pb and Zn concentrations. Similar concentration trends were observed for the algae. Harbor and port activities in the sampling locations may increase the concentration of most heavy metals. Appreciable amounts of some heavy metals may come from the large quantities of crude oil discharged into the coastal waters, creeks and rivers. Urban drainages and small scale industries also contribute to lhigh levels of the trase metals in nearby sediments. The average precision of measurements varied in the range of 4.3% to about 10% for most metals. (Moore-IVI)
W85-00283

UNDERGROUND TANKS CONTAMINATE GROUNDWATER,
S. Tejada.
EPA Journal, Vol. 10, No. 1, p 20-22, January-February, 1984. 1 Fig.

Descriptors: *Groundwater pollution, *Gasoline, *Leakage, Gasoline tanks, Storage tanks, Corrosion, Xylene, Benzene, Toluene, BTX.

Leaking underground gasoline storage tanks are a national problem. The great majority of tanks in use are made of steel, about 1.2 million. Only a small number of them, about 16,000, are protected against corrosion. About 200,000 of the tanks in use are made of fiberglass. Corroded tanks leak slowly, so even a dealer who inventories tank supplies regularly might not detect a leak for a long time. Gasoline floats on top of water, but some of the toxic components dissolve in the water. When gasoline is removed from soil or water, these colorless, odorless components, including benzene, toulene, and xylene, or BTX, remain behind. With passage of the Pipeline Safety Act of 1979 the Dept. of Transportation was authorized to prescribe safety standards and accident reporting requirements for transportation of hazardous liquids in pipelines. The best bet for EPA regulation of underground tanks for storage of non-waste materials such as gasoline and other hazardous substances appears to lie with another law the agency administers, the Toxic Substances Control Act. State and local efforts along with the efforts of industry to curb this problem are considerd. (Baker-IVI)
W85-00287

RED HERRINGS IN ACID RAIN RESEARCH
Toronto Univ. (Ontario). Inst. for Environmental Studies.
M. Havas, T. C. Hutchinson, and G. E. Likens.
Environmental Science and Technology, Vol. 18, No. 6, p 176A-186A, June, 1984. 6 Fig, 1 Tab, 7(Ref.

Descriptors: *Acid rain, *Water pollution sources, Lakes, Fish, Toxicity, Measuring instruments, Land use, Forestry, Agriculture, Runoff, Ecosystems.

Five common misconceptions regarding the effects of acid deposition on aquatic ecosystems are exposed. First: bog lakes have been acidic for thousands of years, thus the acidification of lakes is not a recent phenomenon. The erroneous conclusion here is that all acidification is natural and therefore not of recent anthropogenic origin. Second: the early methods for measuring pH are in error; therefore, no statement can be made regarding historical trends. To combat this claim, various comparison studies of methods for detrmining pH have been undertaken. Third: acidification of lakes and streams results from changed land use practices and not acid deposition. Although changes in land use cannot be eliminated entirely as a mechanism for surface water acidification, they cannot explain convincingly the widespread regional acidification of lakes and streams in parts of Scandinavia and eastern North America exposed to acid deposition. Fourth: the decrease in fish populations is caused by over-fishing, disease, and water pollution - not acidification. The opposite conclusion is reached by various studies dealing with the failure of restocking programs, episodic fish kills, correlations between fish populations and pH, characteristic age-class distributions, and distinctive physiological blood parameters. Fifth: because lakes that receive identical rainfall can have considerably different pHs, regional lake acidification cannot be due to acid precipitation. Lakes vary in their susceptibility to acidification based on biogeochemical parameters, surface topography, lake depth, volume, and flushing time. (Baker-IVI)
W85-00288

UTRIENT AND TRACE METAL GEOCHEMSTRY OF A DREDGE PLUME,
onnecticut Univ., Groton. Marine Sciences Inst.
M. Tramontano, Jr., and W. F. Bohlen.
stuarine, Coastal and Shelf Science, Vol. 18, No. p 385-401, April, 1984. 10 Fig, 3 Tab, 27 Ref. SN contract N00140-77-C-6536.

escriptors: *Dredging, *Nutrients, *Trace etals, *Plumes, *Geochemistry, *Thames River, Connecticut, Estuaries, Resuspension, Suspended diments, Dissolved solids, Phosphates, Ammo-, Silica, Manganese, Copper, Cadmium, Envinmental effects, Water pollution sources.

eld sampling of the dissolved and particulate terial field downstream of a large volume cket dredge operating in the lower Thames ver estuary near New London, Connecticut, was nducted in order to examine the magnitude and aracter of the dredge-induced resuspension. ese data indicate that large amounts of dissolved sphate, ammonia, silica, manganese, copper and ticulate materials are released into the water umn, whereas cadmium concentrations were ffected. Concentrations in the vicinity of the dge exceed background levels by two to nine es for the dissolved materials and by two orders magnitude for particulates. During the ebb le, downstream material concentrations dese rapidly to background within approximately m for dissolved materials and 700 m for partices. Two mechanisms were found to control the ribution of materials downstream of the dredge: physical transport, including advection, turbu- mixing and diffusion, and (b) geochemical cesses (i.e. adsorption, desorption, precipitation, olution, etc.). The concentration of dissolved erials downstream of the dredge at a first order nential rate. The downstream distribution of dissolved ammonia and silica was found to be istent with the reactivity experiments which icted that PO4 would undergo a decay in entration in the presence of suspended sedi-s. Absorption of phosphate onto suspended ments and gravitational settling of the suspend-articulates were the processes. Manganese and er underwent a dual transformation which lved an initial dissolution, followed by floccun and possible coprecipitation as MnO2. Cad-n concentrations in the water column were fected by the dredging process due to low water concentrations. The observed spatial bution indicates that dredge-induced injection ssolved and particulate materials is primarily a field phenomenon producing relatively minor tions as compared to those caused by naturally occurring storm events. These latter systems have been shown to produce estuary-wide variations in suspended materials, PO4 and NH4 concentrations increasing the mass of materials in suspension by at least a factor of two. This increase in total suspended load, PO4 and NH4, is nearly an order of magnitude larger than that produced by the dredge. (Author's abstract)
W85-00289

COMPLEXATION OF TRACE METALS BY ADSORBED NATURAL ORGANIC MATTER,
Geological Survey, Miami, FL. Water Resources Div.
J. A. Davis.
Geochimica et Cosmochimica Acta, Vol. 48, No. 4, p 679-691, April, 1984. 11 Fig, 4 Tab, 26 Ref.

Descriptors: *Trace metals, *Adsorption, *Organic matter, *Complexation, Chemical speciation, Alumina, Colloids, Natural waters, Copper, Cadmium, Fate of pollutants.

Adsorption is significant in regulating the concentration of dissolved trace metals in natural waters. Modeling approaches for adsorption have been based on studies on colloidal hydrous oxides in the absence of organic matter. The adsorption behavior and solution speciation of Cu(II) and Cd(II) were studied in model systems containing colloidal alumina particles and dissolved natural organic matter. At equilibrium a significant fraction of the alumina surface was covered by adsorbed organic matter. Cu(II) was partitioned primarily between the surface-bound organic matter and dissolved Cu-organic complexes in the aqueous phase. Complexation of Cu(2+) with the functional groups of absorbed organic matter was stronger than complexation with uncovered alumina surface hydroxyls. The complexation of Cu(II) by adsorbed organic matter can be described by an apparent stability constant approximately equal to the value found for solution phase equilibria. Cd(II) adsorption was not significantly affected by the presence of organic matter at the surface, due to weak complex formation with the organic ligands. Models of particle/trace element interactions which are based on the surface chemistry of clean hydrous oxides may not be directly applicable to natural systems. The suspended particle concentration in many natural waters is low enough that a large percentage of the surface area may be covered with organic matter. (Moore-IVI)
W85-00296

HYDRAULIC CONDUCTIVITY OF A FINE-GRAINED TILL, CATTARAUGUS COUNTY, NEW YORK,
Geological Survey, Carson City, NV.
For primary bibliographic entry see Field 2F.
W85-00305

FLY ASH DISPOSAL IN A LIMESTONE QUARRY,
Dunn Geoscience Corp., Camphill, PA.
J. R. Peffer.
Ground Water, Vol. 20, No. 3, p 267-273, May-June, 1982. 5 Fig, 11 Ref.

Descriptors: *Fly ash, *Quarries, *Water pollution sources, *Groundwater pollution, *Pennsylvania, Water table, Land disposal, Sulfates, Alkaline water, Limestone.

Approximately 740,000 tons (670,000 metric tons) of eastern bituminous coal fly ash were deposited at the abandoned Zullinger limestone quarry (Pennsylvania) from 1973 to 1980. The quarry extended below the water table and was not lined to isolate the ash from the aquifer. The initial filling involved dumping ash directly into the quarry water. The quarry was situated in folded and fractured limestone with relatively high solution-void permeability. Ground-water quality was monitored at the site for seven years through a network of wells. During the first three years of the filling operation, high levels of sulfate were detected in downgradient ground water. However, this initial pollution diminished sharply in 1976 when the ash filled the volume of the quarry below the water table. Long-term ground-water pollution has apparently not resulted. The lack of any significant long-term impact on ground-water quality is attributed to the low permeability of the ash relative to the surrounding limestone aquifer. Typically alkaline limestone ground water at the site is also attributed with neutralizing the low pH fly ash which was deposited. (Author's abstract)
W85-00309

INVESTIGATION OF ALDICARB IN GROUND WATER IN SELECTED AREAS OF THE CENTRAL SAND PLAIN OF WISCONSIN,
Wisconsin Univ.-Madison. Dept. of Geology and Geophysics.
E. R. Rothschild, R. J. Manser, and M. P. Anderson.
Ground Water, Vol. 20, No. 4, p 437-445, July-August, 1982. 4 Fig, 1 Tab, 26 Ref.

Descriptors: *Aldicarb, *Groundwater pollution, *Wisconsin, Pesticide residues, Path of pollutants, Water pollution sources, Carbamate pesticides, Wells.

The systemic pesticide aldicarb is applied in the potato furrow during planting. Its primary use in Wisconsin is to protect potatoes form the Colorado potato Beetle and nematodes. The goal of this study was to provide a preliminary assessment of the occurrence and movement of the pesticide aldicarb in ground water in the Central Sand Plain of Wisconsin. Aldicarb concentrations in ground water beneath three main study fields and two subsidiary fields were monitored during the period December 1980 to August 1981. A total of 67 well points, some nested, and one multilevel sampler were installed for this study. Twenty-five private wells and seven irrigation wells were sampled. The highest concentrations of aldicarb were detected in shallow monitoring wells (those located immediately below the water table; no aldicarb was detected in any of the deep monitoring wells (those located roughly 60 feet below the water table), although aldicarb was found in some of the irrigation wells finished at approximately the same depth. Aldicarb seems to be concentrated in roughly a 5-foot layer near the water table. The presence of aldicarb in shallow groundwater is due in part to the highly water-soluble nature of this pesticide. The presence of aldicarb in a few of the deep irrigation wells was probably a result of local vertical flow components near the pumping well. The detection of aldicarb in a few shallow private wells downgradient from some fields demonstrates the mobility of this contaminant in groundwater. This pesticide is a good indicator of potential groundwater contamination by other organics because it is highly soluble and poorly adsorbed; in this sense it represents a worst case contaminant. (Moore-IVI)
W85-00324

NATURE AND SOURCE OF ARSENIC IN NORTHEASTERN OHIO GROUND WATER,
Case Western Reserve Univ., Cleveland, OH. Dept. of Geological Sciences.
G. Matisoff, C. H. Khourey, J. F. Hall, A. W. Varnes, and W. H. Strain.
Ground Water, Vol. 20, No. 4, p 446-456, July-August, 1982. 7 Fig, 34 Ref. OWRT grant A-061-OHIO.

Descriptors: *Arsenic, *Groundwater pollution, *Canal Fulton, *Ohio, *Water pollution sources, Methane, Glacial till, Hydrogen ion concentration, Redox conditions, Adsorption equilibrium, Ferric hydroxides.

Elevated arsenic concentrations were found in ground water near Canal Fulton, Ohio. The hydrologic and chemical properties of the area were studied to determine the source of the arsenic and evaluate the possibility of a similar problem occurring elsewhere. Two major aquifer systems exist within the study area: the Sharon Sandstone of the upland areas; and the outwash sand and gravel deposits of the buried valleys. Ground-water flow is generally from the north, but local variations are caused by the Tuscarawas River valley on the

south and west of the study area. Within the study area, there is no evidence for an anthropogenic source of arsenic to the ground water. Agricultural soils, abandoned underground coal mines, industrial impoundments to the north, and an abandoned industrial dump site within the study area were all eliminated as possible sources for the arsenic. The arsenic in Canal Fulton ground water is entirely inorganic, consisting of about equal parts of arsenate and arsenite. Reduction-oxidation (redox) considerations suggest that arsenic is controlled by an adsorption equilibrium with ferric hydroxides, and that the reduction of the ferric hydroxides by a recent lowering of Eh and/or pH in the aquifer has liberated both iron and arsenic to solution. A high correlation between ferrous iron and total dissolved arsenic supports this model. It is hypothesized that Eh conditions have been lowered in the aquifer by either the recent introduction of methane gas or the deposition of a thick layer of till during the last glacial retreat. The methane gase could be leaking from deep underground storage at the site and reducing oxidized compounds. The deposition of till would have eliminated local recharge of oxygenated waters. (Author's abstract)
W85-00325

NITRATE DISTRIBUTION IN THE GROUND WATER OF THE ALLISTON REGION OF ONTARIO, CANADA,
York Univ., Toronto (Ontario). Dept. of Geography.
A. R. Hill.
Ground Water, Vol. 20, No. 6, p 696-702, November-December, 1982. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Groundwater pollution, *Nitrates, *Fertilizers, *Ontario, *Alliston, Path of pollutants, Agriculture, Wells, Water pollution sources.

Analysis of groundwater samples from wells and springs indicates that several major areas of nitrate contamination occur within the shallow aquifer near Alliston, Ontario. Nitrate-N concentrations under potato fields often exceed 10 mg/l, whereas concentrations of less than 1 mg/l are characteristic of groundwater under areas of forest and permanent pasture. Regression analysis revealed a significant positive correlation between nitrate-N concentration in groundwater and the average rate of fertilizer nitrogen application in the 1977-80 period. A significant positive association between ground water chloride concentration and rates of potassium chloride fertilizer application together with consistent Cl/NO3-N ratios in ground water under potato fields also suggests that fertilizers are the major source of nitrate in the aquifer. Eight wells located adjacent to heavily fertilized potato fields had very low nitrate-N concentrations. In contrast to the majority of wells, these 8 penetrated to more than 20 ft below the water table. The likelihood that low nitrate-N concentrations occur in the deeper portion of the aquifer requires further study. If the presence of a widespread zone of low nitrate-N concentrations could be confirmed in the Alliston area, it may be possible to alleviate problems of high nitrate levels in domestic water supplies by constructing wells which extend to a greater depth below the water table. (Baker-IVI)
W85-00347

APPROXIMATING POLLUTANT TRANSPORT TO GROUND WATER,
Robert S. Kerr Environmental Research Lab., Ada, OK.
C. G. Enfield, R. F. Carsel, S. Z. Cohen, T. Phan, and D. M. Walters.
Ground Water, Vol. 20, No. 6, p 711-722, November-December, 1982. 3 Fig, 5 Tab, 35 Ref.

Descriptors: *Groundwater pollution, *Solute transport, *Model studies, Pesticides, Degradation, Aldicarb, DDT, Path of pollutants.

Three models are presented for estimating transport of organic chemicals though soils to groundwater. The models consider mobility and first order degradation. The first model calculates linear sorption/desorption of the pollutant and first order degradation without considering dispersion. The second is similar but also considers dispersion. The third considers nonlinear sorption following a Freundlich equation and first order degradation but does not consider dispersion. The models are compared to field data for the pesticides aldicarb and DDT. Based on the correlation between field data and model projections the approach should be adequate to make environmental decisions evaluating the potential hazard of nonionic organics to the ground water. Modification to one of the equations would be necessary to evaluate ionic or charged compounds. The sensitivity of the model to degradation rate shows the need to describe degradation and the parameters affecting degradation accurately. Each of the models has certain advantages, and the appropriate model should be selected based on individual need. (Baker-IVI)
W85-00349

NUMERICAL MODEL STUDY OF GROUNDWATER CONTAMINATION FROM PRICE'S LANDFILL, NEW JERSEY - I. DATA BASE AND FLOW SIMULATION,
Princeton Univ., NJ. Dept. of Civil Engineering.
W. G. Gray, and J. L. Hoffman.
Ground Water, Vol. 21, No. 1, p 7-14, January-February, 1983. 8 Fig, 1 Tab, 11 Ref.

Descriptors: *Water quality control, *Groundwater pollution, *Atlantic City, *New Jersey, Aquifers, Landfills, Data collections, Geohydrology, Model studies.

Toxic waste is currently threatening to contaminate the public water supply wells for Atlantic City, New Jersey. The geohydrologic data for this region are presented and organized into a two dimensional modeling study of the flow in the upper zone of the Cohansey formation in the region of the contamination problem. The study as described is strictly a modeling exercise. For two dimensional transient flow, prime aquifer parameters for simulation of the head configuration are the storage coefficients and the transmissivity. A pump test was conducted on the Atlantic City Municipal Supply Well No. 4 in 1981. The well was pumped at 580 gpm for 36 hours. Drawdown in the upper Cohansey during the pumping period was noted at several nearby wells. A Thiem type analysis was performed. The primary region of interest in this modeling study is the portion of the upper Cohansey formation in the vicinity of Price's Landfill. Presentation of the data in light of numerical work reveals the importance of good estimates of boundary conditions, historical pumping records, reliable water quality data, accurate well logs, and reasonable parameter estimates. (Baker-IVI)
W85-00353

GROUND WATER CONTAMINATION OF TWO PRODUCTION WELLS: A CASE HISTORY,
Ecology and Environment, Inc., Seattle, WA.
For primary bibliographic entry see Field 5F.
W85-00363

GROUND WATER MONITORING AT A SEPTAGE LAGOON FACILITY IN CONNECTICUT,
Geotoxi Associates, Inc., Glastonbury, CT.
B. L. Morton, J. J. Kolega, and H. D. Luce.
Ground Water Monitoring Review, Vol. 4, No. 2, p 45-50, Spring, 1984. 3 Fig, 2 Tab, 11 Ref.

Descriptors: *Groundwater monitoring, *Connecticut, *Lagoons, Wastewater treatment, Nitrogen, Nitrates, Chlorides, Monitoring wells.

Current design guidelines in Connecticut for septage lagoons stipulate that they be constructed in a two cell, series configuration. Lagoon sidewalls and bottoms generally consist of excavated earthen material with a 30 cm layer of medium sand, ranging in grain size from 0.25 to 0.60 mm, placed on the bottom to facilitate sludge removal. Monitoring studies indicated that in general natural water table elevations were found to be at their highest during the late part of February and early part of March. Chloride concentrations in the peripheral monitoring well array have been consistently below 10 mg/l except for one point located to the west of the secondary treatment lagoon. Chloride levels beneath the septage lagoon have been generally elevated above background levels. From the outset of lagoon operation, the nitrogen contribution from the septage cell to the ground water has been primarily in the form of ammonium nitrate. The assumption that nearly complete nitrification occurs within the 1.22 m separation distance required between the base of the lagoon and the water table was not confirmed during the study period. Ammonium-nitrogen concentrations in the ground water immmediately below the primary lagoon have averaged 86.9 mg/l. It is speculated that the ammonium-nitrogen transformations observed were due to ground water advection processes. (Baker-IVI)
W85-00365

LANDFILL LEACHATE MIGRATION AND ATTENUATION IN THE UNSATURATED ZONE IN LAYERED AND NONLAYERED COARSE-GRAINED SOILS,
Wisconsin Dept. of Natural Resources, Madison.
R. A. Gerhardt.
Ground Water Monitoring Review, Vol. 4, No. 2, p 56-65, Spring, 1984. 8 Fig, 4 Tab, 14 Ref.

Descriptors: *Landfills, *Groundwater pollution, *Attenuation, *Leachates, *Sauk County, *Wisconsin, Aeration zone, Lysimeters, Soil water, Path of pollutants.

Two natural attenuation landfill sites, one near Prairie de Sac in Sauk County, Wisconsin, and the other near Reedsburg, also in Sauk County were selected for study. Leachate and soil-moisture samples were collected from the refuse and the unsaturated soils by means of pressure-vacuum lysimeters. The observed concentrations of the leachates, or any leachate component, at depth in the unsaturated zone beneath the landfills have apparently resulted from the interaction of several factors: the chemical quality of the leachates being produced within the refuse material; chemical interactions between the soil and the leachate; and unsaturated soil moisture/leachate movement. The attenuation of leachate within the unsaturated zone was observed beneath the Sauk County and Prairie due Sac landfills. However, ground water beneath both sites was contaminated. The limited attenuation capacity of the unsaturated sands and gravels beneath the two sites was apparently incapable of preventing ground water contamination. Operating the landfills as natural attenuation sites did not prevent ground water contamination. Sampling with one or two lysimeter nests in the unsaturated zone may not be indicative of the actual ground water contamination potential of a landfill, as evidenced by this study. In the case of layered soils in the unsaturated zone, the possibility of horizontal leachate movement must also be considered. At the Prairie du Sac landfill, leachate was detected in the unsaturated zone at least 15.2 m beyond the fill limits. (Baker-IVI)
W85-00366

EXPERIMENTAL STUDY OF THE STRUCTURE OF A FRESHWATER-SALTWATER INTERFACIAL MIXING (ETUDE EXPERIMENTALE DU MELANGE A L'INTERFACE EAU-SAUMURE),
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 2L.
W85-00387

5C. Effects Of Pollution

BIOACCUMULATION STUDY ON HOMARUS AMERICANUS.
O'Brien and Gere Engineers, Inc., Syracuse, NY.
Final Report to U.S. Army Engineer District, New York, April, 1979. 52 p, 6 Tab, 41 Ref, 1 Append.

Descriptors: *Bioaccumulation, *Biochemical characteristics, *Biochemical tests, *Accumulation, *Chemical analysis, *Lobsters, *Tissue analysis,

*Municipal wastes, Industrial wastes, Dredging, Ocean dumping, Crustaceans, *New York, New York Bight.

One method of determining man's impact on the marine ecosystem is to assess the bioaccumulation of contaminants by organisms indigenous to areas of interest. The American lobster, Homarus americanus, is a generalized marine predator of the ocean floor and, as such, has the potential to accumulate contaminants from its immediate habitat. It is also a highly sought-after food fish, which could present toxicologic problems. As of 1970, the commercial catch averaged approximately 30 million pounds. In addition to the Ocean Disposal Site for Dredged Material, three alternate sites were chosen to study whether ocean disposal of dredged material is substantially enhancing bioaccumulation in lobsters. Contributing factors at each site included ship traffic and associated discharges and spills; sewage effluent; wind-carried debris; cellar dirt and industrial wastes; and other factors related to an urban environment. Ten samples were taken from each site. All but one petroleum hydrocarbon and all DDT concentrations were below detectable values. PCBs, mercury and cadmium were found in all 40 samples. Bioaccumulation of PCBs, Hg and Cd was found to a higher degree at the Gravesend Bay location than at the other three. Further evidence of bioaccumulation was demonstrated by the correlations between body weight and tissue concentration. Tissue contamination accumulated at the Gravesend Bay site, the Disposal site, and the Long Island Control site are most likely site specific. (Garrison-Omniplan)
W85-00045

PPLICATION OF THE BIOTAL OCEAN ONITOR SYSTEM TO A STUDY OF THE MPACTS OF OCEAN DUMPING OF REDGED MATERIAL IN THE NEW YORK IGHT,

ereco Corp., College Station, TX.
. E. Peguegnat, B. M. James, E. A. Kennedy, A. Fredericks, and R. R. Fay.
echnical Report prepared for the Department of e Army Corps of Engineers, New York District, nuary 1980. 48 p, 7 Fig, 9 Tab, 17 Ref, 2 ppend.

escriptors: *Bioaccumulation, *Ocean dumping, iochemical characteristics, *Municipal wastes, lytilus, *Killfish, *Clams, *Accumulation, *Bioemical tests, *Waste disposal, Lead, Heavy tals, Cadmium, Lead, Mercury, Ocean bottom, ew York, New York Bight.

limited biological monitoring study was conted at the Mud Dump Site and environs in w York Outer Harbor and the Bight Apex, ng biotal ocean monitors of the benthic type B-MS. Each of the B-BOMS was loaded with the Fundulus grandis; the bivalve mollusks Mytiedulis and Mercenaria mercenaria; the shrimp aemonetes pugio; and the worm Nereis sp. All ept the worm were used in subsequent laboratoests. Analyses were run on three metals: cadmi- mercury, and lead. The only significant inse in cadmium occurred in Fundulus at the d Dump Site and Gravesend Bay. Some lowerof concentrations occurred in both Mytilus and cenaria, but both of these bivalves have very natural levels of cadmium. Results of the cury analysis suggest that tissue accumulation his metal occurred in Mercenaria at the Mud p Site. The only statistically significant tissue mulation of lead occurred in Mytilus in the B-MS but not in the BOMS of the pelagic type oyed in the Mud Dump Site and in Gavesend Several toxic chlorinated hydrocarbon pesti- were found in Fundulus, Mytilus, and/or ed Cancer irroratus. Among the more toxic of were the cyclodiene compounds aldrin; T, DDD, DDE; and such others as BHC and ne. In addition, PCBs in the form of Arochlor were found in all organisms tested. In Funduandis exposed in B-BOMS for 10 days PCB ens ranged from .079 to .287 pp. (Garrisoniplan)
-00051

EFFECTS OF FRESHWATER RUNOFF ON NEARSHORE TROPICAL MARINE FISHERIES,

Caribbean Research Inst., St. Thomas, VI.
M. J. Canoy, J. Beets, F. D. Martin, and B. Weichert.
Available from the National Technical Information Service, Springfield, VA 22161, as PB84 190214, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. 16, September 1983. 57 p, 7 Fig, 10 Tab, 19 Ref, 3 Append. OWRT Project No. A-017-VI (1), Contract/Grant No. 14-34-0001-2150.

Descriptors: *Runoff, Production, Plankton, Fisheries, Tropical waters, Fish larvae, Primary productivity, *Virgin Islands, *Finfish, *Marine fisheries.

A study was done to determine the relationship of freshwater runoff to breeding conditions, reproduction, and larval ecology of common nearshore marine fishery species. Finfish of the families Anchoa, Engraulidae, Culpeidae, Gobiidae, and Syngnathinae were found to reach peaks in the ichythoplankton about 6-8 weeks after heavy rains; however on two occasions peaks, occurred without rains. The numbers of surviving fish larvae appears greater during plankton blooms following nutrient-rich runoff.
W85-00064

CALIBRATING EFFECTS OF ACIDITY ON ATLANTIC SALMON FOR USE IN HABITAT SUITABILITY MODELS,

Maine Cooperative Fishery Research Unit, Orono.
J. G. Trial, and J. G. Stanley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 190065, Price codes: A03 in paper copy, A01 in microfiche. Land and Water Resources Center Completion Report, February 1984. 37 p, 1 Fig, 9 Tab, 45 Ref, 1 Append. OWRT Project No. A-054-ME (1), Contract/Grant No. 14-34-0001-0121, -1121, -2121.

Descriptors: *Acid rain, *Carrying capacity, *Fish management, Habitats, *Model testing, *Salmon, Streams, Model studies, *Acidity, *Habitat Suitability Index, Water quality, Water pollution effects, *Hydrogen ion concentration.

A Habitat Suitability Index model for Atlantic salmon was developed as a method for predicting reductions of habitat quality caused by acid precipitation. 18 suitability curves describing density and survival of Atlantic salmon as a function of habitat variables were developed from published information. Of the 18 variables, 5 dealt with water quality, 3 with each of the life stages spent in freshwater (fry and parr), and 7 with reproduction (spawning and embryo development). Stream pH was a variable in both water quality and reproduction. Effects of pH on other model variables were studied. Experiments at three levels of pH from 5.0 to 6.0 had no effect on the temperature or oxygen levels selected by parr, demonstrating that the 3 variables independently affect fish. Thus, a limiting factor model was used in aggregating variables of water quality. Field observations suggest that depth, velocity, and substrate for fry and parr should be combined using geometric means, because the variables were compensatory. Laboratory studies of the effects of low pH on swimming performance of salmon fry led to modification of the original suitability curve for velocity, such that velocities greater than 30 cm/sec were unsuitable if average pH was less than 4.5. The models are based on the assumption that the index of habitat quality is directly proportional to carrying capacity. To test this assumption and the sensitivity of this model to the effects of acidification, 1982 salmon populations were correlated with HSI values calculated from measurements in 3 streams of differing pH. The model predicted reduced carrying capacity of Atlantic salmon in one stream because of the effect of pH on embryo survival. The HSI value calculated by including pH data was 70% lower than that calculated without considering pH. HSI values including pH data did not correlate with standing crops, whereas the HSI's produced without pH data did ($p = 0.8$). However, one estimate of Atlantic salmon standing crop may not be indicative of carrying capacity.
W85-00068

HYPOXIC STRESS IN COPEPODS,

Maryland Univ. Baltimore County, Baltimore. Dept. of Biological Sciences.
B. P. Bradley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 190420l, Price codes: A02 in paper copy, A01 in microfiche. Maryland Water Resources Research Center, College Park, Publication No. 81, August 1983. 17 p, 5 Tab, 17 Ref. OWRT Project No. A-067-MD (1), Contract/Grant No. 14-34-0001-2122.

Descriptors: *Oxygen, *Dissolved oxygen, *Copepods, *Water temperature, *Hypoxia, *Stress, Tolerance.

Lowering oxygen levels in the water lowered tolerance to high temperatures in copepods. Tolerances to high temperature and to low oxygen did not seem to be the same trait physiologically but may be related genetically. Females were more tolerant than males to hypoxia; acclimation to temperature increased tolerance to hypoxia and there seemed to be genetic variation in tolerance at both high and low oxygen levels. Slight changes in oxygen levels at critical temperatures, within the range experienced in nature, markedly affected the copepods.
W85-00078

RIOU MORT, A TRIBUTARY OF THE LOT POLLUTED BY HEAVY METALS. III. GENERAL FAUNISTIC STUDY (LE RIOU MORT, AFFLUENT DU LOT, POLLUE PAR METAUX LOURDS. III. ETUDE FAUNISTIQUE GENERALE),

Toulouse-3 Univ. (France). Lab. d'Hydrobiologie.
N. Giani.
Annales de Limnologie, Vol. 19, No. 1, p 29-43, 1983. 9 Fig, 4 Tab, 29 Ref.

Descriptors: *Riou Mort, *France, *Ecological effects, *Oligochaetes, *Lot, *Aquatic animals, Water pollution effects, Species diversity, Heavy metals, Population density.

The Riou Mort, a river strongly degraded by domestic and industrial effluents, is characterized by a marked organic pollution, a high turbidity, the presence of heavy metals and sudden variations of pH and O2 content in relation to regular discharges. This pollution is examined here from the faunistic approach by two methods: the total study of the fauna and the study of parameters that summarize the faunistic data (density, number of taxa, index of Bournand and Keck). The two methods give similar results and can be used to describe the changes in the environment. The second method is the simplest and quickest, and a general faunistic study appears superfluous in such cases of gross pollution. Likewise, it is sufficient to consider the total oligochaetes only because very little additional information is obtained from their specific identification. (Author's abstract)
W85-00090

DYNAMICS OF CONTRIBUTION OF NITROGEN AND PHOSPHORUS TO THE RIVER AVEYRON (DYNAMIQUE DES APPORTS EN NUTRIENTS AZOTES ET PHOSPHORES A LA RIVIERE AVEYRON),

Centre National de la Recherche Scientifique, Toulouse (France). Centre d'Ecologie des Ressources Renouvelables.
E. Chauvet, M. Prat, and J. N. Tourenq.
Annales de Limnologie, Vol. 19, No. 1, p 51-58, 1983. 7 Fig, 2 Tab, 8 Ref.

Descriptors: *Aveyron, *France, *Nitrogen, *Phosphorus, *Eutrophication, Water pollution effects, Aquatic plants, Water pollution sources, Denitrification, Watersheds, Slope.

The upper reaches of the Aveyron show obvious signs of eutrophication. Even in the lotic zones, the

periphyton (mostly benthic diatoms) and the aquatic macrophytes indicate the effects of the nutrient levels. Physical-chemical data were collected at 15 stations on the Aveyron from October 1979 through September 1980. The water chemistry, with generally high levels of nitrogen and phosphorus, favors the development of aquatic vegetation. The quantities of nutrients from forested basins is very low. The effect of cultivated zones on the level of nutrients is evident at Briane. Certain sections of the Aveyron exhibit auto-epuration - a phenomenon associated with denitrification bacteria. The three locations with the greatest basin slopes (Severac, Laissac and Rodez) are the origin of most of the point source pollution. (Moore-IVI)
W85-00092

DISTRIBUTION OF BACTERIAL PLASMIDS IN CLEAN AND POLLUTED SITES IN A SOUTH WALES RIVER,
University Coll., Cardiff (Wales). Dept. of Applied Biology.
N. F. Burton, M. J. Day, and A. T. Bull.
Applied and Environmental Microbiology, Vol. 44, No. 5, p 1026-1029, November, 1982. 2 Tab, 18 Ref.

Descriptors: *Bacteria, *Plasmids, *Wales, *River Ely, Sediments, Water pollution effects, DNA, Conjugal transfer.

Four hundred aerobic heterotrophic bacteria were isolated from the sediment of unpolluted and polluted sites in the River Ely, a fast-flowing south Wales river. Isolates were subjected to taxonomic tests and screened for the presence of plasmid DNA by alkaline lysis and agarose gel techniques. There were no significant differences between sites in either the total percentage of isolates containing plasmids (unpolluted site 9.4%; polluted site 15%) or in the percentage of non-Pseudomonas-like isolates containing plasmids (unpolluted site 15%; polluted site 10%). There were significantly more Pseudonomas-like isolates with plasmids at the polluted site than at the unpolluted site (unpolluted site 7%; polluted site 18%). This presumably reflected a response of the nutritionally versatile Pseudomonas-like isolates to conditions at that site. The majority (86%) of the plasmids detected had molecular masses between 35 and 312 megadaltons. These plasmids were large enough to carry genes for conjugal transfer, suggesting the possibility of such transfer in this environment. One result of the technique used in this study supposedly is the reflection of a response to a generally increased level of pollutants. The values for plasmid occurrences reported are minimum values for two main reasons. First, the technique used will not detect plasmids which are integrated with the host chromosome (i.e. episomes). Second, the band of chromosomal DNA on the agarose gels may obscure plasmids of 25 to 35 Md. (Baker-IVI)
W85-00094

IMPACT OF COAL-COKING EFFLUENT ON SEDIMENT MICROBIAL COMMUNITIES: A MULTIVARIATE APPROACH,
Tennessee Univ., Knoxville. Dept. of Microbiology.
G. S. Sayler, T. W. Sherrill, R. E. Perkins, L. M. Mallory, and M. P. Shiaris.
Applied and Environmental Microbiology, Vol. 44, No. 5, p 1118-1129, November, 1982. 6 Fig, 2 Tab, 28 Ref.

Descriptors: *Water pollution effects, *Microbiological studies, *Industrial wastes, *Coking, Coal wastes, Alkaline phosphatase, Naphthalene, Phenanthrene, Mineralization, Nitrogen fixation, Protein, Anaerobic conditions, Methane.

The response of a natural microbial community to coal-coking wastewater contamination was described in order to predict microbial community responses to coal-conversion contaminant-induced ecosystem perturbations. A specific objective was to determine whether coal coking wastewater caused a permanent alteration in the microbial community's ability to respond to temporal changes in the environment and to evaluate that response with respect to PAH biotransformation rates. Those microbial variables that provide the greatest information in detecting changes or responses within the microbial community of a contaminated environment were also sought. Findings support the hypothesis that multiple functional measures of microbial community response are required to evaluate the effect of and recovery from environmental contamination. When long term effects are evaluated, select physiological traits such as polyaromatic hydrocarbon mineralization may not reflect population and biomass estimates of community response. (Baker-IVI)
W85-00095

EFFECT OF EFFUENT FROM A NITROGEN FERTILIZER FACTORY AND A PULP MILL ON THE DISTRIBUTION AND ABUNDANCE OF AEROMONAS HYDROPHILA IN ALBEMARLE SOUND, NORTH CAROLINA,
Puerto Rico Univ., Rio Piedras. Dept. of Biology.
T. C. Hazen, and G. W. Esch.
Applied and Environmental Microbiology, Vol. 45, No. 1, p 31-42, January, 1983. 7 Fig, 6 Tab, 35 Ref.

Descriptors: *Water pollution effects, *Industrial wastes, *Aeromonas, *Albemarle Sound, *North Carolina, Pulp and paper industry, Kraft process, Fertilizers, Pulp wastes, Nutrients, Phosphates, Phytoplankton, Nitrates, Epizootics, Fish diseases, Roanoke River, Chowan River, Estuaries.

The densities of Aeromonas hydrophila in Albemarle Sound were studied to determine if they were affected by the industrial waste effluents present in the area. Albermarle Sound is a natural estuary with a mean depth of 3 m, a maximum depth of 20 m and a shoreline length of 600 km. The total watershed covers 45,695 sq km. The two main tributaries are the Roanoke River and the Chowan River. A Kraft pulping process papermill is located on the Roanoke River, discharging 147,000,000 liters/day into Welch Creek, a small feeder that joins the Roanoke River. A nitrogen fertilizer factor near Winton, N.C., on the lower Chowan River released 544 kg of total nitrogen each day during this study into the Chowan River. The impact of the pulp mill on water quality was acute, whereas that of the nitrogen fertilizer factory was chronic and much more subtle. A. hydrophila survival is increased by pulp mill effluent and decreased by nitrogen fertilizer factory effluent. A. hydrophila was directly affected by phytoplankton density and, thus, indirectly by concentrations of phosphate, nitrate, and total organic carbon. These two point sources are suspect as indirect causes of red-sore disease epizootics, a disease of fish caused by A. hydrophila. (Baker-IVI)
W85-00096

UPSTREAM MIGRATION BY YOUNG PIGMENTED FRESHWATER EELS (ANGUILA AUSTRALIS AUSTRALIS RICHARDSON) IN TASMANIA,
Tasmanian Inland Fisheries Commission, Hobart (Australia).
For primary bibliographic entry see Field 6G.
W85-00131

ANTIMONY AND THALLIUM TOXICITY TO EMBRYOS AND LARVAE OF FATHEAD MINNOWS (PIMEPHALES PROMELAS),
EG and G Bionomics, Wareham, MA.
G. A. LeBlanc, and J. W. Dean.
Bulletin of Environmental Contamination and Toxicology, Vol. 32, No. 5, p 565-569, April, 1984. 1 Tab, 16 Ref. EPA contract 78-01-4646.

Descriptors: *Water pollution effects, *Antimony, *Thallium, *Minnows, Adsorption, Fish, Larval growth stage, Hatching, Embryonic growth stage, Metals.

Fathead minnow embryos hatched normally when exposed to antimony concentrations as high as 7.5 microg/L. Survival and growth of larvae was also unaffected from exposure to antimony concentrations at this level. Solutions saturated with antimony, as antimony trioxide, appear therefore not to be toxic to fathead minnows. No fathead minnow embryos survived exposure to 720 microg/L thallium. Significantly fewer embryos exposed to 350 micro g/L successfully hatched than would be normally expected. Embryos were not affected by exposure to thallium concentrations as high as 200 microg/L. No fathead minnow larvae survived exposure to 350 microg/L thallium. Larvae survival was significantly reduced from exposure to thallium concentrations as low as 40 microg/L. The Maximum Acceptable Toxicant Concentration for thallium, as thallium sulfate, is estimated to be less than 40 micro g/L. Thallium exhibited considerable chronic toxicity. (Baker-IVI)
W85-00134

FISH MORTALITY FOLLOWING APPLICATION OF PHENTHOATE TO FLORIDA CITRUS,
Agricultural Research and Education Center, Lake Alfred, FL.
H. N. Nigg, J. H. Stamper, R. M. Queen, and J. L. Knapp.
Bulletin of Environmental Contamination and Toxicology, Vol. 32, No. 5, p 587-596, April, 1984. 5 Tab, 1 Ref.

Descriptors: *Water pollution effects, *Fish, *Phenthoate, *Florida, *Citrus fruits, Gastropods, Insects, Toxicity, Mortality, Pesticides, Bass, Bluegill.

Florida citrus growers regularly apply pesticides near bodies of water and also may pump water from nearby lakes and ditches to supply spray machines. On April 27, 1982, 4 lb/gal emulsifiable phenthoate was applied to 33 acres of mature citrus trees at a rate of 10 lb phenthoate AI/A. Water was pumped into the supply vehicle from a pond and, as the vehicle was filling, pesticides were added to the tank. All precautions were taken to prevent pesticide from entering the pond. Each sampling day the near shoreline regions of the control and treatment ponds were inspected for dead or dying aquatic organisms. None were observed in the control pond. Uncaged fish were still active postspray and demonstrated no observable problems. In the treatment pond no dead or dying organisms were noted 3 hr after application. On day 1 postapplication, dragonflies, cove-headed grasshoppers, angular winged katydid, and various species of snails were dead or dying on the surface of the pond. One dead bass and 30 bluegills were retrieved. On day 2 more dead fish were retrieved. During the next several days, additional dead fish appeared on the surface of the treatment pond. No live fish were observed in the treatment pond from day 2 to day 8, but 3 small live minnows were noted at the boat launch on day 8. Fish in treatment cages, when alive, appeared to be in shock and responded sluggishly when prodded. The western side of the treatment pond received more drift than the eastern half, consistent with westerly winds observed during application. (Baker-IVI)
W85-00135

TOXICITY AND ACCUMULATION OF MERCURY IN FISH, THE HIMEDAKA ORYZIAS LATIPES,
Tokyo Univ. of Fisheries (Japan).
Y. Nagashima, T. Kikuchi, and M. Chiba.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 50, No.1, p 95-99, January, 1984. 7 Fig, 11 Ref.

Descriptors: *Mercury, *Bioaccumulation, *Oryzias, *Himedaka, *Toxicity, Methyl mercury, Mercuric chloride, Mortality, Heavy metals, Organomercury compounds, Water pollution effects.

The toxicity of mercury to Himedaka (Oryzias latipes) was assessed at exposures of 100-1000 ppb mercuric chloride and 50-300 ppb methyl mercuric chloride (MeHgCl) in water tanks using the static water method. LC50 values obtained were 700 ppb and 155 ppb for HgCl2 and MeHgCl, respectively. In live fish 25 ppm was the maximum concentration regardless of the concentration of HgCl2 used for rearing. Concentrations in dead fish were very high, ranging from 41-58 ppm when reared in 600

1000 ppb HgCl2 solutions. No conversion of HgCl2 to MeHgCl was noted. The percentage of organic mercury in total Hg in fish reared in MeHgCl solutions was fairly consistent, being 60-90%. No evidence was found for the conversion of methyl mercury to other forms of mercury in fish bodies. Accumulation of mercury in Himedaka was not observed in the group reared with the feed containing mainly HgCl2. Throughout the 5 week period the total Hg concentration remained less ha 0.1 ppm. In contrast, gradual accumulation was observed in the other group of fish reared with the eed containing mainly methyl mercury. The total Hg concentration reached 0.34 ppm after 5 weeks, 5-95% of which was methyl mercury. (Baker-VI)
V85-00138

EASONAL CHANGE IN THERMAL TOLER-NCE OF COMMON ESTUARINE CRUSTA-EANS,
/niversidad de Oriente, Cumana (Venezuela). Inst. Oceanografico.
. S. Chung, and K. Strawn.
ulletin of the Japanese Society of Scientific Fish-ies, Vol. 50, No. 3, p 451-456, 1984. 2 Fig, 2 Tab, 5 Ref.

escriptors: *Crustaceans, *Cooling towers, Thermal pollution, *Survival, *Bacliff, *Texas, alveston Bay, Water temperature, Seasonal varia-on, Estuarine environment, Intake canals, Canals, ntrainment.

ne common estuarine crustaceans collected in the ake canal of the P. H. Robinson Generating ation, Bacliff, Texas, were tested for 180 minutes various discharge canal temperatures during ne 1974 through September 1975 to determine if ey could survive passage through a discharge oling system. Temperature ranged from 13.0 to 1 degrees C in the intake canal, from 14.4 to 2 in the discharge canal above the cooling vers, and from 22.3 to 37.8 below the cooling vers. Before June and after September efferent peratures were usually under 35 degrees C and cooling towers were not operated. Three-hr 50 temperatures were significantly higher, oughout the year, than the temperatures in the charge canal downstream from the cooling vers, indicating that crustaceans should survive sage to Galveston Bay. The thermally critical iod of the year for the crustaceans entrained entrapped from intake water and exposed to discharge effluent is the summer, especially e-August, when discharge canal temperatures nearly 40 degrees or greater. (Baker-IVI)
5-00140

AWNING SITE WATER CHEMISTRY AND KE TROUT (SALVELINUS NAMAYCUSH) FRY SURVIVAL DURING SPRING OWMELT,
ario Ministry of Natural Resources, Toronto.
. Gunn, and W. Keller.
adian Journal of Fisheries and Aquatic Scienc-Vol. 41, No. 2, p 319-329, February, 1984. 6 1 Tab, 43 Ref.

criptors: *Trout, *Snowmelt, *Aluminum, dic water, *Fish fry, *Whitepine Lake, *On-, Acid precipitation, Mortality, Spawning, Hy-en ion concentration, Water pollution effects.

uations of pH associated with snowmelt can r in poorly buffered lakes receiving high acid ngs. For fall spawning fish, especially species spawn near shorelines in shallow waters, the g of hatch, yoke absorption, and emergence subject progeny to depressed pH levels and ted lithologically derived aluminum concen-ns produced by snowmelt. Aluminum appears use fish mortalities under acidic conditions. g the spring of 1982, lake trout (Salvelinus ycush) sac fry were incubated at a spawning n Whitpain Lake, 90 km north of Sudbury, io, a pH 5.7 lake with a history of lake trout tment failure. Snow-pack pH ranged from 5.2 and rainfall pH ranged from 3.6 to 4.9. short episodes of substantial pH depression red at the spawning site. Observed sac fry mortalities (18%) occurred primarily during the longest depression (5 d at pH 4.5-5.0), which coincided with maximum surface runoff and peaks in concentrations (approximately 50 micro g/L) of inorganic (monomeric) Al. Although most mortalities were coincident with low pH and elevated inorganic Al concentrations, the high survival (82%) demonstrated that under natural conditions most sac fry could tolerate pH < 5.0 and inorganic Al concentrations of 40-50 micro g/L for at least 5 d. Substantially higher concentrations of inorganic Al (approximately 80 micro g/L) were observed in the interstitial waters of the spawning rubble than in ambient waters, which indicated that fry within a spawning substrate may be subjected to more toxic conditions than test fry in incubators above the substrate surface. Conventional open-water sampling programs, and field and laboratory bioassays, may not adequately describe responses of natural populations to acidification. (Collier-IVI)
W85-00150

EMPIRICAL PREDICTION OF CRUSTACEAN ZOOPLANKTON BIOMASS AND PROFUNDAL MACROBENTHOS BIOMASS IN LAKES,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W85-00152

FATE OF KEPONE AND MIREX IN THE AQUATIC ENVIRONMENT,
Columbia National Fisheries Research Lab., MO.
For primary bibliographic entry see Field 5B.
W85-00160

ACUTE TOXICITY, BIOCONCENTRATION, AND PERSISTENCE OF AC 222,705, BENTHIOCARB, CHLORPYRIFOS, FENVALERATE, METHYL PARATHION, AND PERMETHRIN IN THE ESTUARINE ENVIRONMENT,
Environmental Research Lab., Gulf Breeze, FL.
S. C. Schimmel, R. L. Garnas, J. M. Patrick, Jr., and J. C. Moore.
Journal of Agricultural and Food Chemistry, Vol. 31, No. 1, p 104-113, January-February, 1983. 3 Fig, 8 Tab, 52 Ref.

Descriptors: *Toxicity, *AC 222,705, *Benthiocarb, *Chlorpyrifos, *Fenvalerate, *Methyl parathion, *Permethrin, *Biological magnification, *Persistence, Pyrethroids, Oysters, Partition coefficient, Solubility, Crustaceans, Sheepshead minnows, Pesticide kinetics, Organophosphorus pesticides, Bioaccumulation.

Six pesticides were evaluated in laboratory studies to determine acute (96-h) toxicity, octanol-water partition coefficient (log P), solubility, and persistence in seawater. In addition, three of the six pesticides (synthetic pyrethroids) were tested by using the eastern oyster (Crassostrea virginica) in long-term (28-day) tests to determine their respective bioconcentration factors (BCF). Acute toxicity tests provided the following decreasing order of toxicity to estuarine crustaceans and fishes: AC 222,705, fenvalerate, permethrin, chlorpyrifos, methyl parathion, and benthiocarb. The estuarine mysid (Mysidopsis bahia) was consistently the most sensitive species, with LC50 values as low as 0.008 micro g/L. The sheepshead minnow (Cyprinodon variegatus) was generally the least sensitive (range of LC50 values = 1.1-1370 micro g/L). log P values were inversely related to solubility in seawater. The following are the increasing order of log P values (range 1.8-6.5) and decreasing order of solubility (range > 1000-24 micro g/L): methyl parathion, benthiocarb, chlorpyrifos, AC 222,705, fenvalerate, and permethrin. Pesticide half-lives in sediment-water studies range from 1.2 to 34 days and were in the following order of increasing persistence: methyl parathion, permethrin, benthiocarb, AC 222,705, chlorpyrifos, and fenvalerate. The steady-state BCF's of the three synthetic pyrethroids were 1900 for permethrin, 2300 for AC 222,705 and 4700 for fenvalerate. After termination of the exposure, each insecticide was depurated by oysters to nondectable concentrations within 1 week. (Author's abstract)
W85-00163

ACEPHATE IN RAINBOW TROUT (SALMO GAIRDNERI): ACUTE TOXICITY, UPTAKE, ELIMINATION,
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences.
G. H. Geen, B. A. McKeown, and P. C. Oloff.
Journal of Environmental Sciences and Health, Vol. B19, No. 2, p 131-155, June, 1984. 3 Fig, 4 Tab, 30 Ref.

Descriptors: *Acephate, *Trout, *Toxicity, *Elimination, *Bioaccumulation, Organophosphorus pesticides, Biological magnification, Methamidophos, Partition coefficient, Water pollution effects.

The 96-h LC50 of acephate, a water-soluble organophosphorus insecticide, averaged 2,740 ppm for rainbow trout. Such low acute toxicity is apparently unique among commercial insecticides. Uptake of acephate by trout from water was rapid and reached equilibrium concentrations (4 to 6% of ambient concentrations) in 5 to 8 days. Methamidophos, a metabolite of acephate, formed rapidly, reaching approximately 25% of the acephate concentrations in the fish. Elimination of 50% of acephate and methamidophos from rainbow trout required 1.73 to 2.43 days. Neither acephate nor methamidophos were bioconcentrated in the trout (mean biconcentration factor = 0.0533). Predictions of bioconcentration of acephate, based on its water solubility, its octanol/water partition coefficient, or based on relationships developed in other studies, did not, as a rule, agree with the experimental results. (Author's abstract)
W85-00169

EFFECTS OF ACEPHATE (ORTHENE) ON DEVELOPMENT AND SURVIVAL OF THE SALAMANDER, AMBYSTOMA GRACILE (BAIRD),
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences.
G. H. Green, B. A. McKeown, T. A. Watson, and D. B. Parker.
Journal of Environmental Sciences and Health, Vol. B19, No. 2, p 157-170, June, 1984. 2 Fig, 16 Ref.

Descriptors: *Acephate, *Orthene, *Salamanders, Toxicity, Organophosphorus pesticides, Water pollution effects, Hatching, Eggs, Larval growth stage, Mortality, Growth rates.

The effects of acephate, a water-soluble organophosphorus insecticide, on the early growth and survival of the salamander, Ambystoma gracile, were examined. The 96-h LC50 for 69-day old larvae was 8816 mg/L. Exposure of egg masses to concentrations up to 798 mg/L did not produce significant differences in mortality up to the time of hatching. Larval mortality in the first 7 days after hatching increased at the higher acephate concentrations but declined in the period day 7-29 to low rates independent of acephate concentration. Growth rate decreased and morphological abnormalities increased in larvae exposed to 382 and 798 mg/L acephate. This component of lake fauna would be little affected by insect control programs which use acephate since maximum surface water concentrations would probably be < 1 mg/L. (Author's abstract)
W85-00170

IN VITRO EFFECTS OF ACEPHATE ON ACETYLCHOLINESTERASE ACTIVITY IN THE BRAIN AND GILLS OF RAINBOW TROUT, SALMO GAIRDNERI,
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences.
T. A. Watson, P. A. G. Tilley, B. A. McKeown, and G. H. Geen.
Journal of Environmental Sciences and Health, Vol. B19, No. 2, p 171-181, June, 1984. 1 Fig, 1 Tab, 20 Ref.

Descriptors: *Acetylcholinesterase, *Brains, *Gills, *Trout, *Acephate, Toxicity, Organophosphorus pesticides, Water pollution effects, Orthene, Esterase activity.

The in vitro effects of acephate (Orthene), a water-soluble organophosphorus (OP) insecticide, on acetylcholinesterase (AChE) activity in rainbow trout tissues were investigated over an acephate concentration range of 1,000 mg/L (5.5 mM) to 25,000 mg/L (136 mM). A recognized toxic action of OP insecticides is the direct inhibition of AChE with the consequent hyperstimulatory neurotransmitting action of acetylcholine. Measurements of in vitro AChE activity were based on the difference between total esterase activity and esterase activity in the presence of .0001 M eserine. A decline of AChE activity to < 18% of control activity, a level previously reported to be associated with fish mortality, was reached at concentrations of 25,000 mg/L. In vitro concentrations required to produce 50% inhibition of AChE in the brain and gill were 12,600 mg/L and 14,100 mg/L respectively. Since such concentrations would not occur in natural waters following use of acephate to control terrestrial insect pest populations, fish mortalities would not be expected. (Collier-IVI)
W85-00171

INFLUENCE OF EXPERIMENTAL SEWAGE POLLUTION ON LAGOON PHYTOPLANKTON,
Institute of Geological Sciences, Nottingham (England). Geochemistry and Petrology Div.
N. Fanuko.
Marine Pollution Bulletin, Vol. 15, No. 5, p 195-198, 1984. 5 Fig, 12 Ref.

Descriptors: *Phytoplankton, *Population dynamics, *Water pollution effects, *Wastewater pollution, *Lagoons, Coastal areas, Chlorophyll a, Biomass, Seasonal variation.

Phytoplankton populations were examined in two experimental basins during an in situ enrichment program in coastal lagoons at Stunjan, north Adriatic, from 1976 to 1978. Within a large lagoon two experimental basins were constructed, 63 sq m each, one of them receiving 300 l of primary settled municipal sewage and the other one serving as the control. In the clean lagoon the phytoplankton exhibited regular seasonal variations. During the warm part of the year the lagoon was rich in phytoplankton. The phytoplankton growth in the polluted lagoon, however, showed marked symptoms of inhibition. Chlorophyll a values were significantly reduced in the polluted lagoon and the cell density was significantly lower too. There was no correlation at all between chlorophyll a and cells in the polluted lagoon, while in the clean one a significant relationship between the two variables was found. (Baker-IVI)
W85-00202

MERCURY LEVELS IN BROOK TROUT (SALVELINUS FONTINALIS) FROM SELECTED ACID AND LIMED ADIRONDACK LAKES,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Natural Resources.
R. Sloan, and C. L. Schofield.
Northeastern Environmental Science, Vol. 2, No. 3/4, p 165-170, 1983. 1 Fig, 3 Tab, 22 Ref.

Descriptors: *Trout, *Mercury, *Adirondack Mountains, *New York, *Liming, Acid lakes, Acidity, Heavy metals, Water pollution effects, Hydrogen ion concentration.

Liming of acidified lakes is effective in maintaining pH levels conducive to fish survival and has been extensively employed in acid lakes of the Adirondack Mountains of New York. Concern that liming might increase mercury body burdens in fish led to the sampling and analysis by atomic absorption spectrophotometric methods of whole brook trout (Salvelinus fontinalis) from 15 small lakes. Brook trout inhabiting acid drainage lakes with pH 5 exhibited significantly higher mercury concentrations than more alkaline acid drainage, seepage and bog type lakes. There was no evidence of increased mercury uptake by brook trout due to liming practices utilized in Adirondack lakes. None of the brook trout or other species sampled from the Adirondack lakes in this study had mercury concentrations greater than the Food and Drug Administration action level of 1.0 ppm. (Baker-IVI)
W85-00204

IN-SITU BIOASSAYS OF FISH MORTALITY IN TWO PENNSYLVANIA STREAMS ACIDIFIED BY ATMOSPHERIC DEPOSITION,
Pennsylvania State Univ., University Park. School of Forest Resources.
W. E. Sharpe, W. G. Kimmel, E. S. Young, Jr., and D. R. DeWalle.
Northeastern Environmental Science, Vol. 2, No. 3/2. p 171-178, 1983. 4 Fig, 3 Tab, 22 Ref.

Descriptors: *Fish, *Mortality, *Acid streams, *Pennsylvania, *Bioassay, Water quality, Acid rain, Water pollution effects, Atmospheric deposition, Hydrogen ion concentration, Aluminum, Toxicity, Trout, Sculpin.

A limited in-situ bioassay of fish mortality for the species Salvelinus fontinalis, Salmo gairdneri, Salmo trutta and Cottus bairdi was conducted on two streams, Wildcat and McGinnis Runs, during February and March 1982. Both streams are suffering from varying degrees of acidification attributed to atmospheric deposition. These streams are located on adjacent watersheds on the Laurel Hill in southwestern Pennsylvania. Bioassay tanks were set up along each stream and maintained by a gravity flow of stream water. The less acidified stream, Wildcat Run, served as control. Observations of water quality during the experiment revealed severe depressions of pH and increases of total aluminum in the water of McGinnis Run and similar but much less severe changes on Wildcat Run. Trout mortality in McGinnis Run commenced during the first 24 hr of exposure. By the end of 9 days, all wild and hatchery-reared trout had succumbed with the exception of wild brook trout. Nearly all fish and invertebrates in the Wildcat Run tank survived beyond the study period and showed no signs of stress. The mottled sculpin was the most tolerant of all fish tested. Allonarcys proteus was the most tolerant organism, although this organism is not found in McGinnis Run. Microscopic examination of the gill filaments of the dead fish revealed the presence of a yellowish deposit characteristic of aluminum toxicity. Fish stress symptoms at the time of death and species tolerance differences were also typical of low pH-high aluminum toxicity. The lack of more detailed aluminum analysis obviates the conclusion that aluminum was a factor in the deaths of the McGinnis Run fish. (Baker-IVI)
W85-00205

ACID RAIN: NEW SO2 CONTROLS INEVITABLE,
L. Catalano, and J. Makansi.
Power, Vol. 127, No. 9, p 25-33, September, 1983. 2 Fig, 1 Tab.

Descriptors: *Acid rain, *Legislation, *Sulfur dioxide, *Water pollution control, Powerplants, Utilities, Scrubbers, Waste treatment, Air pollution control, Acid lakes.

Acid dead lakes are believed to result from the poor buffering qualities of the surrounding soils, rather than from rain falling directly into the lakes. Lakes are not the only victims. Damage to vegetation is extreme in some areas. Environmentalists urge that the only way to stop this ecological damage is to reduce emissions at the powerplants. Utilities vehemently protest this presentation of the problem urging that more conclusive evidence be gathered, perhaps through the use of radioactive tracer elements placed in the emissions of midwestern powerplants and the path of the gases followed. The differences of opinion voiced by the environmentalists vs the utilities makes coming to a decision on this issue very difficult. The various legislative proposals that Congress has to choose from are outlined. Fueling the debate over the various proposals is an inundation of reports from scientific research organizations. Options open to industry to meet the acid-rain emission limits include wet lime/limestone flue-gas desulfurization (FGD), FGD with product recovery, physical coal cleaning, low-sulfur coal switch, spray-dryer FGD, atmospheric fluidized-bed combustion, limestone-injection multistage combustion, and post-injection dry-sorbent injection. (Baker-IVI)
W85-00210

ANALYSIS OF CILIATA FROM POLLUTED SECTOR OF THE RIVER DRWINKA ON THE BASIS OF BINARY DATA,
Jagiellonian Univ., Krakow (Poland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 2 .
W85-00223

OCCURRENCE OF WATER MITES (HYDRACARINA) IN THE RIVER WIEPRZ POLLUTED WITH DOMESTIC-INDUSTRY SEWAGE,
Akademia Rolnicza, Lublin (Poland). Dept. of Zoology and Hydrobiology.
W. Kowalik, and E. Biesiadka.
Acta Hydrobiologica, Vol. 23, No. 4, p 331-348, 1981. 3 Fig, 5 Tab, 20 Ref.

Descriptors: *Mites, *Rivers, *Water pollution effects, *River Wieprz, *Poland, Bioindicators, Industrial waste, Municipal waste.

The occurrence of Hydracarina was investigated in the River Wieprz, which is polluted with domestic-industry sewage. A total of 42 species of water mites was found. Species structure showed great similarity with Polish lowland rivers. Three main groups of species were distinguished. The most interesting group was connected mainly with mountain and submontane running waters and included Lebertia pilosa, L. slovenica, Torrenticola stadleri, Hygrabates longiporus, Satractides tener, and Mideopsis roztoczensis. The second group was the most numerous and was constituted by largely spread water mites including Hygrobates nigromaculatus, Lebertia porosa, and Hygrobates fluviatilis along with Sperchon setiger, Lebertia inaequalis, Hygrobates calliger, and Sperchon clupeifer. The third, fairly large group consisted of species connected with stagnant waters. There was an evident, negative correlation between the abundance of water mites and the number of their species and the degree of water pollution. The possibility of using water mites as indicators of the level of water pollution was estimated. (Baker-IVI)
W85-00224

EFFECT OF WASTE WATER ON CILIATE COMMUNITIES IN THE BIALA PRZEMSZA RIVER,
Jagiellonian Univ., Krakow (Poland). Inst. of Environmental Biology.
For primary bibliographic entry see Field 2H.
W85-00227

GROUPS OF PELAGIC ZOOPLANKTON IN THREE LAKES OF DIFFERENT TROPHY,
Akademia Rolnicza, Lublin (Poland). Dept. of Zoology and Hydrobiology.
For primary bibliographic entry see Field 2H.
W85-00228

ZONATION OF MAYFLIES (EPHEMEROPTERA) IN SEVERAL STREAMS OF THE TATRA MTS AND THE PODHALE REGION,
Polish Academy of Sciences, Krakow. Zaklad Ochrony Przyrody i Zasobow Naturalnych.
For primary bibliographic entry see Field 2H.
W85-00229

EFFECT OF RAIN WATERS ON LEAD LEVEL IN THE VISTULA IN THE REGION OF CRACOW AGGLOMERATION,
Instytut Ksztaltowania Srodowiska, Krakow (Poland).
I. Skoczen.
Acta Hydrobiologica, Vol. 24, No. 2, p 95-107, 1982. 2 Fig, 3 Tab, 9 Ref.

Descriptors: *Lead, *Water quality, *Storm runoff, *Krakow, *Vistula, *Poland, Snowmelt.

rban runoff, Public health, Drinking water, Diurl variation, Seasonal variation.

he quantity and duration of polluted runoff was vestigated in the Vistula in the region of Cracow. ay and night variations of lead level were estabhed under various hydrological and meteorologil conditions. The problem was to investigate the namics of pollutant variations of the Vistula in pendence on the character, intensity, and locaon of atmospheric precipitations. The starting int of the study was protection of the water ken in for drinking purposes and necessity of imating the sanitary state of the catchment area the Upper Vistula. The lowest amount of lead riability was found during the dry period. uring the precipitation and thaw periods the day d night variability was considerably higher and pended on the amount of runoff pollution and cation of atmospheric precipitation. The quantity lead loads during precipitation periods was conioned by the character and location of atmosric precipitation. Greatest lead loads occurred ing periods of continuous precipitation. In some es, maximum lead concentrations exceeded the el for the third class of surface water purity in and. Storing water for drinking purposes proded mainly during periods of high flow. (Baker-
)
5-00230

FECT OF RAIN WATERS ON SALINITY RIATION OF THE VISTULA IN THE GION OF CRACOW AGGLOMERATION THE EXAMPLE OF CHLORIDES),
ytut Ksztaltowania Srodowiska, Krakow and).
koczen.
a Hydrobiologica, Vol. 24, No. 2, p 109-124, 2. 2 Fig, 6 Tab, 12 Ref.

criptors: *Salinity, *Storm runoff, *Vistula, akow, *Poland, *Rain, *Chlorides, Water qualontrol, Diurnal variation, Snowmelt.

rides are the main components of salinity of Vistula in the region of Cracow agglomeration. rides do not undergo sedimentation for self-ication processes, thus eliminating the impact ater stages on the decrease in concentration es. A quantitative determination was made of hlorides in the runoff and their influence on Vistula in this region. Secondly, day and night tigations of the Vistula were made to deterthe variation in salinity of the Vistula during al periods and to examine the pollutant load e river. Lowest chloride loads were found in dry period in all the years investigated. In ds of precipitation and thawing the loads higher. Highest loads were found during nuous precipitation localized in the region and the Kracow agglomeration. Increases in sa-of the Vistula were dependent on the amount nospheric precipitation occurring to a greater than on other factors. The diurnal variation oride loads was dependent to a great extent teorological factors. Lowest load values and t variablity were found in the dry period. r-IVI)
0231

POSITION AND ZONATION OF HIC INVERTEBRATE COMMUNITIES OME CHEMICALLY STRESSED AQUATABITATS OF NIEPOLOMICE FOREST TH POLAND),
Academy of Sciences, Krakow. Zaklad ny Przyrody i Zasobow Naturalnych.
tnal, and E. Dumnicka.
Hydrobiologica, Vol. 24, No. 2, p 151-165, Fig, 3 Tab, 11 Ref.

ptors: *Invertebrates, *Water pollution ef-*Forest watersheds, *Niepolomice Forest, d, Acid waters, Dissolved oxygen, Organic Oligochaetes, Chironomids, Benthos.

ypes of the invertebrate communities are ished in which Oligochaeta and Chironoare dominant groups. The changes of some al factors along the water course under study are presented along with their influences on the benthic macroinvertebrate community population. High acidity of the water causes a reduction in the number of taxons found at chemically stressed sites. The Niepolomice Forest area, the study site, is divided by the Drwinka River into a southern and a northern part. In the northern part a decidous forest predominates, while the southern part is mixed. Thirteen study sites were chosen, 4 along the middle stretch of the Drwinka River, 5 along the Traczowka Stream in the southern part of the forest, 2 sites in the lode in the southern part of the forest, tributary of the Traczowka Stream, and two sites in the lode in the northern part of the forest area. Very characteristic changes in acidity were noted along the stream. The lowest value, below 5, occurred in the southern lode and pH below 6 was ascertained in the middle stretch of the Traczowka Stream. Among acidifying compounds chlorides and sulfates were abundant in the waters in the forest area. Changes in the carbon dioxide content, accompanied by the changes in the content of calcium and magnesium seem to influence pH. The levels of CO2 and of pH value are almost inversely proportional at all sites, and only the ability of calcium and magnesium to buffer bicarbonates modifies this proportion. The content of the oxygen dissolved in the water at all sites was quite sufficient. COD and oxidizability levels reveal that the forest waters are rich in organic matter, consisting mainly of humus compounds resistant to bacterial decomposition. (Baker-IVI)
W85-00233

RECENT TROPHIC CHANGES IN KOOTENAY LAKE, BRITISH COLUMBIA, AS RECORDED BY FOSSIL DIATOMS,
Department of Fisheries and Oceans, Vancouver (British Columbia). Field Services Branch.
For primary bibliographic entry see Field 2H.
W85-00249

SIMULATING THE BIOLOGICAL EFFECTS OF TOXICANTS IN AQUATIC MICROCOSM SYSTEMS,
Washington Univ., Seattle. School of Fisheries.
G. Swartzman, and K. A. Rose.
Ecological Modelling, Vol. 22, No. 104, p 123-134, 1983/1984. 5 Fig, 1 Tab, 15 Ref.

Descriptors: *Microcosms, *Water pollution effects, *Model studies, *Simulation, Bioassay, Toxicity, Aquatic environment, Mathematical equations, Phytoplankton, Zooplankton, Nitrogen, Phosphorus, Mesocosms.

A multistage experimental approach involving laboratory bioassays, microcosms and mesocosms is proposed for assessing the effect of toxicant loading to an aquatic system. Simulation models can tie these experiments together and predict the response of natural ecosystems. The model simulator allows comparison of alternative equations from a number of models. The model structure includes 8 functional groups of phytoplankton, 5 groups of zooplankton, and nitrogen and phosphorus. The model consists of a system of non-linear differential equations representing, for each functional group, the rates of change of plankton biomass. Nutrient flows for phosphorus and nitrogen are also represented in the model. For equation calibration, a series of experiments was chosen offering substantially different environmental conditions with essentially the same biota, thereby allowing exposure of the model to a variety of conditions. The equations comparison is facilitated through a simulator called AEGIS (Aquatic Ecosystem General Impact Simulator) which allows selection of compatible groups of process equations in all possible combinations. Once the phytoplankton-zooplankton model is calibrated to the control microcosms, the next step is the linking of the effects of a toxicant to the biological processes in the model. For both phytoplankton and zooplankton, the toxicant effects must be related to the concentration of toxicant to which the organisms are exposed over time. (Moore-IVI)
W85-00261

EFFECT OF CUPRIC CHLORIDE ON OXIDATIVE METABOLISM IN THE FRESHWATER TELEOST, TILAPIA MOSSAMBICA,
Sri Venkateswara Univ., Tirupati (India). Pesticide and Industrial Toxicology Centre.
M. Balavenkatasubbaiah, A. Usha Rani, K. Geethanjali, K. R. Purushotham, and R. Ramamurthi.
Ecotoxicology and Environmental Safety, Vol. 8, No. 3, p 289-293, June, 1984. 3 Tab, 11 Ref.

Descriptors: *Cupric chloride, *Tilapia, *Metabolism, *Toxicity, *Copper, Enzymes, Fish behavior, Stress, Oxidative metabolism, Succinate dehydrogenase, Lactate dehydrogenase.

The freshwater teleost Tilapia mossambica was subjected to lethal (6.0 mg/l = LC50/48 hr) and sublethal (1.5 mg/l copper treatment for 1, 7, and 14 days. The behavioral responses of fish exposed to lethal concentrations of CuCl2 include slight exitation, irregular body movements, and increase in gill opercular movements. The unit metabolism of fish exposed to lethal and sublethal concentrations showed a significant ($P < 0.001$) decrease over the control animals. The stressed fish appear to be meeting the energy requirements through anaerobic oxidation, as indicated by elevated lactate dehydrogenase and decelerated succinate dehydrogenase activities that can be interpreted as a functional/physiological adaptation during copper intoxication and that these enzymes can be used as good indicators of the metal-induced stress. (Moore-IVI)
W85-00271

BIOCHEMICAL AND HEMATOLOGICAL STUDIES ON PERCH, PERCA FLUVIATILIS, FROM THE CADMIUM-CONTAMINATED RIVER EMAN,
Goeteborg Univ. (Sweden). Dept. of Zoophysiology.
M.-L. Sjobeck, C. Haux, A. Larsson, and G. Lithner.
Ecotoxicology and Environmental Safety, Vol. 8, No. 3, p 303-312, June, 1984. 1 Fig, 3 Tab, 46 Ref.

Descriptors: *Perch, *Cadmium, *Eman, *Sweden, Water pollution effects, Toxicity, Industrial wastes, Blood, Fish, Immune response, Metabolism.

Since the beginning of the century, the lower reach of the Eman river system (Sweden) has been polluted by a discharge of cadmium and nickel from an accumulator factory at Fliseryd. The discharge of metals ceased when the factory was closed down in 1976, but there are still elevated cadmium levels in sediments and water downstream from Fliseryd. In a field investigation, biochemical and hematological parameters were measured in perch, Perca fluviatilis, living in the cadmium-contaminated river Eman. The number of lymphocytes was 45-100% higher in perch from the contaminated area than in the reference perch, indicating a stimulated immune defense. In addition, the cadmium-loaded fish suffered from a slight anemia and a disturbed carbohydrate metabolism and blood plasma ion composition. The perch in Eman did not show any hyperglycemia or hypocalcemia, which are typical symptoms in cadmium-poisoned fish in laboratory experiments. The observed effects suggest that cadmium affects fish in the environment in a way similar to what has been observed in laboratory studies. The weaker response may imply that the perch in the field situation have adapted and thus acquired an increased resistance to cadmium. Biochemical and hematological methods have promise as diagnostic tools to reveal sublethal toxic responses in natural populations of fish. (Moore-IVI)
W85-00272

OIL SHALE - POTENTIAL ENVIRONMENTAL IMPACTS AND CONTROL TECHNOLOGIES,
Environmental Protection Agency, Cincinnati, OH.
E. R. Bates, W. W. Liberick, and J. Burckle.
Environmental Progress, Vol. 3, No. 2, p 107-115, May, 1984. 4 Fig, 13 Tab, 6 Ref.

Descriptors: *Oil shale, *Water pollution control, *Environmental effects, Sulfur dioxide, Wastewater treatment, Retort water.

A program was begun in 1973 to evaluate potential environmental impacts from oil-shale development activities and suggest various potential control technologies. Recent results of these activities are reported including field test results on control of sulfur gases at Occidental Oil Shale's Logan Wash Site, and Geokinetic's Kamp Kerogen Site, wastewater treatability studies on retort water and gas condensate at Logan Wash, and results of laboratory and field testing on raw and retorted oil shales. Of the various systems studied, the Stretford, EIC, MDEA, (Selectamine and Adip), Benfield, Diamox, and Selexol appear to have the potential for the greatest sulfur dioxide selectivity for application to direct fired retorts. Based on a cost evaluation of a model case, the Stretford process appears to be the most cost effective approach for direct fired retorts. (Baker-IVI)
W85-00285

NICKEL TOXICITY TO MICROBES: EFFECT OF PH AND IMPLICATIONS FOR ACID RAIN,
New York Univ., NY. Lab. of Microbial Ecology.
H. Babich, and G. Stotzky.
Environmental Research, Vol. 29, p 335-350, December, 1982. 7 Fig, 4 Tab, 39 Ref. EPA grant R808329.

Descriptors: *Nickel, *Hydrogen ion concentration, *Acid rain, *Toxicity, *Microorganisms, Bacteria, Actinomycetes, Yeasts, Fungi, Heavy metals.

A broad spectrum of microorganisms, including eubacteria (nonmarine and marine), actinomycetes, yeasts, and filamentous fungi, were evaluated for their sensitivities to nickel. Wide extremes in sensitivity of Ni were noted among the filamentous fungi, whereas the range of tolerance to Ni of the yeasts, eubacteria, and actinomycetes was narrower. With all microorganisms, the toxicity of Ni was potentiated as the pH was decreased to acidic levels. The mechanism(s) of how pH affects the toxicity of Ni has not been defined, although the formation of hydroxylated Ni species with differing toxicities was not involved. The enhanced toxicity of Ni at acidic levels may have implications for the toxicity of Ni in environments stressed by acid precipitation. (Author's abstract)
W85-00286

EFFECTS OF COPPER ON SPECIES COMPOSITION OF PERIPHYTON IN A SIERRA NEVADA, CALIFORNIA, STREAM,
Freshwater Biological Association, Wareham (England). River Lab.
H. V. Leland, and J. L. Carter.
Freshwater Biology, Vol. 14, No. 3, p 281-296, June, 1984. 5 Fig, 1 Tab, 28 Ref.

Descriptors: *Copper, *Periphyton, *Water pollution effects, *Convict Creek, *California, *Algae, Sierra Nevada, Chlorophyta, Chrysophyta, Cyanophyta, Stream biota, Species diversity, Diatoms, Species composition, Abundance, Standing crop.

Changes in species composition of the periphyton of an oligotrophic, Sierra Nevada stream (Convict Creek, California) continuously dosed for 1 year at three concentrations of copper (2.5, 5 and 10 micro g/l total Cu; approximately 12, 25 and 50 ng/l Cu(2+)) were determined. The numerically most abundant taxa were Bacillariophyceae (Achnanthes minutissima, Cocconeis placentula, Cymbella microcephala, C. sinuata, Fragilaria construens, F. crotonensis, Navicula spp., Synedra acus and S. rumpens), and the Cyanophyta Lyngbya spp., a co-dominant during spring and summer. Population densities of Lyngbya spp. were markedly reduced at all test concentrations of copper. Population densities of the principal Chlorophyta (Spirogyra spp. and Cladophora spp.) and the diatom Amphipleura pellucida were reduced at 5 micro g/l total Cu. Of the twenty-two most abundant taxa, sixteen were reduced in abundance by continuous exposure to 10 micro g/l total Cu. There was no commensurate reduction in standing crop (total number of individuals of all taxa). Achnanthes minutissima, a co-dominant in the control was the primary replacement species. Other taxa that were more abundant at 5 micro g/l total Cu than in the control were Ceratoneis arcus, Cocconeis placentula, Navicula spp. and Synedra rumpens. Only A. minutissima and Calothrix spp. were more abundant at 10 micro g/l than in the control. Three resemblance measures (Canberra metric, Bray-Curtis and Dice) and diversity (Brillouin's) were evaluated for detecting differences in species composition among experimental stream sections. The Canberra metric, an index sensitive to proportional rather than absolute differences, was the most informative of these indices. (Author's abstract)
W85-00294

DISTRIBUTIONAL PATTERNS AND HABITAT CHARACTERISTICS OF AMPHIPODA (CRUSTACEA) IN THE INLAND WATERS OF ISRAEL AND SINAI,
Hebrew Univ., Herusalem (Israel). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W85-00395

POPULATION GROWTH PATTERNS OF SKELETONEMA COSTATUM AND NUTRIENT LEVELS IN THE LOWER EAST RIVER, NEW YORK, U.S.A.,
Geological Survey, Reston, VA.
W. B. Samuels, G. S. Kleppel, and J. J. A. McLaughlin.
Hydrobiologia, Vol. 98, No. 1, p 35-43, January, 1983. 8 Fig, 38 Ref. EPA grant R803370030.

Descriptors: *Skelotonema, *Diatoms, *East River, *New York, *Growth rates, Water pollution effects, Phytoplankton, Nitrates, Phosphates, Silica, Seasonal variation, Nutrient requirements, Phytotoxicity.

Discharges to the lower Hudson River estuarine system (New York), which includes the East River, contribute nutrients, toxic substances, and suspended material which all may have variable effects on phytoplankton growth. The population growth patterns of the centric diatom Skeletonema costatum and nutrient levels in the lower East River were examined through field measurements and laboratory experimentation. Maximum growth rates of this diatom (approximately 1.8 divisions per day) were obtained in water samples from the late winter - early spring months. Summer water samples supported little or no growth of this diatom. Measurements of NH3-N, PO4-P, and Si in water samples from the lower East River indicated that nutrient saturated conditions exist year round in this area. During the summer months when S. costatum standing crop was low, the organism also failed to grow well in summer water samples incubated under controlled and near optimum conditions; grazing pressure is thus not limiting the population size during this period. Toxic substances in the water column may be responsible for limiting S. costatum growth during the summer months. During the summer low river flow period, the residence time of phytoplankton is longer than during the high flows experienced during the late winter and early spring; summer phytoplankton populations would be exposed for a longer period to local toxic conditions than would late winter - early spring populations. (Collier-IVI)
W85-00397

WATER QUALITY AND THE ROTIFER POPULATIONS IN THE ATCHAFALAYA RIVER BASIN, LOUISIANA,
Louisiana Cooperative Wildlife Research Unit, Baton Rouge.
L. E. Holland, C. F. Bryan, and J. P. Newman, Jr.
Hydrobiologia, Vol. 98, No. 1, p 55-69, January, 1983. 4 Fig, 4 Tab, 29 Ref. Army Corps of Engineers contract 14-16-0008-767.

Descriptors: *Rotifers, *Atchafalaya River, *Louisiana, *Water quality, Aquatic habitats, Plankton, Cluster analysis, Swamps, Species diversity, Suspended solids, Dissolved solids, Organic carbon.

The Atchafalaya Basin contains North America's largest hardwood river-swamp. The basin, a rich and dynamic system, covers 4,662 sq km in south-central Louisiana. Distributional and ecological information on the class Rotifera were compiled from both flood controlled and uncontrolled reaches of the Atchafalaya River Basin. In this study, the lower basin is that portion of the Atchafalaya system south of Interstate Highway 10. The upper basin refers to the habitats of Petite Prairie Bayou near Melville. This upper area is virtually confined by levees. In the minimally altered lower basin a variety of aquatic habitats within a small area resulted in a very diverse rotifer community consisting of an average of 46 taxa. In contrast, only an average of 28 different taxa were collected in leveed upper basin habitats. Cluster analysis identified rotifer communities associated with areas of similar water quality. Variations in suspended solids, total dissolved solids, and organic carbon were most often significantly associated with variations in rotifer numbers from the lower basin. Seasonal flushing of backwater areas by mainstream waters is very important in maintaining the diversity of these lower basin rotifer communities. (Moore-IVI)
W85-00399

TOXIC ASPECTS OF COPPER ON THE BIOMASS AND PRODUCTIVITY OF PHYTOPLANKTON OF THE SAGUENAY RIVER, QUEBEC (ASPECTS TOXIQUES DU CUIVRE SUR LA BIOMASSE ET LA PRODUCTIVITE DU PHYTOPLANCTON DE LA RIVIERE DU SAGUENAY, QUEBEC),
Quebec Univ., Chicoutimi. Dept. des Sciences Fondamentales.
R. Cote.
Hydrobiologia, Vol. 98, No. 1, p 85-95, January, 1983. 2 Fig, 3 Tab, 49 Ref.

Descriptors: *Saguenay River, *Quebec, *Copper, *Phytoplankton, *Biomass, *Productivity, Water pollution effects, Chlorophyll, Chlorella, Diatoms, Heavy metals.

The effect of copper ion (at 10, 50, 100, 200 and 400 micro g Cu/L) in vitro on chlorophyll concentrations and rates of primary productivity were studied in phytoplankton for 124 hours. The same copper concentrations were tested on Chlorella vulgaris for 8 days. These algal assays were carried out using the surface water of the Saguenay River. In natural populations of phytoplankton, photosynthesis was more sensitive than growth: at the lowest concentrations, such as 10 micro g Cu/L, copper seemed to increase the chlorophyll concentrations whereas the rates of primary production show a decrease of 60% with respect to the control. At higher concentrations of copper, the effect on chlorophyll concentrations is weak but the effect on the rates of primary production is more pronounced (decrease of 86% to 90%). The pennate diatoms are dominant (in all the samples) and these organisms are relatively resistant to copper. In Chlorella vulgaris, it was observed that with 100 micro g Cu/L, chlorophyll concentrations and rates of photosynthesis respectively decrease by 63% and 99% with respect to the control. At higher concentrations of copper, a maximum decrease of 70% and 99% respectively for chlorophyll concentrations and rates of primary production are observed. Such selection for resistant taxa in populations of phytoplankton in the Saguenay River may have important implications in the low productivity in Saguenay Fjord. (Collier-IVI)
W85-00401

AQUATIC CRYPTOGRAMS OF NATURAL ACID SPRINGS ENRICHED WITH HEAVY METALS: THE KOOTENAY PAINT POTS, BRITISH COLUMBIA,
Durham Univ. (England). Dept. of Botany.
For primary bibliographic entry see Field 2H.
W85-00402

INFLUENCE OF ACID PRECIPITATION ON BACTERIAL POPULATIONS IN LAKES,

lational Water Research Inst., Burlington (Ontar-
o). Microbiology Labs.
. S. Rao, and B. J. Dutka.
lydrobiologia, Vol. 98, No. 2, p 153-157, January,
983. 1 Fig, 1 Tab, 20 Ref.

escriptors: *Acid rain, *Bacteria, *Water pollu-
on effects, *Turkey Lake, *Ontario, *Lake
uron, *Lake Erie, *Lake St. George, Nitrogen
ducing bacteria, Sulfur bacteria, Organic matter,
lkalinity, Aerobic bacteria, Heterotrophic bacte-
a, Hydrogen ion concentration.

elative abundance of total, respiring, aerobic he-
rotrophic, nitrogen cycle, and sulfur cycle bacte-
was measured in the acid-stressed Turkey Lake
atershed (in Ontario) and compared to data col-
cted from the relatively non-acid-stressed, hard
ater Lakes Huron, Erie, and St. George. The pH
lues in Turkey Lake ranged from 5.3 to 6.5, with
average of 6.0; the alkalinity value was 3.7 mg/
CaCO3. In non-acid-stressed lakes, pH ranged
m 7.3 to 8.7, with an average of 8.2; the alkalini-
value was 75 mg/L CaCO3. Data indicated that
cterial populations and densities were nearly an
er of magnitude less in acid stressed waters than
ion-acid stressed waters. Nitrifying bacteria and
ne sulfur cycle bacteria (Thiobacillus sp.) were
y low or absent in acid stressed waters. Surface
iments of acid stressed lakes contained 3 to 4
es more organic matter (340 mg organic matter
g dry weight sediment in Turkey Lake) than
amount found in the relatively more enriched
. Acid-stressed conditions and a poor buffering
em in the Turkey Lake watershed appear to
e suppressed the bacterial populations and the
equent degradative processes. (Collier-IVI)
5-00404

**ESSED STREAM ECOSYSTEM: MA-
DINVERTEBRATE COMMUNITY INTEG-
Y AND MICROBIAL TROPHIC RE-
NSE,**
ronmental and Chemical Sciences, Inc.,
n, SC.
Kondratieff, R. A. Matthews, and A. L.
ema, Jr.
obiologia, Vol. 111, No. 2, p 81-91, April,
6 Fig, 4 Tab, 18 Ref.

riptors: *Water pollution effects, *Inverte-
s, *Microorganisms, *Stream biota, *Virginia,
trial wastewater, Wastewater pollution,
Chlorophyll a, Autotrophs, Heterotrophs.

ar-long study of a second-order stream in
western Virginia was carried out from 1979-
ne of the objectives of the study was to
ate the effects of sewage and electroplating
effluent stress on the trophic response of
c invertebrate assemblages and microbial
unities in the stream. Quantitative benthic
es were collected periodically at three refer-
tations and four stressed stations below the
s. Invertebrates were counted, identified tax-
cally, and classified into functional groups
on their feeding strategies. Ash-free dry
ts were obtained for each functional group
a and station, and the number of density of
nt taxa were calculated as well. Reference
s had diverse invertebrate assemblages;
rs were well represented and all functional
were present in reasonably equivalent pro-
ns. Stressed stations were dominated by col-
gatherers and filterers to the virtual exclu-
scrapers. The trophic status of the microbi-
munity was determined by suspending artifi-
bstrates in the stream for 1-week periods.
mmunity that colonized the substrates was
for ATP and chlorophyll a, and an auto-
index (AI) was calculated using these
The autotrophic component of the microbi-
munity was greatest at the reference sta-
nd the community became primarily hetero-
below the outfalls. The AI correlated well
e proportion of scrapers. Aquatic inverte-
ssemblages and microbial communities re-
to stress by changing their trophic struc-
fit best the available energy sources. Where
ophic microbes dominated, gathering and
invertebrates utilized the abundant organic
In areas where a mainly autotrophic micro-
bial community existed, scrapers, gatherers, and filterers were all present in balanced proportions. (Author's abstract)
W85-00415

THERMAL ALTERATION OF STREAMS DRAINING CLEARCUT WATERSHEDS: QUANTIFICATION AND BIOLOGICAL IMPLICATIONS,
Pennsylvania State Univ., University Park. School of Forest Resources.
J. A. Lynch, G. B. Rishel, and E. S. Corbett.
Hydrobiologia, Vol. 111, No. 161-169, 1984. 6 Fig, 3 Tab, 20 Ref.

Descriptors: *Water temperature, *Clearcutting, *Herbicides, *Thermal pollution, Forest management, Watershed management, Temperature effects, Logging, Environmental effects, Invertebrates, Fish, Trout.

Stream temperature alterations due to a commercial forest harvesting practice and a research treatment were quantitatively evaluated. Summer maximum stream temperatures averaged 1 C higher in the commercial clearcut and 9 C higher in the clearcut-herbicided watershed than in the forested control. The largest average monthly temperature increase on the commercial clearcut (2.2 C) occurred during April; on the clearcut-herbicided basin it occurred during June (10.5 C). The clearcut-herbicide treatment resulted in changes which could have a negative effect on the aquatic invertebrates and fish life of the stream. High maximum temperatures, large diel fluctuations, and temperatures above tolerance limits of aquatic organisms for long periods could be lethal to various organisms, including brook trout. Little change in the aquatic community would be expected with the slight stream temperature changes which occurred on the commercial clearcut. If anything, these small temperature changes, especially during the spring, may be beneficial. The increases in temperature could increase primary productivity, increasing available food for aquatic invertebrates and fish. (Moore-IVI)
W85-00421

EFFECT OF DOMESTIC SEWAGE ON SAND BEACH MEIOFAUNA AT GOA, INDIA,
National Inst. of Oceanography, Panaji (India).
Z. A. Ansari, A. Chatterji, and A. H. Parulekar.
Hydrobiologia, Vol. 111, p 229-233, 1984. 1 Fig, 5 Tab, 20 Ref.

Descriptors: *Wastewater pollution, *Beaches, *Meiofauna, *Goa, *India, Invertebrates, Seasonal variation, Water pollution effects, Monsoons.

Mandovi estuary, which opens into the Arabian Sea near Panjim on the west coast of India, receives about 1,300 million liters of urban runoff annually. A section of beach of the estuary receiving domestic sewage through a nullah, was sampled for meiofauna. Samples were collected from 3 stations along a decreasing gradient of sewage pollution during the premonsoon, monsoon and postmonsoon from February 1980 to January 1981. Nematodes dominated the fauna numerically at all stations, followed by harpacticoid copepods, oligochaetes, polychaetes, and archiannelids. Other important groups were turbellarians and gastrotrichs. Most of the animals were confined to the top 5 cm of the sediment. A seasonal pattern was observed in the distribution of the fauna. Maximum density was during premonsoon and minimum density in the monsoon season. There were significant spatial and temporal variations in mean meiofauna density, attributed to organic discharge via sewage and prevailing environmental conditions in the study area. Beach stability is an important factor. (Moore-IVI)
W85-00423

NUTRIENTS OF THE SARONIKOS GULF IN RELATION TO ENVIRONMENTAL CHARACTERISTICS (1973-1976),
Institute of Oceanographic and Fisheries Research, Athens (Greece).
N. Friligos.
Hydrobiologia, Vol. 112, No. 1, p 17-25, May, 1984. 4 Fig, 4 Tab, 24 Ref.

Descriptors: *Saronikos Gulf, *Athens, *Greece, *Nutrients, *Water pollution effects, Nitrates, Phosphates, Effluents, Wastewater pollution, Marine environments, Seasonal variation, Stratification.

Saronikos Gulf represents in many ways an excellent case for the investigation of the effects of urban waste disposal into an oligotrophic marine environment. The nutrient distribution in relation to environmental characteristics of the Saronikos Gulf was studied for the period 1973-1976 at two stations in the Gulf, an oligotrophic one in the Outer Gulf and an eutrophic one in the vicinity of the sewage outfall of the Greater Athens Area. The distribution of measured values and their spatiotemporal variations were compared with previous data for the same area. Winter convection resulted in a very weak gradient of temperature, salinity, oxygen and nutrients. Stratification started to develop in May and persisted for about six months. Little seasonal variation of nutrients appeared to occur, with higher values generally in winter. The station in the vicinity of the outfall contained more phosphate and ammonia than the station in the source water. The levels of nutrients were similar in both years, except in the case of phosphate and nitrite, which were double at the station near the outfall in 1975. Of the nutrients controlling productivity in the photic layer of the stations in the Saronikos Gulf, phosphate had a stronger limiting effect on plant growth than inorganic nitrogen. The distribution of nutrients was closely correlated with the effluent-generated nutrient-field and its consequent wind-driven distribution. (Moore-IVI)
W85-00424

5D. Waste Treatment Processes

PHOSPHORUS RENOVATION OF WASTEWATER BY OVERLAND FLOW LAND APPLICATION,
Maryland Univ., College Park. Dept. of Agronomy.
R. R. Weil and F. S. Payer.
Available from the National Technical Information Service, Springfield, VA 22161, as PB84 19018, Price code: A03 in paper copy, A01 in microfiche. Maryland Water Resources Research Center Publication No. 74, August 1983. 33 p, 8 Fig, 5 Tab, 21 Ref. OWRT Project No. A-061-MD (1), Contract/Grant No. 14-34-0001-2122.

Descriptors: *Wastewater treatment, *Wastewater disposal, Wastewater irrigation, Soil contamination, Adsorption, Canarygrass, Reeds, Coastal Plains, *Land application, Monitoring.

A study was set up to monitor an operating overland flow wastewater system on soils derived from clayey coastal plain sediments. Three treatments were imposed on the Reed Canarygrass (Phalaris canarlensis) cover; cut 4 times per year and leave residue; cut 4 times and harvest residue; and cut 1 time and leave residue. Effluent was sampled at 6, 12, 18, and 27 m from the point of application as well as from final collection weirs and directly from spray nozzles. Inflow and outflow rates were monitored. Samples were collected on 8 dates at the beginning and end of each of 4 spray cycles consisting of 4-6 weeks of continuous spraying followed by a rest period of 4-6 weeks. Levels of total P in the applied effluent were low (1.5 mg/l) but application rates were high (15 to 23 cm/wk). The cutting treatments had no significant effect on P removal. While total soluble phosphorus (TSP) concentration in the applied wastewater ranged from 0.6 to 1.3 mg/l for the cycles, the 27 m flow distance was sufficient to consistently bring the TSP in the effluent down to about 0.3 mg/l. Averaged across all samples dates, TSP concentrations in the effluent were 0.91, 0.70, 0.52, and 0.32 mg P/L at the 6, 12, 18, and 27 m distances, respectively.
W85-00076

APPLICATION OF WASTEWATER TO WETLANDS,
East Carolina Univ., Greenville, NC. Dept. of Biology.
M. M. Brinson, and F. R. Westall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 190388, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Report No. 5, Land Treatment Series, August 1983. North Carolina State Univ., Raleigh. 27 p, 1 Fig, 11 Ref. OWRT Project No. B-123-NC (15), Contract/Grant No. 14-34-0001-9144.

Descriptors: *Land treatment, *Wetlands, *Wastewater treatment, *Wastewater disposal, *North Carolina, Water quality standards.

The fifth of a series of five reports dealing with land (and wetland) treatment of wastewater and sludge under the general guidance of a task force representing North Carolina regulatory agencies and universities. Draft reports were critiqued by other specialists and practitioners at regional conference before publication. This report reviews the status of wetland treatment technology and examines its potential application in North Carolina and similar areas. Wetlands are viewed as valuable natural resources whose use for wastewater treatment should be limited to careful treatment in the context of water quality improvement not disposal. The report differs considerably from the other reports in this series in a more incomplete state of the art and the fact that wetlands contribute to water quality improvement in their natural state, provide valuable wildlife habitat, and function as important buffer zones between upland runoff and down stream receiving waters. Part I (Natural Wetlands) covers wetland types, hydrology, functional properties, and mechanisms of water quality improvement; Part II (Regulation, Planning and Engineering) deals with regulatory issues, planning and design considerations, and artificial wetlands. An Appendix lists reference and additional readings.
W85-00079

GENERAL GUIDELINES FOR SUBSURFACE TREATMENT OF WASTEWATER,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
C. G. Cogger, and A. R. Rubin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 190370, Price codes: A03 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Report No. 4, Land Treatment Series, August 1983. 28 p, 16 Ref, 1 Append. OWRT Project No. B-123-NC (14), Contract/Grant No. 14-34-0001-9144.

Descriptors: *Land treatment, *Land disposal, Soil disposal, Fields, *Wastewater disposal, *Wastewater treatment, Septic tanks, *North Carolina, Water quality standards.

The fourth of a series of five reports dealing with land (and wetland) treatment of wastewater and sludge under the guidance of a task force representing North Carolina regulatory agencies and universities. Draft reports were critiqued by other specialists and practitioners at regional conference before publication. The report provides general guidelines for the design and management of large subsurface wastewater treatment and disposal systems. While developed primarily for flows greater than 3000 gal. per day, many of the concepts apply to smaller systems. Emphasis is on the land treatment part of the system rather than initial treatment units. Major sections include Waste Characterization, Site Selection, Initial Treatment, Land Area Requirements, Absorption Area Design, and Maintenance and Monitoring. In addition to references, the Appendix discusses grass uptake of nitrate and three models for determining nitrate loading rates.
W85-00080

GENERAL GUIDELINES FOR LAND TREATMENT OF SLUDGE,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
L. D. King, and P. W. Westerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 190362, Price codes: A03 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Report No. 3, Land Treatment Series, August 1983. 37 p, 2 Fig, 6 Tab, 12 Ref, 1 Append. OWRT Project No. B-123-NC (13), Contract/Grant No. 14-34-0001-9144.

Descriptors: *Land treatment, *Land disposal, *Sludge disposal, Sludge treatment, North Carolina, Water quality standards.

The third of a series of five reports dealing with the land (and wetland) treatment of wastewater and sludge prepared under the general guidance of a task force representing North Carolina regulatory agencies and universities. Draft reports were critiqued by other specialists and practitioners at regional conference before publication. This booklet presents a discussion of land treatment of sludge and general guidelines for design and management of related land treatment systems. It does not present detailed standards and attempts to leave maximum latitude for design by competent professionals. Introduction covers basic considerations and general design principles. Major sections include Sludge Characterization, Site Evaluation and Selection, Site Assimilation Capacity and Land Requirement, System Management, Monitoring Requirements, and Public Health Protection. An Appendix lists sources of materials and information and reference literature.
W85-00081

POLICIES AND PROCEDURES FOR LAND TREATMENT OF WASTEWATER,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
W. L. Fleming, D. H. Howells, and F. J. Humenik.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 190230, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Institute Report No. 1, Land Treatment Series, August 1983. North Carolina State Univ., Raleigh. 11 p. OWRT Project No. B-123-NC (11), Contract/Grant No. 14-34-0001-9144.

Descriptors: *Land treatment, *Land disposal, *Wastewater disposal, Wastewater farming, Wastewater irrigation, *Wastewater treatment, Wetlands, *North Carolina, Water quality standards.

The first of a series of five reports dealing with the land (and wetland) treatment of wastewater and sludge prepared under the general guidance of a task force representing the North Carolina Agricultural Research and Extension Services, Water Resources Research Institute, Division of Environmental Management, and Division of Health Services. Draft reports were presented at a regional workshop for critique and input from other sources. Policies and Procedures for Land Treatment of Wastewater introduces the series and discusses public acceptance, North Carolina Statutes and Regulations, Administrative Permitting Procedures and Requirements, and the availability of Advisory and Technical Assistance. The series as a whole provides general guidelines for the design and management of land treatment systems. It does not present detailed standards and attempts to leave maximum latitude for alternative designs by competent professionals. The guidelines should be reviewed periodically to keep abreast of state-of-the-art developments.
W85-00082

GENERAL GUIDELINES FOR LAND TREATMENT OF WASTEWATER,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.
P. W. Westerman, and L. D. King.
Available from the National Technical Information Service, Springfield, VA 22161, as PB84 190354, Price codes: A04 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Report No. 2, Land Treatment Series, August 1983. 51 p, 2 Fig, 3 Tab, 23 Ref, Append. OWRT Project No. B-123-NC (12), Contract/Grant No. 14-34-0001-9144.

Descriptors: *Land treatment, *Land disposal, *Wastewater disposal, Wastewater farming, Wastewater irrigation, *Wastewater treatment, *North Carolina, Water quality standards.

The second of a series of five reports dealing with the land (and wetland) treatment of wastewater and sludge prepared under the general guidance of a task force representing North Carolina regulatory agencies and universities. Draft reports were critiqued by other specialists and practitioners at regional conference before publication. This booklet presents a discussion of land treatment of wastewater effluent and general guidelines for design and management of related land treatment systems. It does not present detailed standards and attempts to leave maximum latitude for innovative design by competent professionals. Introduction includes basic considerations for design, general design principles, and system alternatives. Major sections include Wastewater Characterization, Site Evaluation and Selection, Site Assimilative Capacity and Land Treatment, System Management, Monitoring Requirements, Public Health Protection, and Economic Considerations. An Appendix lists sources of materials and information useful in designing land treatment systems, as well as reference literature on land treatment.
W85-00083

DETECTION OF INDUSTRIAL POLLUTANTS AND TOXIC CHEMICAL WASTES IN SEWAGE TREATMENT PLANT INFLUENT BY USE OF A BIOLOGICAL MONITOR,
Pennsylvania State Univ., University Park. Dept. of Microbiology, Cell Biology, Biochemistry and Biophysics.
L. J. McElroy.
Applied and Environmental Microbiology, Vol. 45, No. 2, p 730-732, February, 1983. 1 Fig, 1 Tab, 4 Ref.

Descriptors: *Wastewater treatment facility, *Pollutant identification, Industrial wastes, Toxicity, Anaerobic digestion, Bioindicators, Spirillum

Sanitary sewage systems associated with industrial communities are often subject to industrial chemical wastes which can cause a partial or complete inhibition of anaerobic digestion upon receipt at the treatment plant. In such cases, raw or partially treated sewage sludge must be diverted to holding basins until digester activity can be restored. A simple prewarning system for detecting potentially detrimental inhibitory materials would allow for timely diversion of influent, thus protecting plant operating systems. Heterogeneous mixtures of toxic chemical wastes affecting the normal operation of a sewage treatment facility employing anaerobic digestion were detected by dark-field observation of uncoordinate flagellar orientation patterns displayed by cells of Spirillum volutans. These results were compared with plant parameters determined by gas production, volatile fatty acids, and alkalinity measurements and the method was found successful for this plant. (Baker-IWRT)
W85-00107

APPLICATION OF A COMBINED CHEMICAL-BIOLOGICAL TREATMENT TO HIGH STRENGTH WASTEWATER,
Osaka City Inst. of Public Health and Environmental Sciences (Japan).
K. Takamizawa, and A. Honda.
Journal of Fermentation Technology, Vol. 60, No. 5, p 447-456, 1982. 18 Fig, 2 Tab, 14 Ref.

Descriptors: *Biological wastewater treatment, *Coagulation, *Combined treatment, *Activated sludge process, Biological oxygen demand, Sludge, Ferric chloride, Wastewater treatment, Sewage wastes, Hydrogen ion concentration.

method for treating high-strength wastewater
ectively in a smaller scale plant and also for
creasing BOD to below the acceptable limit (300
/l) for sewage works at a practically low cost
s developed. Wastewater generated by the
watering process for a slurried-mixture of
shed-refuse and sewage sludge was used as
h-strength wastewater. A combined chemical-
logical treatment using direct addition of a
ic chloride solution (a coagulant) to an aeration
k of activated sludge was more efficient com-
ed with the conventional activated sludge treat-
nt. The optimum pH in the aeration tank for the
bined chemical-biological treatment was 5-6.
ler this pH, the limitation of BOD-MLVSS
xed Liquor Volatile Suspended Solids) loading
btain an effluent BOD value below 300 mg/l
increased from 1 kg BOD/kg MLVSS/day
the conventional activated sludge treatment to
g BOD/kg MLVSS/day. For the combined
nical-biological treatment, the calculated value
OD removal coefficient (Kr) was 0.00057 (1/h
VSS mg/l), the value of the biomass growth
ficient (Y) was 0.41 (g MLVSS/g BOD), and
biomass-decay coefficient (Kd) was 0.38 (1/
. For the conventional activated sludge treat-
the values were 0.00030 (1/h MLVSS mg/l),
(g MLVSS/g BOD), and 0.06 (1/day), respec-
y. BOD removal was faster in the combined
ment than in the conventional treatment. To
n the same treatment efficiency, the combined
m could accept two times greater loading
the conventional system with the same aer-
tank volume and the same mass of activated
e. (Collier-IVI)
00172

CH REACTOR ACTIVATED SLUDGE ATMENT OF MILK PROCESSING TEWATERS,
land State Univ., OH. Dept. of Civil Engi-
ng.
Hung.
ss Biochemistry, Vol. 19, No. 1, p 25-28,
ary, 1984. 6 Fig, 3 Tab, 4 Ref.

iptors: *Dairy industry, *Activated sludge
ss, *Milk, *Batch reactors, Industrial
water, Biological wastewater treatment, Or-
compounds, Chemical oxygen demand,
organisms.

oratory study was performed using batch
ed sludge reactors to determine the organic
al rates from milk wastewaters and to deter-
he kinetic coefficients for biological treat-
Five batch bench-scale activated sludge re-
of 1 l volume were used in this investigation.
water strength in the reactors were 0, 1, 3, 5,
g of powdered milk per liter of reactor
t. The COD removal efficiency decreased
ncrease in F/M (food to microorganism)
Percent COD removal was 87% at a F/M
based on COD removal) of 0.73, and was
a F/M ratio of 1.865. The oxygen utiliza-
efficients, a' and b', were determined to be
1.7/h. The sludge production coefficients,
, were found to be 0.483 and 0.14/day. The
e removal rate constant, k, was 11.5/day,
quantity of non-biodegradable material, y,
edicted to be 30 mg/l. (Author's abstract)
212

VERY OF HOT WATER, DYES AND LIARY CHEMICALS FROM TEXTILE STREAMS,
n Univ., SC.
ter, and G. A. Goodman.
ation, Vol. 49, No. 2, p 185-192, February,
Fig, 1 Tab, 5 Ref.

tors: *Textile mill wastes, *Membrane hy-
tion, *Water reuse, Wastewater renova-
/astewater treatment, Filtration, Dyes,
ne processes.

overy of hot water, dyes and auxiliary
s from a continuous dye range has been
rated using a full-scale dynamic membrane
ration (HF) system. The membrane stabili-
and rejections are satisfactory. Recycle of 88-96% of the wash water has occurred thus far and the remainder is suitable for normal waste treatment and discharge. Reuse of the dye pad drops and HF concentrates is possible; the eventual amount will depend on the type of dyes and run length. Plant operator experience and color matching problems will also determine practical limits of concentrate reuse. A means has been evaluated on a pilot scale whereby any residual dye liquor and concentrate can be reduced to an officially innocuous solid suitable for landfill application or perhaps agricultural use. By this means it is possible to approach zero discharge. (Baker-IVI)
W85-00252

REVERSE-OSMOSIS MEMBRANE FOR TESTING COAL-LIQUEFACTION WASTEWATER,
Kentucky Univ., Lexington.
D. Bhattacharyya, M. Jevtitch, J. K. Ghosal, and J. Kozminski.
Environmental Progress, Vol. 3, No. 2, p 95-102, May, 1984. 9 Fig, 6 Tag, 19 Ref.

Descriptors: *Membrane processes, *Filtration, *Water reuse, *Coal liquefaction wastewater, Wastewater treatment, Membranes, Reverse osmosis, Chlorides, Phenols.

The development of low-pressure membrane-separation processes for the purpose of permeate-water reuse is gaining considerably importance because of the feasibility of simultaneous removal of organic and inorganic dissolved solids. The treatment scheme for the coal-liquefaction wastewater calls for: H2S-NH3 stripping, phenolics extraction, powdered activated carbon-assisted biological processes, followed by a low pressure membrane separation process. Two types of membranes were evaluated: a polyamide hollow-fiber module and a spiral-wound module containing a thin-film composite membrane. The membranes were evaluted in terms of water flux, specific rejections of solutes and extent of water recovery. Both membranes removed 94-98% organics at zero to 90% water-recovery levels. At low water-recovery levels the chloride rejections were: 98% with the spiral-wound module and 94% with the hollow-fiber module. At 90% water recovery, 91% chloride removals were obtained with the spiral-wound module compared to 80% removal with the hollow-fiber module. As these membranes also provide efficient removals of phenolics and salts, it is possible that the indirect use of membranes without prior biological treatment may be feasible to produce adequate permeate quality for reuse. (Baker-IVI)
W85-00284

ADVECTION-DISPERSION INTERPRETATION OF TRACER OBSERVATIONS IN AN AQUIFER,
Stanford Univ., CA. Dept. of Applied Earth Sciences.
For primary bibliographic entry see Field 4B.
W85-00326

DEGRADATION OF PHENOLIC CONTAMINANTS IN GROUND WATER BY ANAEROBIC BACTERIA: ST. LOUIS PARK, MINNESOTA,
Geological Survey, Menlo Park, CA.
G. G. Ehrlich, D. F. Goerlitz, E. M. Godsy, and M. F. Hult.
Ground Water, Vol. 20, No. 6, p 703-710, November-December, 1982. 5 Fig, 4 Tab, 20 Ref.

Descriptors: *Groundwater pollution, *Phenols, *Bacteria, *St. Louis Park, *Minnesota, Wastewater treatment, Anaerobic conditions, Coal mine wastes, Methane, Carbon dioxide, Naphthalene.

Studies of contaminated near surface ground water at St. Louis Park, Minnesota indicate that coal tar derivatives from a coal tar distillation and wood treating plant operated there from 1918 to 1972 have entered the water and that phenolic compounds are being converted to methane and carbon dioxide by anaerobic bacteria. The findings which support this conclusion are: methane is present in the contaminated portions of the aquifer but not elsewhere; methane producing bacteria are present in areas where methane is found but not elsewhere; and methane is produced from aqueous extracts of fluid from Well W13 inoculated with microbes from the contaminated zone and incubated under anaerobic conditions. Under the ambient conditions of the groundwater, over 95% of both the total recoverable phenolic compounds (TRP) and the phenolic compounds are removed within 1,000 m of the contamination source. Although dilution, dispersion and exchange effects may be operating, these cannot alone account for the observed attenuation of TRP and total organic carbon relative to sodium. Sorption of TRP on aquifer sediments as a single cause of the observed attenuation is unlikely as independent measurements on lab columns showed that phenol is not significantly sorbed. Chemical analyses show that naphthalene also exhibits a differential attenuation in concentrations relative to the sodium tracer, but the effect is less pronounced. The contaminated drift seems to be acting as a treatment zone for removal of phenolic compounds that have penetrated the aquifer. It can be characterized as a continuous flow bioreactor consisting of a fixed film microbial population fed by a multiple nutrient stream. (Baker-IVI)
W85-00348

NITROGEN AND PHOSPHORUS INTERCHANGE BETWEEN SEDIMENTS AND OVERLYING WATER OF A WASTEWATER RETENTION POND,
Agricultural Research and Education Center, Sanford, FL.
K. R. Reddy.
Hydrobiologia, Vol. 98, No. 3, p 237-243, February, 1983. 3 Fig, 5 Tab, 15 Ref.

Descriptors: *Wastewater treatment, *Retention ponds, *Nitrogen, *Phosphorus, *Sediments, Nitrogen removal, Phosphorus removal, Temperature, Solar radiation, Turbulence, Floodwater, Sediment-water interface, Volatilization, Soil types.

Nitrogen and P interchange between the sediments and the overlying water of a stimulated retention pond used for wastewater treatment were evaluated under conditions of seasonal temperature fluctuations and varying physico-chemical conditions (exposing floodwater surface to daylight vs. dark and turbulent vs. quiscent floodwater). Natural sediment columns obtained from two types of field retention ponds were used. One type of retention pond consisted of calcareous clay loam sediment while the sediment of second retention pond contained organic soil. Nutrient interchange between sediments and the overlying water was measured once a month over a period of one year. Nitrogen removal rates from floodwater were controlled by the initial floodwater NH4(+) and NO3(-) concentration, rate of NH4(+) diffusion from the sediments to the overlying water, ammonification in the sediments. NH3(-) volatilization and nitrification at the sediment-water interface, and denitrification in the sediments. Under the conditions studied, NH4(+) concentrations of the floodwater were in the range of 0.01 to 0.05 micro g/ml, while NO3(-) concentrations were in the range of 0.27 to 0.78 micro g/ml. Sediments with organic soil were found to be less effective in the removal of floodwater organic N, organic C and P, compared to the sediments with calcareous clay loam. Phosphorus exchange rates were dependent on the capacity of the sediment to adsorb or desorb P. Total P exchange rates were in the range of -1.04 to 0.34 mg P/sq m day. Seasonal temperature fluctuations, turbulent vs. quiscent water conditions or exposing the floodwater surface to daylight or dark had very little effect on N and P exchange rates. (Author's abstract)
W85-00410

5E. Ultimate Disposal Of Wastes

SEDIMENT BUDGET STUDY FOR CLAMSHELL DREDGING AND DISPOSAL ACTIVITIES,
Army Engineer District, New York.
J. F. Tavolaro.

Report (1982). 27 p, 22 Fig, 5 Tab, 29 Ref.

Descriptors: *Dredging, *Ocean dumping, *Marine sediments, *Sand, *Municipal wastes, Barges, Turbidity flow, Turbidity, Physical properties, Sediment-water interfaces, Boats, *New York, New York Bight, Mud Dump site, New Jersey.

The sediment budget study represented one aspect of the investigation of ocean disposal of dredged material for the Port of New York and New Jersey. Approximately 500,000 cubic yards of dredged material from six separate locations were disposed at one previously unused location at the Mud Dump Site. The material was capped with a layer of 252,000 cubic yards of 'clean' fine-grained dredged material and 1,533,000 cubic yards of sand from Ambrose Channel. Approximately 2.0% of the dredged material was lost at the dredging site. Of this lost dredged material, 55% was due to the dredging itself and 44.3% was due to intentional barge overflow. Approximately 3.7% of the dredged material is lost at the Mud Dump Site, presumably during disposal. Total loss of dredged material during these clamshell dredging and ocean disposal operations was calculated to be 5.6%. Observations revealed that turbidity plumes generated at dredging sites were local features which traveled along the bottom for several hundred feet. These plumes only persisted while dredging was occurring, and ambient conditions were established within a relatively short time after dredging ceased. Of the total quantity of dredged material which is allowed to overflow from the barges, 57.2% settles back to the bottom in a relatively short time. It appears as if dredging itself is the major contributor to the loss of dredged material at the dredging site. (Garrison-Omniplan)
W85-00048

EVALUATION OF CAPPING OPERATIONS AT THE EXPERIMENTAL MUD DUMP SITE, N.Y. BIGHT APEX, 1980,
New York Univ. Medical Center, NY. Inst. of Environmental Medicine.
J. M. O'Connor.
Final Report to U.S. Army Corps of Engineers, New York District, December 1982. 70 p, 6 Fig, 7 Tab, 126 Ref.

Descriptors: *Dredging, *Ocean dumping, *Chemical analysis, *Municipal wastes, *Municipal wastewater, *Contamination, Bioaccumulation, Sand, Accumulation, Biochemical characteristics, Biochemical tests, *New York, New York Bight, Mud Dump site.

Conflicting multiple uses of the New York Bight impose various stresses on its physical and biological resources. Current regulations dictate that contaminated waste dredged material be given special treatment. Contaminated sediment from dredging projects in the Hudson estuary, Newark Bay, and contiguous waters were capped with fine sediment and sand from the Bronx River, Westchester Creek and the Ambrose Channel. The capping resulted in a layer of sand about one meter thick lying atop the contaminated sediment. It was determined that a sand-mud cap was successfully placed at the experimental dumpsite. The cap was still intact and in place after at least sixteen months. Cap erosion was minor; predictions of cap life were in excess of twenty years under normal meteorologic conditions. Major storm events, however, are capable of eroding the cap and exposing the contaminated material. During the sixteen months of the study, the total loss of contaminated material was about 4%; all this loss occurred during the dumping/deposition/compaction phase. Chemical analyses showed that contaminant levels in the sand cap were much lower than in the contaminated sediments. Bioaccumulation studies showed that less contaminant uptake occurred at the capping site than at uncapped dredged material sites, and at sites in New York Harbor. Bioaccumulation rates were, for the most part, 0.1 or less. (Garrison-Omniplan)
W85-00049

IDENTIFYING CHEMICAL SIGNATURES FOR DISPOSED DREDGED MATERIALS.
New York Univ. Medical Center, NY. Inst. of Environmental Medicine.
Final Report to U.S. Army Engineers, New York District, June 1982. 77 p, 59 Ref, 3 Append.

Descriptors: *Chemical analysis, *Ocean dumping, *Contamination, *Dredging, *X-rays, *Sediments, *Continental shelf, Heavy metals, Zinc, Metals, Municipal wastes, *New York, Staten Island, New York Bight, Mud Dump site.

Contaminants dumped at sea on the continental shelf within the confines of the designated Dredged Material Dumpsite were analyzed, including subaquaceous burial of dredged material. The analysis was of physical and chemical characteristics of sediments from 10 dredging projects and 11 cores from the Mud Dump. Level of chemical contamination were greatest for metals, especially zinc; PCB levels were roughly similar throughout the projects. Unique chemical signatures were determinable for the Staten Island project, due primarily to very high levels of metals, particularly zinc. Chemical and physical analyses of core samples showed the presence of a sand cap of varying thickness. X-ray analyses of vibracore samples taken at the Mud Dump Site also demonstrated the presence of a sand cap; the depth of the cap was variable and ranged from a few centimeters to more than one meter. No samples from dredging projects were found to contain unique chemicals. Levels of organic and inorganic contaminants at the Mud Dump Site were equivalent to levels detected in the analysis of samples from individual dredging projects. Where the sand cap was found to be in place, contaminant levels in the sand, and thus in contact with the water column, were greatly reduced. The use of contaminated sediments for capping made it difficult to draw any conclusion regarding the extent to which successful capping occurred through the region under study. (Garrison-Omniplan)
W85-00050

SEDIMENT CAP STABILITY STUDY, NEW YORK DREDGED MATERIAL DUMPSITE,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
G. L. Freeland, R. A. Young, G. Drapeau, T. L. Clarke, and B. L. Benggio.
Report prepared for the Dept. of the Army, New York District Corps of Engineers, and the Office of Marine Pollution Assessment, NOAA, February 1983. 209 p, 81 Fig, 12 Tab, 74 Ref.

Descriptors: *Ocean dumping, *Municipal wastes, *Dredging, *Sediments, *Marine sediments, Sand, Storms, Fetch, Waves, Economic aspects, *New York, *Sediment transport, New York Bight.

The area under study had dredged material dumped which was determined, after the dumping occurred, to be unsuitable for unrestricted ocean disposal under the ocean dumping pollution criteria. This material was subsequently capped by clean dredged material. The sea-bottom conditions on the surface of the cap were measured. Both actual and predictive analysis indicated a slight amount of erosion occurring during a 'normal' year. The bottom is particularly susceptible to erosion during the winter season, when the water column is unstratified. Especially important for bottom sediment transport are storm conditions when the wind blows from directions of open water fetch (from east-northeast to south-southwest). Sea swell coming from these directions may also cause some transport. Severe conditions did not occur during the measurement period; nevertheless, some sediment transport, primarily to the south, did occur. Since the present surface of the cap contains high percentages of easily transported find sand, it is recommended that additional material be added to the cap, and that this material be clean sand as coarse as is economically available, but not finer than 0.25 mm in grain size. The wave hindcasting technique used correlated very well with bottom measurements, but at least one bottom transport event corresponded with a time of sea swell, not locally generated wind waves. The cap, which is four to eight feet thick, appears to be safe for the time being. (Garrison-Omniplan)
W85-00053

AREAS SUITABLE FOR APPLICATION OF MUNICIPAL SLUDGE.
Fox Valley Water Quality Planning Agency, Menasha, WI.
Report, July 1983. 20 p, 104 Maps, 11 Tab, 4 Ref.

Descriptors: *Sludge utilization, *Sludge disposal, Liquid sludge, Sludge solids, *Sludge drying, *Wastewater disposal, *Municipal wastewater, Slopes, Municipal wastes, Industrial wastes, Permeability, Bedrock, *Wisconsin, Maps, Land application.

Sites near Menasha, Wisconsin, that were potentially acceptable for the land application of municipal wastewater treatment sludges were analyzed, using two main criteria: (1) the land had to be outside of existing urban development, to avoid conflicting land use problems, and had to be located within a reasonable distance from the municipal treatment plant; and (2) detailed soil and topographic standards had to be met. These standards included: less than 12% slope, depth to seasonal water table greater than three feet, no flooding or ponding, depth to bedrock greater than three feet, permeability of the most restricting layer to be above three feet of 0.2 to 6.0 in. per hour, and available water capacity to be more than three inches based on a 60-inch column of soil. Maps showing suitability for sludge application maps are included for Brown, Calumet, Fond du Lac, Outagamie, and Winnebago Counties. A landowner interested in spreading sludge must be aware of the particular solids present in the fields and the limitation of these soils for the land application of sewage sludge. Other concerns such as the percentage of slope, proximity to a waterway, and climatic conditions are also involved in the decision. Some treatment plants have a policy of hauling the sludge to the farmer's field and dumping it onto the field; others not only haul the sludge to the field but also spread in onto the land. Liquid sludges demand different application equipment than dewatered sludge. (Garrison-Omniplan)
W85-00054

DISPOSAL OF SECONDARILY TREATED MUNICIPAL SEWAGE BY SUBSURFACE IRRIGATION,
Maryland Univ., College Park. Dept. of Agricultural Engineering.
L. E. Stewart, D. S. Ross, H. L. Brodie, and T. Sohrabi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB8 190081. Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center Technical Report No. 70, August 1983. 19 p, 5 Fig, 6 Ref. Project No. OWRT A-055-MD(1), Contract/Grant No. 14-34-0001-2122.

Descriptors: *Subsurface irrigation, Sprinkler irrigation, *Septic waste water, Chlorination, Trickling filters, Biological wastewater treatment, Sand filter, Secondary wastewater treatment, Tertiary wastewater treatment, *Wastewater treatment, *Wastewater disposal.

Trickle irrigation tubing was used for low pressure, uniform subsurface distribution of chlorinated sewage effluent for land treatment and disposal. The effluent was domestic, secondarily treated water from a septic tank and sand filter system. The land provided tertiary treatment of the water through growing plants, evaporation, and ground water recharge. This method eliminated a point source discharge into a stream and appears to have future application. This experimental system performed well in the fall of 1982 and, with modification, in 1983. Although the rowcrop trickle irrigation tubing (tape) appeared to function satisfactorily in a heavy soil containing stones, rigid wall trickle tubing may be advantageous in problem soils or at deeper depths. Effluent was evenly distributed without surface wetting for all treatment application rates but precipitation was very low during the test period. This system appeared to allow good utilization of effluent nutrients because plant roots were not saturated. This system may have application in urban areas where the surface can be used for public green space. Dispo

al can be under turfgrass in parks or under forage crops with lower pumping energy than by an overhead sprinkler system.
W85-00060

MEASUREMENTS TO QUANTIFY WASTEWATER FIELDS PRODUCED BY OUTFALL DIFFUSERS,
Michigan State Univ., East Lansing. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W85-00067

APPLICATION OF WASTEWATER TO WETLANDS,
East Carolina Univ., Greenville, NC. Dept. of Biology.
For primary bibliographic entry see Field 5D.
W85-00079

GENERAL GUIDELINES FOR SUBSURFACE TREATMENT OF WASTEWATER,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 5D.
W85-00080

GENERAL GUIDELINES FOR LAND TREATMENT OF SLUDGE,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 5D.
W85-00081

POLICIES AND PROCEDURES FOR LAND TREATMENT OF WASTEWATER,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5D.
W85-00082

GENERAL GUIDELINES FOR LAND TREATMENT OF WASTEWATER,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5D.
W85-00083

NATURAL BUFFERS FOR SLUDGE LEACHATE STABILIZATION,
James and Moore, Washington, DC.
L. S. Makeig.
Ground Water, Vol. 20, No. 4, p 420-429, July-August, 1982. 3 Fig, 3 Tab, 42 Ref.

Descriptors: *Sludge disposal, *Buffer area, *Leachates, *Sludge entrenchment, Land disposal, Groundwater pollution, Soil properties, Cation exchange, Nitrates, Permeability coefficient, Groundwater movement, Mathematical models.

Large quantities of sludge can be disposed of safely by burial in narrow trenches. This paper describes a study to quantify the amount of buffer area around a trenching operation that would allow for the natural soils to stabilize sludge leachate without threatening the ground-water supplies of surrounding communities. A vertical buffer consists of a thickness of unsaturated soil below the base of the trench. Its thickness is calculated by comparing the cation exchange capacity of the soil with the exchangeable cations in the sludge leachate. Data from metropolitan Washington, D.C. consistently require a vertical buffer of less than 3 feet thick. A minimum of 3 feet of unsaturated soil is recommended as a margin of safety, although no specific studies were performed to reach this value. The horizontal buffer is a strip of land that must be maintained between the trenching operations and the site boundary. Its width can be more than two orders of magnitude greater than the vertical buffer. Its width is based on the nitrogen loading of the soil from the sludge and the mobility of nitrate in the upper aquifer based primarily on hydraulic conductivity and the characteristics of the sludge/soil interaction. An advection-dispersion model predicts nitrate concentrations for various buffer widths, and is used in conjunction with a specified maximum allowable nitrate concentration to determine a minimum horizontal buffer under certain ground-water flow conditions. (Author's abstract)
W85-00322

5F. Water Treatment and Quality Alteration

FREQUENCY DISTRIBUTION OF COLIFORMS IN WATER DISTRIBUTION SYSTEMS,
Drexel Univ., Philadelphia, PA. Dept. of Biological Sciences.
R. R. Christian, and W. O. Pipes.
Applied and Environmental Microbiology, Vol. 45, No. 2, p 603-609, February, 1983. 1 Fig, 4 Tab, 15 Ref.

Descriptors: *Coliforms, *Drinking water, *Pennsylvania, *New Jersey, *Water distribution, Frequency distribution, Bacteria, Public health.

Nine small water distribution systems in Pennsylvania and New Jersey were sampled intensively to determine the patterns of dispersion of coliforms. Coliforms were not randomly dispersed in any of the water distribution systems. In all systems studied most locations yielded no coliforms. The frequency distributions of confirmed coliform counts were compatible with either the negative binomial or the lognormal distribution. They were not compatible with either the Poisson and Poisson-plus-added zeroes distribution. If the lognormal model is representative of the coliform distribution, the arithmetic mean sample count is a poor estimator of the true mean coliform density. Also, the likelihood of a person consuming water with a very high coliform density is small but finite even if the system is not shown to be in violation. (Baker-IVI)
W85-00106

TREATMENT OF CONTAMINATED GROUNDWATER WITH GRANULAR ACTIVATED CARBON,
R. P. O'Brien, M. M. Clemens, and W. G. Schuliger.
AIChE Symposium Series, Vol. 79, No. 230, p 44-52, 1983. 14 Fig.

Descriptors: *Groundwater pollution, *Water treatment, *Activated carbon, *Pennsylvania, *Tobyhanna Army Depot, *New Jersey, *Rockaway Borough, Potable water, Organic compounds, Leachates, Cost analysis, Spills.

Contamination of groundwater supplies in the United States with organic chemicals has become a serious widespread problem. In the granular carbon treatment of leachates and groundwaters generated from waste storage lagoons, industrial accidents, and transportation accidents, a total of 27 different organic compounds were detected. Treatment with granular activated carbon is a cost effective process for removing a wide range of organic compounds from contaminated leachates and groundwaters. Case histories for Rockaway Borough, New Jersey and the Tobyhanna Army Depot, Tobyhanna, Pennsylvania show that nondetectable levels of synthetic organic chemicals can be achieved in water supply systems with total operating costs as low as 22 cents per 1,000 gallons treated and carbon usage rates as low as 0.1 lbs per 1,000 gallons. Predicting the performance of granular carbon in groundwater treatment is no longer a time consuming or expensive operation. With the development of the Accelerated Column Test, potential granular carbon users can expect a more accurate system design in less time and for less money. (Baker-IVI)
W85-00128

INTEGRATION OF A REVERSE OSMOSIS INSTALLATION IN THE FULLY AUTOMATED OPERATION OF A RURAL WATER SUPPLY COMPANY,
Eichsfelder Energie- und Wasserversorgungs G.m.b.H., Duderstadt (Germany, F.R.).
F. Bergmann, and B. Schuette.
Desalination, Vol. 49, No. 2, p 203-214, February, 1984. 8 Fig.

Descriptors: *Reverse osmosis, *Water treatment, *Sulfates, *West Germany, Automation, Computers, Drinking water, Conductivity.

The Eichsfelder Energy and Water Supply Company Limited is a service company in the northern section of the German Federal Republic. It supplies water to one city and 38 smaller towns in Lower Saxony. The water is supplied from 6 deep wells. German drinking water regulations require that the sulfate content of drinking water not exceed 240 mg of SO4/l. Since the sulfate content in well water fluctuates considerably, a reverse osmosis (RO) plant was added to the existing water treatment plant to provide sulfate ion removal capabilities. The RO plant consists of two trains each using a different type of RO membrane and producing 50 cu m/h (316.8 kpgd). The plant is fully automated and operated by computer based on conductivity values of the blended product water and the water requirement. The remote water treatment plant is not staffed around the clock. All operating data are transmitted by radio to a central control room where the plant performance is monitored on CRT. Water of nearly constant conductivity can be delivered to the supply net by using speed regulation motors. During nearly one year of operation (2,500 h) the RO plant has experienced no upsets. (Moore-IVI)
W85-00253

WATER TREATMENT FOR WATERFLOOD INJECTION,
S. Rooks.
Effluent and Water Treatment Journal, Vol. 24, No. 4, p 140-142, April, 1984. 1 Fig, 1 Tab.

Descriptors: *Waterflood injection, *Water treatment, *Oil recovery, *Seawater, Filtration, Suspended solids, Deaeration, Dissolved oxygen, Organic compounds.

Secondary recovery techniques are used on oilfield reservoirs either to increase production rates or to stimulate older reservoirs which have lost pressure. The most common method of secondary recovery is waterflood injection in which water from a source external to the field is treated and injected at high pressure into the reservoir. Knowledge of the amount of suspended solids and their particle size distribution is very important, and before a water flood development takes place, the seawater at or near the eventual abstraction site is tested for these parameters so that the optimum treatment process is selected. Seawater is usually abstracted from about mid-sea depth to ensure the cleanest water. Any biological material is killed by the injection of chlorine and biocides at the pump to prevent growths in the treatment system and to enable the material to be removed by filtration. Waterflood injection requires very high quality filtered water as, under the normally large flow rates employed, the pressure of even quite low suspended solids and very fine particles would quickly lead to blockages in the injection wells and consequent falling off of injection rate. Backwashing of the filters uses unfiltered seawater when the suspended solids level is low thus eliminating the need for a backwash tank and pumps. Normally a single stage of the fine filtration is sufficient. Filter aids may involve the addition of a chlorine resistant polyelectrolyte. Dissolved oxygen must be removed from the water to be injected. A variety of chemicals is added to the injection water during the treatment process to control biological activity, to serve as filtration aids, to aid deaeration, and to reduce foaming in deaerators due to the presence of organic compounds. (Baker-IVI)
W85-00273

GROUND WATER CONTAMINATION OF TWO PRODUCTION WELLS: A CASE HISTORY,

Ecology and Environment, Inc., Seattle, WA.
K. Boateng, P. C. Evers, and S. M. Testa.
Ground Water Monitoring, Vol. 4, No. 2, p 24-31, Spring, 1984. 9 Fig, 3 Tab, 7 Ref.

Descriptors: *Wells, *Groundwater pollution, *Lakewood, *Washington, *Chlorinated hydrocarbons, Monitoring wells, Tetrachloroethylene, Dichloroethylene, Trichloroethylene, Water pollution control, Organic compounds.

Ground water sampling in the summer of 1981 revealed that two production wells belonging to the Lakewood Utility District (Washington) were contaminated with chlorinated hydrocarbons. Testing revealed the source of the problem to be a commercial facility located a few feet northwest of a monitoring well. Contaminants identified included 1,2-(trans)-dichloroethylene, trichloroethylene, and tetrachloroethylene. Recommendations were that the contaminated discharge from the facility be eliminated; that the two contaminated wells be pumped at intervals and sampled to determine when acceptable levels of water purity were achieved; and that if reasonable levels were not achieved within a reasonable time, then cost-benefit studies of treatment or the use of alternate sources be made. (Baker-IVI)
W85-00363

5G. Water Quality Control

PROJECTED EFFECTS OF PROPOSED CHLORIDE-CONTROL PROJECTS ON SHALLOW GROUND WATER--PRELIMINARY RESULTS FOR THE WICHITA RIVER BASIN, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
S. Garza.
Available from the OFSS, USGS, Box 25425, Denver, CO 80255. USGS Water-Resources Investigation Report 83-4026, 1983. 40 p, 11 Fig, 2 Tab, 23 Ref.

Descriptors: *Groundwater, Water quality, *Natural chloride pollution, *Digital computer model, *Aquifer simulation, Aquifer-head changes, *Texas, Wichita River basin.

The U.S. Army Corps of Engineers' plan to control the natural chloride pollution in Wichita River basin includes construction of Truscott Brine Lake on a tributary of North Wichita River. In connection with the proposed brine lake, the U.S. Geological Survey was requested to define the existing ground-water conditions in the shallow freshwater system of the project area and to project the postconstruction effects of the proposed lake on the freshwater aquifer. The freshwater aquifer in the project area is a shallow water-table system with relatively freshwater that contains approximately 500-5,000 milligrams per liter of dissolved solids and consists of Permian rocks with very small values of hydraulic conductivity. It overlies a brine system that is even less permeable. Two-dimensional mathematical computer models were developed for aquifer simulation of steady-state conditions in a freshwater system and transient conditions in a brine-freshwater system where density effects of the brine are considered. Main results of the project are: (1) Water-level rises in the aquifer of 5-40 feet would be confined to areas near the proposed dam and along lake shoreline, and (2) migration of saltwater downstream from dam generally would be limited to less than 1 mile and apparently, would not reach equilibrium during the 100-year duration of the project. (USGS)
W85-00026

ESTIMATION OF NONPOINT SOURCE LOADINGS OF PHOSPHORUS FOR LAKES IN THE PUGET SOUND REGION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-00038

WATER SUPPLY SOURCE PROTECTION RULES AND REGULATIONS PROJECT,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
For primary bibliographic entry see Field 6E.
W85-00046

GROUNDWATER: AN INVENTORY OF WELLS AND CONTAMINATION POTENTIAL WITHIN THE SILURIAN AQUIFER OF CALUMET COUNTY,
Fox Valley Water Quality Planning Agency, Menasha, WI.
S. C. Hansen.
Report, July 1983. 120 p, 13 Fig, 17 Tab, 29 Ref, 1 Append.

Descriptors: *Groundwater availability, *Available water, *Water supply, *Subterranean water, *Coliforms, *Contamination, *Agricultural chemicals, Aquifers, Political aspects, Governmental interrelations, Interagency cooperation, Fertilizers, Groundwater quality.

Concern over the quality of Wisconsin's groundwater supplies has recently increased due to incidents of contaminated drinking water sources. The presence of the pesticide 'aldicarb' in some wells in the Central Sands area of the state is but one example. Currently, two-thirds of the residences in the state rely solely on groundwater for their water supply. Most private drinking water systems in the state pump well-water from this reserve, as do about 560 out of 580 municipal water systems. The quality of groundwater within the Silurian aquifer of Calumet County was found to be generally good and safe for human and livestock consumption, but excessive levels of nitrates and coliform bacteria have been found in wells. Surface activities such as manure spreading, animal waste storage, solid waste landfilling, and pesticide and fertilizer applications are considered potential sources of contaminants. Large informational gaps exist on much of Wisconsin's groundwater supplies. It is recommended that Calumet County adopt policies stipulating land use or zoning restrictions for activities which threaten groundwater quality. The county should also initiate an informational program to inform landowners and the general public of activities which could degrade the quality of their groundwater. The proper design of manure storage facilities should be encouraged, and the Silurian aquifer groundwater should be sampled over a period of time to establish its existing quality and trends. (Garrison-Omniplan)
W85-00055

INVESTIGATION OF THE CARRYING CAPACITY OF THE MONOCACY RIVER AS A SCENIC AND RECREATIONAL RESOURCE, VOLUME III. THE MONOCACY RIVER--ANALYSIS OF EXISTING SITUATION AND RECOMMENDATIONS FOR PROTECTING THE RIVER RESOURCE,
Maryland Univ., College Park. Dept. of Recreation.
For primary bibliographic entry see Field 6D.
W85-00073

WATER QUALITY CONTROL,
G. Kovacs.
Ambio, Vol. 13, No. 2, p 101-103, 1984. 4 Fig.

Descriptors: *Water quality control, *Hungary, *Lake Balaton, *Lake Velence, Wastewater treament, Industrial wastes, Canals, Eutrophication, Lakes.

As in every industrialized country the control of water quality is a problem of water management in Hungary. The efficient treatment of effluents is needed to protect the environment and also to develop water resources. The available natural water resources are limited and the ever increasing demand can be covered only if the repeated use of the water is ensured by the sufficient treatment of the effluents released into the water courses. Although transboundary pollution, along with a widening gap between water supply and sanitation, hinder the development of water quality control, some improvements have been attained. The improvement of water quality in Lake Velence, the second largest shallow lake in Hungary, is discussed. The eutrophication of Lake Balaton and the efforts to provide sewage treatment and restore the canals are considered. Apart from technical measures, which mostly involve the treatment of effuents, a regular observation of qualitative parameters, the localization and elimination of accidents and the administrative regulations for licensing the use of water, are all instruments for the improvement of water quality control. Multidisciplinary research is needed to establish a firm scientific basis for the ongoing protection of water resources. (Baker-IVI)
W85-00086

CONSERVATION OF FRESHWATER FISHES OF SRI LANKA,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
F. R. Senanayake, and P. B. Moyle.
Biological Conservation, Vol. 22, No. 3, p 181-195, March, 1982. 1 Fig, 3 Tab, 46 Ref.

Descriptors: *Conservation, *Fish, *Sri Lanka, Environmental effects, Deforestation, Urbanization, Watershed management, Translocation, Land use, Mining, Pesticides, Diversion, Fisheries, Legal aspects.

Sri Lanka supports a diverse fauna of freshwater fishes, 24% of which are endemic. A survey of the island's streams indicated that a number of the endemic fishes are threatened with extinction and others are depleted due to the interaction of deforestation, urbanization, gem mining, pesticides, exploitation, water diversions, and introduction of exotic species. It is important to conserve these endemic species for ethical, economic, and ecological reasons. Ways of achieving this goal are outlined. The endemic species considered included two spot barb, black ruby barb, cherry barb, side striped barb, blotched filamented barb, red scissortail barb, vateria flower rasbora, green carplet, green labeo, banded mountain loach, spotted loach, green topminnow, comb tail, ornate paradisfish, and redtail goby. The distribution of fishes of Sri Lanka suggest that there are three distinct ichthyological provinces: the Southwestern Province, the Mahaveli Province, and the Dry Zone Province. Legal machinery for protecting the fishes already exists in Sri Lanka, under sections 34 and 37 of the Fauna and Flora Protection Ordinance, as amended by Act 44 of 1964 and approved by the National Assembly in 1972. Some of the steps that should be taken include captive breeding, watershed management, translocation, and regulation of fisheries. (Baker-IVI)
W85-00118

LOCAL PROBLEMS BECOME NATIONAL ISSUE,
L. Tangley.
BioScience, Vol. 34, No. 3, p 142-146 and 148, March, 1984. 3 Fig, 3 Tab.

Descriptors: *Groundwater pollution, *Water pollution control, Natural resources, Groundwater movement, Aquifers, Legislation.

Groundwater is a vast natural resource with aquifers that hold it underlying most of the United States. Groundwater comprises more than 96% of all fresh water in the United States. One well known characteristic of groundwater, particularly relevant to its contamination, is the speed that the water moves, anywhere from a few feet to just a fraction of an inch per day. Slow movement of contaminants also means that groundwater quality can differ dramatically from place to place. In addition, aquifer geology and natural groundwater quality vary locally, leading many researchers to believe that the resource is best managed at the state or local level. Many groundwater pollutants tend to be invisible, as well as being odorless and tasteless. Detection can be difficult. Often there are no surface water alternatives for communities that depend on groundwater. Testing of many contaminants as possible carcinogens has not yet been completed. Such testing, particularly in humans, is

difficult. The complex microbial ecosystems contained in groundwater are discussed along with consideration of various sources of pollution and the EPA strategy for dealing with the problem. (Baker-IVI)
W85-00125

TREATMENT OF CONTAMINATED GROUNDWATER WITH GRANULAR ACTIVATED CARBON,
For primary bibliographic entry see Field 5F.
W85-00128

INTEGRATION OF FOREST AND LAKE FERTILIZATION: TRANSPORT AND TRANSFORMATIONS OF FERTILIZER ELEMENTS,
British Columbia Ministry of Environment, Vancouver. Fish and Wildlife Branch.
C. J. Perrin, K. S. Shortreed, and J. G. Stockner.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 2, p 253-262, February, 1984. 9 Fig, 6 Tab, 44 Ref.

Descriptors: *Mohun Lake, *British Columbia, *Forest fertilization, *Lake fertilization, *Nutrients, Cycling nutrients, Nitrogen, Phosphorus, Phytoplankton, Nitrogen transport, Chlorophyll, Ureas, Fertilizers.

Application of fertilizers to forests and to lakes has resulted in increased productivity in both systems. Forest fertilization by helicopter with a centrifugal spreader (435 kg urea/ha) on the Mohun drainage, northern Vancouver Island, during late fall 1979 resulted in a combined increase in urea, ammonia, and nitrate concentrations to 8000 micrograms N/L above control levels in streams not protected with 50-m-wide leave (i.e. unfertilized) strips and 350 micrograms N/L in those having leave strips. By spring 1980, dissolved nitrogen loads to Mohun Lake increased by a minimum of 55% in the largest basin and 1924% in the smallest basin. This corresponded to fertilizer losses of 2.1% of the total applied from drainages that had leave strips and up to 5.2% from those where the treatment included direct application to stream channels. Nitrogen transport was dominated by reduced nitrogen species and lasted up to 144 d. During the 3 yr prior to forest fertilization, nitrogen (ammonium nitrate) and phosphorus (ammonium phosphate) were added to the lake at an N:P ratio of 4.5 (wt/wt) and a load of 1.4-2.2 mg P/sq m/wk. Spring overturn phosphorus concentrations were 4-5 microgram/L throughout the study and, except during the spring following forest fertilization, N:P ratios (NO_3-N:TP) at spring overturn were 3-6 (wt/wt). Despite the low ratios, nitrogen-fixing phytoplankton were not dominant in Mohun Lake. The lake's phytoplankton community was nitrogen limited prior to the increased nitrogen supply. After forest fertilization, average epilimnetic chlorophyll concentrations were 1.8 times higher than in 1979, the last year of lake fertilization. The increase is attributed to the much higher spring recycling processes within the extensive littoral zone of the lake. (Collier-IVI)
W85-00147

MERCURY LEVELS IN BROOK TROUT (SALVELINUS FONTINALIS) FROM SELECTED ACID AND LIMED ADIRONDACK LAKES,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Natural Resources.
For primary bibliographic entry see Field 5C.
W85-00204

DISPOSING OF POWERPLANT FLYASH CAN BE EFFECTED IN AN ENVIRONMENTALLY SAFE MANNER,
D. Strauss.
Power, Vol. 128, No. 2, p 45-48, February, 1984. 4 Fig.

Descriptors: *Fly ash, *Powerplants, *Landfills, Delaware, Waste disposal, Waste dumps, Economic aspects, Groundwater protection, Air pollution control, Dusts, Monitoring, Leaching.

Dry disposal of flyash as opposed to ponding was begun in Delaware with experience gained at the Indian River station of the Delmarva Power and Light Company serving as a base. The Indian River station is a coal-fired plant comprising four generating units with nominal capacities for a total capacity of 757 MW. The plant consumes about 5150 tons/day of eastern bituminous coal. About 180,000 tons of dry flyash and 32,000 tons of bottom ash are generated annually. Flyash is loaded into haul pans from the storage silo and transported to an on-site landfill by a contractor. The design of the landfill is based on a 30 yr plant life. The completed landfill will eventually cover about 140 acres, including sedimentation basin, access roads, perimeter dikes, and drainage ditches. Dust control measures are implemented at the landfill to minimize this problem. An emergency response plan has been developed for times when there are high winds at the landfill in the direction of adjacent landowners. An aerovane alarm system sounds an alert, which sets the plan in motion. Some of the environmental control measures used to prevent dusting also are effective in protecting the groundwater. Chemical binders reduce the amount of water needed for dust control, which minimizes the potential for leachate generation. Proper compaction is essential as it not only facilitates cell construction and minimizes dusting, but also promotes surface water runoff by minimizing infiltration and cracking due to settlement. Ground and surface waters are monitored to allow for early detection of potential groundwater contamination. (Baker-IVI)
W85-00211

EFFECT OF RAIN WATERS ON LEAD LEVEL IN THE VISTULA IN THE REGION OF CRACOW AGGLOMERATION,
Instytut Ksztaltowania Srodowiska, Krakow (Poland).
For primary bibliographic entry see Field 5C.
W85-00230

BUMPER CROP YIELDS GROWING PROBLEMS,
SAI Comsystems Corp., Eureka, CA.
L. McWilliams.
Environment, Vol. 26, No. 4, p 25-33, May, 1984. 5 Fig, 2 Tab, 21 Ref.

Descriptors: *Groundwater pollution, *Nitrates, *Agricultural chemicals, *Wisconsin, Aldicarb, Legislation, Water managment, Insecticides, Fertilizers, Leaching, Soil properties.

While agricultural chemicals have helped to set new crop production standards, they sometimes have combined to pollute groundwater and endanger the health of people, livestock, and other animals. Wisconsin's Central Sands region is an example of an area that has reaped the rewards of modern agricultural practices at the expense of water quality. The Central Sand's susceptibility to groundwater pollution began thousands of years ago when glaciers retreated northward, depositing sandy, loamy soils in thin layers on top of igneous and metamorphic bedrock. The adverse environmental and economic consequences of over-irrigation or excessive precipitation on sandy soils is known. One problem is the presence of insecticides and other agricultural chemicals in the groundwater. News of aldicarb in Wisconsin groundwater came too late for action during the 1981 growing season. Subsequent changes can make such an occurrence less likely in the future. The outlook for nitrates is not as good. Nonpoint source pollution is ubiquitous. There are three avenues toward the goal of groundwater free of pollution: federal, state, and local or citizen action. Federal action could include legislation protecting groundwater, incentives to states that voluntarily implement groundwater management, or programs that would aid innovative farmers in implementing practices that prevent groundwater pollution. At the local level, even if laws are passed, it will take time to get meaningful enforcement. The forcefulness of national environmental and conservation groups cannot be ruled out in this issue of great concern. (Baker-IVI)
W85-00277

PERMIT FEES FOR NEW JERSEY'S SURFACE AND GROUNDWATER DISCHARGERS,
New Jersey Dept. of Environmental Protection, Trenton.
For primary bibliographic entry see Field 6E.
W85-00281

UNDERGROUND TANKS CONTAMINATE GROUNDWATER,
For primary bibliographic entry see Field 5B.
W85-00287

DEGRADATION OF PHENOLIC CONTAMINANTS IN GROUND WATER BY ANAEROBIC BACTERIA: ST. LOUIS PARK, MINNESOTA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 5D.
W85-00348

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

COST AND PRECISION IN A STREAM SAMPLING PROGRAM,
Montana Univ., Missoula. Dept. of Zoology.
A. L. Sheldon.
Hydrobiologia, Vol. 111, No. 2, p 147-152, April, 1984. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Costs, *Sampling, *Streams, *Precision, Planning, Research.

The total cost of sampling is the sum of fixed and variable (incremental) components. Attainable sample size and precision are constrained by total budgeted cost and the relative and absolute magnitudes of the components. Nomograms relating fixed, variable and total costs to sample size and precision are presented for use in research planning. Preliminary estimates of cost allow one to estimate attainable precision while knowledge of cost components and desired precision specify the total budget. Time costs for a survey of a Montana stream were dominated by fixed costs and the laboratory component of variable costs while variable field costs were small. Cost reductions are always worthwhile. Cost reduction in survey sampling permits large increases in precision while reducing variable costs in research sampling have more effect on total cost than on precision. (Moore-IVI)
W85-00420

PROBABILISTIC METHOD OF OPTIMIZING SURVEYS WHEN DESIGNING HYDRAULIC STRUCTURES,
E. G. Gaziev.
Hydrotechnical Construction, Vol. 16, No. 6, p 309-312, June, 1982. 3 Fig, 3 Ref. Translated from Gidrotekhnicheskoe Stroitetl'stvo, No. 6, p 19-21, June, 1982.

Descriptors: *Decision making, *Surveys, Design criteria, Systems analysis, Optimization.

The process of designing a hydraulic structure is imagined as consisting of these main stages: surveys, including an engineering-geological survey of the site, geophysical and geotechnical investigations, construction of engineering-geological models; formation of an idea about the character and layout of the future structure; construction of a geomechanical model serving as the basis for mathematical and physical modeling; design, calculations and physical modeling; and parametric analysis and establishment of the most important factors determining the design. The use of such a cyclic process, surveys-models-designing-parametric analysis-surveys, makes it possible to obtain the optimal value from the surveys, the necessary accuracy and detail. (Baker-IVI)
W85-00467

Group 6A—Techniques Of Planning

DETERMINATION OF THE FIRM YIELD OF A SYSTEM OF RESERVOIRS FOR WATER SUPPLY,
A. L. Velikanov, and V. I. Klepov.
Hydrotechnical Construction, Vol. 17, No. 9, p 439-443, September, 1983. 1 Fig, 2 Tab, 11 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 15-18, September, 1983.

Descriptors: *Reservoir yield, *Model studies, *Water supply development, *Moscow, *USSR, Simulation, Storage reservoirs, Reservoir operation, Water quantity management.

The city of Moscow and adjacent areas are currently supplied with water from the Volga, Vazuza, and Moscow rivers. The system has grown and now consists of eight reservoirs, four of which are located in the basin of the Moscow River and the other four are located in the basin of the upper course of the Volga River. The increase of water consumption and the increase of the requirements imposed on nature-conservation flooding releases inevitably lead to an increase of the water yield of the system. When developing the reservoir management regulations it is necessary to be guided by certain management quality criteria, and these criteria should take into account the real possibility and form of predicting the inflow of water to the reservoirs. When planning reservoirs for water supply the design probability is assigned on the basis of standards. Indices such as the volume of water delivered to the user, the relative duration of uninterrupted periods, or the relative number of uninterrupted years can serve as characteristics of the reliability of water supply. Simulation models of the operation of water management systems can be of considerable help in developing management regulations, estimating the yield of a water management system, and in determining the indices of its reliability. The use of simulation modeling methods for determining the properties of a system of reservoirs makes it possible to overcome the barrier of the large dimensionality of the problem of optimal control of water management systems. (Baker-IVI)
W85-00490

6B. Evaluation Process

NATIONAL WATER SUMMARY 1983- HYDROLOGIC EVENTS AND ISSUES.
Geological Survey, Reston, VA. Water Resources Div.
Available from Supt. of Documents, GPO, Washington, D.C. 20402. USGS Water-Supply Paper 2250, 1984. 243 p, 11 Fig, 9 Tab, 66 Maps.

Descriptors: *National Water Summary, Federal-State interrelationships, State jurisdiction, Hydrologic cycle, *Water policy, *State policies, Water management, Institutional constraints, Water availability, Water quality, Hydrologic hazards, Land use.

The 1983 National Water Summary reviews current hydrological conditions and recent events in the United States and provides a broad overview of the hydrologic issues facing the nation. The summary also includes a description of water issues for each State, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and the western Pacific Islands under the jurisdiction of the United States. States were chosen as the basis for describing water issues because the country's water resources are managed and controlled, for the most part, by State governments. The State water-issue summaries were prepared by U.S. Geological Survey personnel in each of the states and are based on discussions with more than 130 State and local organizations, reviews of recently published information, and knowledge of water conditions acquired in the course of U.S. Geological Survey studies. The State water-issue summaries identify concerns expressed by State and local water-management officials. In some cases, they also illustrate the variety of actions that are being taken to resolve the issues. Major issues described in this report include (1) the short-term vulnerability of surface-water supplies and shallow ground-water supplies to drought; (2) concerns about the reliability of water supplies as competition for water increases; (3) declining groundwater levels; (4) control of surface-water pollution, especially nonpoint sources of pollution; (5) contamination of ground-water supplies and the mitigation of existing sources of pollution, such as hazardous-waste sites; (6) the potential effects of acidic precipitation; (7) chronic problems of flooding; (8) the impacts of resource development, such as coal mining and low-head hydropower, on water resources; and (9) the development of water allocation and reallocation procedures. Hydrologic perspectives on these issues are discussed under the heading 'Water availability'; 'Water Quality'; 'Hydrologic hazards and land use'; and 'Institutional and management'. (USGS)
W85-00035

ESTIMATED USE OF WATER IN THE UNITED STATES IN 1980,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6D.
W85-00042

WATER IN AMERICA 1983, A REPORT BY THE OFFICE OF WATER POLICY, DEPARTMENT OF THE INTERIOR.
Department of the Interior, Washington, DC. Office of Water Policy.
Available from Supt. of Documents, GPO, Washington, D.C. 20402. OWP Report, (1984). 18 p, 5 Fig, 1 Tab.

Descriptors: *Water policy, *River management, *Interstate water conflicts, *Indian water rights, *Water project development, *Acid rain, *Salinity, Water quality.

This is a supplemental report to accompany the National Water Summary 1983 (USGS Water Supply Paper 2250). That report provides a detailed look at water resources conditions throughout the United States. Several policy issues emerge from this review of regional and State data relating to the availability and quality of our water supply and the impact of natural hazards such as drought and flooding. Their analysis explores the kinds of problems posed by underlying hydrologic conditions, the changing roles of Federal, State and local authorities, and promising trends in solutions developing at each level of government. In this report six policy issues have been chosen for special attention: (1) Improving River Management; (2) Interstate Water Conflicts; (3) Water Project Development; (4) Indian Water Claims; and (5 and 6) Water Quality: Acid Rain and Salinity.
W85-00057

WATER RESOURCES APPRAISAL OF THE COLLEGE OF THE VIRGIN ISLANDS AREA, ST. THOMAS,
Caribbean Research Inst., St. Thomas, VI.
O. Ajayi, and F. Gomez-Gomez.
Technical Report No. 11, September 1983. 70 p, 12 Fig, 10 Tab, 23 Ref. OWRT Project No. A-009-VI (2), Contract/Grant No. 14-34-0001-2150.

Descriptors: *Water supply management, *Water harvesting, Groundwater development, *Conjunctive use, Optimum development plans, *Virgin Islands, *St. Thomas, Cost effectiveness, *Water supply augmentation.

The St. Thomas campus of the College of the Virgin Islands faces water management problems typical of the Virgin Islands. Lack of detailed accounting in the water supply and distribution system makes optimal decision-making for water management at the College difficult to realize. The College has also had to ration water in the past. However, the College has aquifers which can be exploited under better management to yield enough water, in conjunction with the rainwater harvesting system, to satisfy its water needs in an average rainfall year. The College will face increasing water bills if dependency on public supply continues. Water rates have jumped from $6.50/Kgal to $17.50/Kgal in less than four years and are expected to go higher. Harvested rainwater and groundwater represent least cost alternatives of water supply to the College. Emphasis should be on conservation and full utilization of all available roof areas and storage capacity which are presently under-utilized to reduce the overall costs of providing water to the College.
W85-00066

PREDICTION OF ECONOMIC POTENTIAL FOR IRRIGATION USING A GROUNDWATER MODEL,
Oklahoma State Univ., Stillwater. Dept. of Geology.
For primary bibliographic entry see Field 4B.
W85-00336

PROSPECT RISK ANALYSIS APPLIED TO GROUND-WATER RESERVOIR EVALUATION,
G. H. Davis.
Ground Water, Vol. 20, No. 6, p 657-662, November-December, 1982. 2 Fig, 1 Tab, 12 Ref.

Descriptors: *Groundwater storage, *Water yield, *Assessments, *Storage capacity, Aquifer characteristics, Groundwater hydrology, Reservoirs, Evaluation, Risks, Monte Carlo method.

A method is proposed for predevelopment assessments of the potential yield of groundwater reservoirs. A systematic assessment of aquifer parameters leads to estimates of groundwater storage capacity and the geologic risks that may affect those estimates. Area of reservoir, average saturated thickness of aquifers to a limit of economic dewatering, and average specific yield, all arrived at through a Delphi procedure are combined in a Monte Carlo simulation to yield an unrisked product at several probability levels. Marginal probabilities are assigned to each parameter and combined in a further Monte Carlo simulation to yield a series of risk estimates. The results are expressed in a table and a cumulative probability curve of groundwater storage capacity that can provide a basis for economic modeling. When applied to the estimation of fresh groundwater resources of a specific hydrogeologic unit the following steps would be taken: assemble all available hydrogeologic data on the groundwater reservoir or subdivisions thereof; summarize the information following a standard format of tables, sections, and maps; quantify the data to the feasible degree including extent, thickness and character of known aquifers and interbedded materials, mode of occurrence of ground water, porosity, permeability, and storativity of aquifers, and information on recharge and discharge; convene a panel of hydrogeologic experts to review the data for a given reservoir. Each expert is polled as to his subjective estimate of a low storage capacity corresponding to a 95% chance that at least that much storage capacity is available, a high storage capacity corresponding to a 5% chance that at least that much storage capacity is available, a model value which the expert associates with the highest probability of that storage capacity occurring, and a mean value calculated by summing the others and dividing by three. The results are then reviewed by the group. The subjective estimates of the experts are combined in a Monte Carlo procedure to arrive at a set of probabilistic estimates of the storage capacity of the reservoir under consideration. (Baker-IVI)
W85-00341

QUANTITATIVE MODEL TO PREDICT SAFE YIELD FOR WELL FIELDS IN KUFRA AND SARIR BASINS, LIBYA,
Ohio Univ., Athens. Dept. of Geological Science.
M. U. Ahmad.
Ground Water, Vol. 21, No. 1, p 58-66, January-February, 1983. 7 Fig, 1 Tab, 29 Ref.

Descriptors: *Groundwater management, *Well, *Predicting, *Libya, *Kufra Basin, *Sarir Basi, Basins, Water resources development, Irrigatio, Water demand.

Using the available water level data of the Kuf and Sarir basins, a steady state model was co

structed, and regional transmissivities were determined for the two basins. The best match with the actual water level data indicated a discharge of about 80 cu m/s. This appears to be a reasonable discharge on the basis of estimated underflow of 40 cu m/s from Libya, and about 29 cu m/s is discharged from Libyan oases. In addition to the existing KSP, KPP, South and North Sarir, and Jalo well fields, nine more well fields are proposed in the Kufra and Sarir basins. These well fields are planned to pump a total quantity of 120 cu m/s. The simulation which was performed indicated that sufficient drawdown was available to last at least 50 years. (Baker-IVI)
W85-00358

EVALUATION OF THE EFFECTIVENESS OF MEASURES TO SHORTEN THE CONSTRUCTION TIME OF MASS CONCRETE STRUCTURES OF HYDROELECTRIC STATIONS,
B. E. Kazantsev, and V. I. Teleshev.
Hydrotechnical Construction, Vol. 16, No. 7, p 395-400, July, 1983. 2 Fig, 2 Tab, 2 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 7, p 26-29, July, 1982.

Descriptors: *Concrete, *Decision making, Hydraulic engineering, Construction, Optimization, Systems analysis.

The most important criterion of the optimization of a decision with respect to the technology and organization of constructing structures at hydrostations is the time necessary to complete the various tasks needed. The effectiveness of technological and oganizational decisions aimed at increasing the rate of placing concrete in the main structures and, consequently, at shortening the construction time on the whole, should be examined carefully. An index is presented which permits a numerical evaluation and comparison of the effectiveness of introducing various organizational and technological measures and singles out the most effective ones. The example given uses the proposed criterion and shows its clarity and practical applicability for evaluating the effectiveness of specific measures. Since in principle it is possible that one measure can prove to be optimal with respect to an index, an increase of height above this optimal value not only will not increase the rate of placing concrete in the structure but will even lead to a decrease. (Baker-IVI)
W85-00476

ARCHITECTURE OF FOREIGN HYDROELECTRIC STATIONS,
I. N. Vaksman, and E. A. Pershanin.
Hydrotechnical Construction, Vol. 17, No. 10, p 616-20, October, 1983. 8 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 16-20, October, 1983.

Descriptors: *Hydroelectric plants, *Developing countries, *Architecture, *Egypt, *Syria, *Tunisia, Morocco, Hydraulic structures, Construction, Design criteria, Planning.

When developing the architecture of hydraulic structures for new power stations in developing countries, it is necessary to take into account not only the local climatic conditions and established national traditions, but also those social transformations which are characteristic for the majority of them. The depth of the approach of architects to general architectural solution is characterized by the effect on the engineering-technological layout of the powerhouse of the hydroelectric station. It is noted that when designing generator rooms not combined with dams of powerhouses, a unique engineering tradition has become established in which the structural members of the supporting framework of the powerhouse itself are used for technological servicing of the units by crane equipment during their installation or repair. Several architectural approaches to specific dams are discussed including the Aswan High Dam on the Nile River in Egypt, the Tabqa hydrostation on the Euphrates River in Syria, a hydrostation on the Isseb River in Tunisia, and the Mansour Eddahbi hydroelectric station in Morocco. (Baker-IVI)
W85-00500

HYDROPOWER UTILIZATION SCHEME OF THE EUPHRATES RIVER IN SYRIA,
For primary bibliographic entry see Field 4A.
W85-00504

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COST-BENEFIT ANALYSIS OF WETLAND DRAINAGE,
Leeds Univ. (England). School of Economic Studies.
For primary bibliographic entry see Field 4A.
W85-00278

6D. Water Demand

ESTIMATED USE OF WATER IN THE UNITED STATES IN 1980,
Geological Survey, Reston, VA. Water Resources Div.
W. B. Solley, E. B. Chase, and W. B. Mann, IV.
Available from Distr. Br., USGS, 604 S. Pickett St., Alex., Va. 22304. U.S. Geological Survey Circular 1001, 1983. 56 p, 13 Fig, 22 Tab, 119 Ref.

Descriptors: *Estimated U.S. water use, *Water use, Water use efficiency, *Consumptive use, Water demand, *Estimating, Irrigation water, Municipal water, Domestic water, Industrial water, Water reuse, Conjunctive use, United States.

Water use in the United States in 1980 was estimated to be an average of 450 bgd (billion gallons per day) of fresh and saline water for offstream uses-an 8-percent increase from the 1975 estimate and a 22-percent increase from the 1970 estimate. Average per capita use for all offstream uses was 2,000 gpd (gallons per day) of fresh and saline water, and 1,600 gpd of fresh water; this represents a slight increase since 1975. Offstream uses include (1) public supply (domestic, public, commercial, and industrial uses), (2) rural (domestic and livestock uses), (3) irrigation, and (4) self-supplied industrial uses (including thermoelectric power). From 1975 to 1980, public supply use increased 15 percent to 34 bgd, rural use increased 14 percent to 5.6 bgd, irrigation use increased 7 percent to 150 bgd, and self-supplied industrial use increased 8 percent to 260 bgd. Within the industrial category, thermoelectric power generation increased 9 percent to 210 bgd, whereas other self-supplied industrial uses remained approximately constant at 45 bgd. Total fresh water consumed- that part of water withdrawn that is no longer available for subsequent use- by these offstream uses increased 7 percent to 100 bgd, with irrigation accounting for the largest part of water consumed, estimated at 83 bgd. Estimates of withdrawals by source indicate that from 1975 to 1980, total groundwater withdrawals increased 7 percent to 89 bgd, and total surface-water withdrawals increased 9 percent to 360 bgd. Total saline-water withdrawals increased by about 2 bgd to 72 bgd, of which 71 bgd was saline surface water. Reclaimed sewage amounted to about 0.5 bgd in 1980, an 11-percent decrease from 1975. Water used for hydroelectric power generation, an instream use, remained unchanged from 1975 at 3,300 bgd. This is in contrast to the increasing trend from 1950 to 1975. Although 1980 estimates of water use were higher than the 1975 estimates for all offstream categories, trends establishing during the periods 1970 to 1975 and 1975 to 1980 indicate a general slackening in the rate of increase of total withdrawls in comparison to the period 1965 to 1970. (USGS)
W85-00042

RESOURCES OF THE TUG HILL REGION,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
A. Eschner, J. Osinski, D. Howe, and S. Shupe.
Report prepared for the Temporary State Commission on Tug Hill, February 1984. p 86-119, 5 Fig, 14 Tab, 28 Ref.

Descriptors: *Precipitation, *Aquifers, *Rainfall, *Snow accumulation, *Annual distribution, *Water quality, Regional development, Surface water, Stream gages, Water sampling, Groundwater availability, Groundwater quality, *New York, Tug Hill region.

Few areas in New York State receive more precipitation than the Tug Hill region. The average annual precipitation for the study area during the period 1963-1974 was 45.18 inches, with some portions receiving in excess of 54 inches. Precipitation is fairly evenly distributed throughout the year; average monthly totals range from 7.2 percent (March) to 10.8 percent (November) of the annual value. The annual snow accumulation ultimately provides most of the region's usable water in surface streams or groundwater aquifers. Municipal and industrial pollution, as well as sediment and agricultural pollution, occur mostly on the fringes of the region. Relatively high quality groundwater is available throughout the region. In a large portion of the area, its yield is very low; however, in some places, such as the area around Camden, aquifers have enormous capacity and potential yield. Use of water is relatively low when compared to the total annual amount available. An expanded regional program of streamgaging is recommended, including reactivation of the recently inactive Deer River gage, planned in conjunction with the development of explicit regional resource management objectives. Also recommended is a comprehensive groundwater survey, primarily in Jefferson and Lewis Counties where information is limited; a design sampling network and schedule to better define the water quality of the region's water bodies and aquifers; and additional snow survey courses. (Garrison-Ommiplan)
W85-00044

INVESTIGATION OF THE CARRYING CAPACITY OF THE MONOCACY RIVER AS A SCENIC AND RECREATIONAL RESOURCE, VOLUME III. THE MONOCACY RIVER--ANALYSIS OF EXISTING SITUATION AND RECOMMENDATIONS FOR PROTECTING THE RIVER RESOURCE,
Maryland Univ., College Park. Dept. of Recreation.
F. R. Kuss, and K. Schaub.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 190222, Price codes: A08 in paper copy, A01 in microfiche. Maryland Water Resources Research Center Publication No. 67, December 1982. 141 p, 5 Fig, 30 Tab, 21 Ref, 1 Append. OWRT Project No. A-041-MD (3), Contract/Grant No. 14-34-0001-2122.

Descriptors: River basin development, River systems, Rivers, Watersheds, *Recreation demand, Boating, Fishing, Swimming, Camping, Camp sites, Riparian rights, Management planning, Water quality, Wildlife habitats, *Monocacy River, *Maryland, Piedmont, *Scenic rivers, *Carrying capacity.

The Monocacy River Valley of central Maryland is recognized as a significant cultural and historic resource of national importance. Designated as a scenic river by the state in 1977, this study describes the existing physical, biological and cultural resources of the river and valley; how different segments of the public view the system and its preservations; makes an assessment of future demands for river-oriented recreation in the counties through which the river courses, and recommends a conceptual plan for the preservation of the river corridor. In Volume III the demand for and supply of recreational facilities in the three Maryland counties which encompass the Monocacy River Valley are analyzed. Based on trends in reported participation rates and population projections to 1990, canoeing, hiking, and nature walks will show net increases in demand up to 1990 in the three counties. Demand for camping, fishing, and swimming facilities will plateau or show modest growth during the period. To facilitate future planning efforts which utilize existing institutional means for protecting the river resource and surrounding lands; to encourage the cooperation of the riparian land-owners in maintaining the scenic quality of the corridor; to initiate area-wide program planning to improve water-quality, and to provide im-

proved wildlife habitat in the corridor area, a management plan for the Monocacy River is proposed.
W85-00073

IMPACT OF LAKE MICHIGAN ALLOCATIONS ON THE CAMBRIAN-ORDOVICIAN AQUIFER SYSTEM,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 4B.
W85-00343

6E. Water Law and Institutions

NATIONAL WATER SUMMARY 1983- HYDROLOGIC EVENTS AND ISSUES.
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6B.
W85-00035

WATER SUPPLY SOURCE PROTECTION RULES AND REGULATIONS PROJECT,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
R. D. Hennigan.
Final Report, March 1981. 178 p, 8 Fig, 22 Tab.

Descriptors: *Administrative regulations, *Administrative agencies, *Water supply systems, *Legal aspects, *Water policy, *Public policy, Public health, Policy making, Competing use, Potential water supply, Contamination, *New York.

A comprehensive review of the New York State public water supply rules and regulations program was conducted beginning with notification of 4,000 interested persons in the public sector. The review covered program development and administration, the nature and extent of water resources utilization for public water supply purposes, related environmental protection programs, current issues and possible contaminants. Among the recommendations are that the State Department of Health should enact rules and regulations for all public water supply sources in cooperation with the water supply owners and the local health department. This would help produce an effective water supply source protection program. In addition, county health agencies and district health agencies should be given the responsibility for regular and special inspections so they may be of assistance to water supply systems serving fewer than 5,000 people. The county or district health agency should make annual inspections of the watersheds of larger systems, and should be responsible for enforcing voluntary compliance. The responsibility for enforcement of involuntary or forced compliance should be transferred from local boards of health to regional health offices. The report also recommends various amendments to the public health law. The study found that there is no provision in law to protect surface or ground water resources from contamination. (Garrison-Omniplan)
W85-00046

WATER IN AMERICA 1983, A REPORT BY THE OFFICE OF WATER POLICY, DEPARTMENT OF THE INTERIOR.
Department of the Interior, Washington, DC. Office of Water Policy.
For primary bibliographic entry see Field 6B.
W85-00057

REDUCING THE FEDERAL ROLE IN WETLANDS PROTECTION,
P. Wakefield.
Environment, Vol. 24, No. 10, p 6-13, 30-33, December, 1982. 8 Fig, 98 Ref.

Descriptors: *Wetlands, *Regulations, *Federal jurisdiction, State jurisdiction, Legislation, Decision making, Planning, Policy, Resources management.

A growing awareness that wetlands are both ecological and economic resources has encouraged a stronger commitment to wetlands management through state and federal legislation and regulation. The major federal provision for wetlands protection, Section 404 of the Clean Water Act, has been put high on the priority list by the Presidential Task Force on Regulatory Relief. The debate currently reflects the larger question of the proper role of the federal government in wetlands protection. The National Wetlands Inventory Project, directed by the Fish and Wildlife Service (FWS) was first established in 1974 and expanded by the 1977 Amendments to the Clean Water Act to provide comprehensive, scientifically determined data about the extent and characteristics of the nation's wetlands. Although a preliminary inventory report calls for further study by an interdisciplinary team of scientists to determine the causes and implications of the trends in wetlands gains and losses, the potential importance of the inventory for regulatory use is clear. New proposals designed to reduce the regulatory burdens created by 404 include: reducing 404 jurisdiction to traditionally navigable waters; reduce permit processing time; transfer more permitting authority to the states; expand the use of general permits; and reduce conflicting or overlapping policies and responsibilities. The Clean Water Act is itself due for Congressional reauthorization. Even so, any slowdowns in the flow of regulatory changes are likely to be only temporary. (Baker-IVI)
W85-00275

COLORADO RIVER, RIVER OF CONTROVERSY,
Center for Natural Resource Studies, Berkeley, CA.
R. Coats.
Environment, Vol. 26, No. 2, p 7-13, 36-39, March, 1984. 10 Fig, 22 Ref.

Descriptors: *Management, *Colorado River, *Legal aspects, Agriculture, Fishing, Wildlife, Salinity, Decision making, Planning, Legislation, Regulation, Water supply development.

The Colorado River Working Symposium: Management Options for the Future was convened for the purpose of stimulating, in a neutral forum, freewheeling discussions of the severity of Colorado River problems and of possible solutions. The cornerstone of the body of the law known as the Law of the River is the Colorado River Compact. The upper basin states began in 1920 to push for a compact that would secure a water supply for their own development. Provisions and the lack of provisions in this compact are discussed. Through the years conflicts with the states of Arizona and California as well as international conflicts with Mexico arose. Problems with salinity control, legal and institutional obstacles to diverting and utilizing saline groundwater, relocation of industrial and municipal outfalls, Indian water rights, wilderness values and instream uses, agricultural vs other uses, and efficiency vs equity are discussed. (Baker-IVI)
W85-00276

PERMIT FEES FOR NEW JERSEY'S SURFACE AND GROUNDWATER DISCHARGERS,
New Jersey Dept. of Environmental Protection, Trenton.
P. R. Yeany.
Environmental Forum, Vol. 2, No. 9, p 21-25, January, 1984. 3 Tab.

Descriptors: *Groundwater management, *Legislation, *Permits, *New Jersey, Regulations, Groundwater pollution, Wastewater disposal, Landfills, Waste disposal.

Nearly two years ago the New Jersey Dept. of Environmental Protection adopted regulations establishing the Pollutant Discharge Elimination System for the state (NJPDES). Concerning groundwater, the NJPDES Regulations established a system of permits for a variety of pollution sources including sanitary landfills, land application of waste sludges and septage, underground injection wells, surface impoundments, infiltration-percolation lagoons, and community septic systems. Permit fees were to be used to fund the program. Not only do the fees support the program, as they are designed in relation to environmental factors, the fees encourage reduction of environmental harm caused by the discharges. The NJPDES Surface Water Budget is presented along with a breakdown by discharge category. Examples are offered of compliance sampling inspections listed by permit number, supplying the name of the facility and giving the results of the sampling study. Various issues have been raised in response to the fee schedules. (Baker-IVI)
W85-00281

INADVERTENT INCOME REDISTRIBUTION EFFECTS OF STATE WATER DEVELOPMENT FINANCING,
Utah Water Research Lab., Logan.
D. H. Hoggan, J. M. Bagley, and K. R. Kimball.
Growth and Change, Vol. 14, No. 4, p 32-36 October, 1983. 7 Ref.

Descriptors: *Water resources development, *Financing, *Income distribution, *Utah, Government supports, Loans, Social aspects.

Governmental financing of water development projects typically has income redistribution objectives. Income transfers are accomplished through direct grants between units and levels of government, interest foregone by a higher level of government, sharing of certain costs among units and levels, or other forms of direct and indirect subsidy ultimately derived from general tax revenues. Examples of inadvertent redistribution are offered using three programs of state financial assistance for water projects in Utah. Utah's Revolving Construction Fund was created in 1947 and is used mainly to finance irrigation projects such as the construction of small reservoirs, the lining of canals, installation of pipeline conveyance systems and the repair of existing irrigation facilities. The Cities Water Loan Fund, a second revolving fund was created in 1975 in response to two problems: the need of fast growing communities in energy resource development areas to expand and improve their potable water supply and, the need of many small communities to improve their water systems to meet increasingly stringent health standards. The Water Resources Conservation and Development Fund, a third fund, was created in 1977 in the wake of an 18-month drought and a federal water policy reevaluation and subsequent project hit list that created some concern among western water officials. To initiate and sustain any governmental program requires social justification. Frequent reevaluation is needed to guarantee that outcomes remain congruent with the intended social purpose. (Baker-IVI)
W85-00367

6F. Nonstructural Alternatives

FLOODPLAIN MANAGEMENT HANDBOOK
Flood Loss Reduction Associates, Palo Alto, CA
Available from Supt. of Documents, GPO, Washington, D.C. 20402. Water Resources Council Report, Washington, D.C., September 1981. 89 p, 19 Fig, 3 Tab, 30 Ref.

Descriptors: *Flood plain management, *Handbooks, Flood plains, *Flood protection, *Flood loss mitigation, Flood plain zoning, Nonstructural alternatives, Technical assistance, Financial assistance.

A concerted effort is under way to stem the growth of flood losses. This handbook summarizes the problem and points out what can be done. It is intended to help local officials, public interest groups and concerned citizens in assessing the problems in their area and initiating appropriate and effective management of the floodplain. The handbook treats both riverine and coastal floodplains. It describes a full range structural and nonstructural measures to reduce flood losses and maintain the natural values of the floodplain. The handbook provides step-by-step guidance for developing a floodplain management program. It also identifies the range of technical and financial assis

ance available for preparing and implementing such programs.
W85-00059

IMPROVEMENT OF WATER ACCOUNTING AT PUMPING STATIONS,
Yu. K. Zhukov, and I. S. Sarzhinskii.
Hydrotechnical Construction, Vol. 16, No. 5, p 289-291, November, 1982. 4 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 5, p 48-49, May, 1982.

Descriptors: *Pumping plants, *Water measurement, *Water storage, Accounting, Water shortage, Uzbekistan, Water distribution, Metering.

Due to the shortage of irrigation water in Uzbekistan, improving the system of accounting and distributing water resources is becoming more and more urgent. Reliable operation of water accounting devices at pumping stations is vital to this task. The simplest, most reliable, and at the same time highly accurate method of water accounting is the variable difference method in which the difference of piezometric heads is measured at two selected points of the walls of the pressure conduit. This method is most effective when the conduits have elbows. When designing pumping stations, it is necessary to specify in the design pressure leads for head flowmeters on elbows of pressure pipes and segment orifice plates in the cases where there are no elbows. It is necessary beforehand to provide for and assemble devices facilitating the measurement of discharges when testing pumps and calibrating flowmeters. (Baker-IVI)
W85-00464

G. Ecologic Impact Of Water Development

PROJECTED EFFECTS OF PROPOSED CHLORIDE-CONTROL PROJECTS ON SHALLOW GROUND WATER--PRELIMINARY RESULTS FOR THE WICHITA RIVER BASIN, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 5G.
W85-00026

PHEASANT (PHASIANUS COLCHICUS) HABITAT SUITABILITY MODEL,
Washington State Univ., Pullman. Dept. of Agricultural Economics.
C. Matulich, J. E. Hanson, and I. Lines.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 190438, Price codes: A05 in paper copy, A01 in microfiche. Washington Water Research Center Report 55, November 1983. 83 p, 33 Fig, 58 Ref. OWRT Project No. B-086-WASH (2), Contract/Grant No. 14-34-0001-9160.

Descriptors: *Habitat suitability, Index, Environmental effects, *Wildlife management, *Pheasant, Washington, Literature review, Model studies, Columbia Basin Irrigation Project.

A breeding and winter habitat suitability index (HSI) model is developed for the ring-necked pheasant (Phasianus colchicus). The HSI model framework follows the Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service. Overall habitat suitability is defined in terms of seasonal habitat, species life requisites and the environmental attributes that quantify each habitat type's potential for satisfying specific life requisites. A review of literature on pheasant habitat requirements is presented, followed by a generalized year-round HSI model. This general model is then modified to account for habitat characteristics of the East High area of the Columbia Basin Irrigation Project, Washington.
W85-00062

EFFECTS OF URBANIZATION ON PHYSICAL HABITAT FOR TROUT IN STREAMS,
Montana State Univ., Bozeman. Dept. of Biology.
R. White, J. D. Wells, and M. E. Peterson.
Available from the National Technical Information Service, Springfield, VA 22161, as PB84 190131, Price codes: A03 in paper copy, A01 in microfiche. Montana Water Resources Research Report No. 139, Bozeman, October 1983. 48 p, 8 Tab, 6 Fig, 18 Ref, 1 Append. OWRT Project No. A-134-MONT (1), Contract/Grant No. 14-34-001-2128.

Descriptors: *Trout, *Stream, Fisheries, Habitat, *Channel improvement, Fish populations, Bank stabilization, Shoreline cover, Fish management, *Montana, Urban streams, Nonurban streams, Wyoming Habitat Quality Index.

Non-urban were more favorable than urban stream sections as habitat for trout and held more trout. The major habitat difference was amount of in-stream solid overhead hiding cover. Urban land modifications had created unnaturally straight, narrow channels with high, unstable banks with little of the undercuts and woody debris that provide shelter for fish. Urban and non-urban sections did not differ significantly with respect to water velocity, dissolved nitrate, or amount of pools or water turbulence. Per unit stream length, non-urban sections averaged 54% more trout larger than 20 cm (8 inches) and 74% greater total trout biomass than urban sections. In both urban and non-urban areas, trout abundance as kg/ha was generally below the level predicted by the Wyoming Habitat Quality Index (HQI). This could have been due to effects of angling or other unmeasured factors, to measurement errors or to inapplicability of the HQI method to the areas studied. There is evidence that altering the HQI method to consider solid overhead hiding cover and pool-turbulence hiding cover as separate variables rather than as a total cover index will enhance predictiveness. Implications for urban stream fishery management are discussed.
W85-00070

INFLUENCE OF A REDUCTION IN FLOW ON A MOUNTAIN RIVER: THE ASTON (ARIEGE) (INFLUENCE D'UNE REDUCTION DE DEBIT SUR UN TORRENT DE MONTAGNE: L'ASTON (ARIEGE)),
Centre National de la Recherche Scientifique, Toulouse (France). Centre d'Ecologie des Ressources Renouvelables.
E. Chauvet.
Annales de Limnologie, Vol. 19, No. 1, p 45-49, 1983. 3 Fig, 2 Tab, 17 Ref.

Descriptors: *Aston, *Ariege, *France, *Dam effects, *Mountain streams, *Trout, Environmental effects, Population dynamics, Species diversity, Chironomids, Spawning, Immature growth stages.

Although a number of dams exist in the Pyrenees Mountains, little is known about the ecological effects of such structures on mountain streams. In 1956, a dam was constructed on the Aston, a branch of the Ariege at Riete. The reservoir has an area of 75,000 sq m and a capacity of 800,000 cu m. The flow reduction downstream of the dam (100 l/s minimum instead of 2 cu m/s on the average upstream) has not produced any notable change in the chemical properties of the water. There has been a degradation in the biological diversity of the benthic fauna downstream of the dam, with a predominance of chironomids. The trout population was reduced by 10% and its biomass by 25% downstream of the dam. The reduction in current velocity and the surface area of the stream are probably responsible for this decrease. The trout populations are unbalanced, with a large proportion of old fish. The area immediately downstream from the dam is subject to sudden variations in flow and to turbidity during discharge, and so is unfavorable for reproduction and young fish. (Moore-IVI)
W85-00091

UPSTREAM MIGRATION BY YOUNG PIGMENTED FRESHWATER EELS (ANGUILA AUSTRALIS AUSTRALIS RICHARDSON) IN TASMANIA,
Tasmanian Inland Fisheries Commission, Hobart (Australia).
R. D. Sloane.
Australian Journal of Marine and Freshwater Research, Vol. 35, No. 1, p 61-73, 1984. 6 Fig, 1 Tab, 22 Ref.

Descriptors: *Fish behavior, *Hydroelectric plants, *Migration, *Eels, *Tasmania, *Australia, Seasonal variation, Temperature effects, Turbines, Solar radiation, Fisheries.

In view of the importance of elver migrations, serving to replenish eel stocks in inland waterways, the Tasmanian Inland Fisheries Commission has undertaken a pilot scheme to transfer elvers upstream at major hydroelectric dams that provide an impass to upstream eel migrations. During late spring and summer, upstream migrations by young pigmented freshwater eels can be seen at stream barriers in Tasmania. The elver runs at two major hydroelectric dams, Trevallyn and Meadowbank, were sampled regularly during the period 1977-1981 and migrations at a number of smaller stream barriers throughout Tasmania were also studied. Migrating elvers were short-finned eels, A. a. australis; only a single specimen of the long-finned eel, A. reinhardtii Steindachner, was recorded. Elvers sampled at inland stream barriers were both larger and older than those found nearer the sea, indicating that eels migrate farther upstream for several years in succession. Eels involved in upstream migration were shorter than 25 cm, having spent up to 10 years in fresh water. Day length, water temperature and river flow all contribute to the initiation and control of elver migration. At Trevallyn Power Station it was apparent that the run of elvers was determined by turbine output rather than by any natural environmental influence. The combined loadings of No. 1 and No. 2 turbines have been correlated with the elver catch and it is obvious that the major catches correspond to low flows through the power station tailrace. No clear evidence for any relationship between lunar days and elver runs was noted. The number of elvers involved in annual migrations at major hydroelectric dams in Tasmania is substantial: the largest migration occurs at Trevallyn, where between 3,000,000 and 5,000,000 elvers take part each year. These elvers represent a considerable stocking potential and could be used to expand the local wild eel fishery. (Baker-IVI)
W85-00131

MITIGATING EFFECTS OF ARTIFICIAL RIFFLES AND POOLS ON THE FAUNA OF A CHANNELIZED WARMWATER STREAM,
International Joint Commission-United States and Canada, Columbus, OH.
C. J. Edwards, B. L. Griswold, R. H. Tubb, E. C. Weber, and L. C. Woods.
North American Journal of Fisheries Management, Vol. 4, p 194-203, 1984. 8 Fig, 7 Tab, 20 Ref. Department of the Interior Contract 14-16-00080-738.

Descriptors: *Channelization, *Aquatic animals, *Olentangy River, *Ohio, Fish, Invertebrates, Population diversity, Population dynamics, Riffles, Pools, Environmental effects, Sport fishing.

The effect of stream channelization on macroinvertebrates, fish, and the sport fishery was studied in the Olentangy River at Columbus, Ohio. Macroinvertebrate abundance, diversity indices, standing stock in the benthos, and drift were significantly lower in a channelized area than in either a natural area or a channelized area mitigated with artificial riffles and pools. The common groups of fishes found in the Olentangy River included important game species such as sunfishes, crappies, basses, and catfishes. In general these fishes were significantly more abundant in the unchannelized and mitigated areas, whereas nongame fish, fish that are bottom and detritus feeders, predominated in the channelized areas. Composition of the sport fishing catch and catch rates accurately reflected the predominant fish community in each area. (Baker-IVI)
W85-00203

EFFECTS OF INCREASING SNOWPACK ON A SUBALPINE MEADOW IN THE UINTA MOUNTAINS, UTAH, U.S.A.,
Native Plants, Inc., Salt Lake City, UT.
For primary bibliographic entry see Field 2C.
W85-00236

IMPACT OF LAND-USE ON THE ACID AND TRACE ELEMENT COMPOSITION OF PRECIPITATION IN THE NORTH CENTRAL U.S.,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
For primary bibliographic entry see Field 2K.
W85-00243

RIVERS: OUR VANISHING HERITAGE,
National Audubon Society, Washington, DC.
For primary bibliographic entry see Field 4A.
W85-00282

EFFECTS OF LONG-TERM ARTIFICIAL FLOODING ON A NORTHERN BOTTOMLAND HARDWOOD FOREST COMMUNITY,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
R. A. Malecki, J. R. Lassoie, E. Rieger, and T. Seamans.
Forest Science, Vol. 29, No. 3, p 535-544, 1983. 2 Fig, 3 Tab, 20 Ref.

Descriptors: *Water management, *Flooding, *Forests, *New York, *Plant communities, Wildlife habitats, Bottomlands, Trees, Maple, Oak, Ash, Elm, Water level fluctuations, Foliar stress.

A water management program was begun in 1965 at the Montezuma National Wildlife Refuge in central New York to evaluate the feasibility of seasonally flooding bottomland hardwood forests to encourage their use by waterfowl. Two 120-ha bottomland hardwood impoundments were subjected to at least 12 years of continuous spring flooding (i.e., mid-March to late June). Mean water depth during flooding was 27-30 cm. There was little change in the composition of the major tree species present. Tree seedling survival favored red maple (Acer rubrum), a species capable of reproducing vegetatively as well as by seed germination, over that of red ash (Fraxinus pennsylvania), swamp white oak (Quercus bicolor) and American elm (Ulmus americana). Among the herbaceous species, arrow arum (Peltandra virginica), swamp loosestrife (Decodon verticillatus), and Bidens spp. increased dramatically in mean density and frequency of occurrence, whereas less flood and shade tolerant species such as ferns were reduced. Growth rates of the major tree species in the impoundments were slower than those of trees samples in a nearby bottomland hardwood stand with natural water level fluctuations. Evidence of foliar stress in the overstory canopy of the flooded impoundments was apparent from analysis of aerial infrared transparencies. This was especially noted in one impoundment which retained water for a longer period due to soil type, topography, and dike design. The successful continuance of such a management scheme depends upon the recognition of the need to limit the duration of flooding, to provide for nonflooding years, to allow seedling establishment and to maintain the vigor of the existing plant community. (Moore-IVI)
W85-00291

SMALL HYDROELECTRIC STATIONS AND THE ENVIRONMENT (ENVIRONMENT ET PETITES USINES HYDROELECTRIQUES),
Conseil Superieur de la Peche, Clermont-Ferrand (France).
R. Cuinat, and Ph. Roussel.
Houille Blanche, No. 4/5, p 243-247, 1981. 2 Fig.

Descriptors: *Hydroelectric plants, *Environmental effects, *France, Mountains, Water resources development, Regulations, Resources development.

In France, due to the increase in the price of oil, the value of other energy sources, such as small hydroelectric plants, has increased. The placement of new small hydroelectric plants in certain mountainous regions may lead to the destruction of the last natural zones in those regions. Thus the lasting effects of these structures may be out of all proportion to the power derived from the installation. The effects of small hydroelectric power stations on the environment are not significantly different from those of larger installations. The current regulations which deal with such installations do provide for a number of constraints on operators which are based on the size of the project and the quality of the environment. These constraints give priority to protecting the aquatic environment, and particularly the aquatic fauna as well as the countryside. A program has been established for the use of the waters in each hydrographic basin, to ensure balanced energy development that enables other uses of water to be preserved. (Baker-IVI)
W85-00381

COLONIZATION AND SUCCESSION OF BENTHIC MACROINVERTEBRATES IN A NEW RESERVOIR,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Entomology.
J. R. Voshell, Jr., and G. M. Simmons, Jr.
Hydrobiologia, Vol. 112, No. 27-39, 1984. 2 Fig, 5 Tab, 46 Ref.

Descriptors: *Benthos, *Colonization, *Succession, *Invertebrates, *Reservoirs, *Postimpoundment, *Lake Anna, *Virginia, Environmental effects, Sedimentation, Detritus, Dam effects, Spatial distribution.

Lake Anna, a mainstream impoundment in Virginia, was constructed to provide cooling water for a nuclear powered electricity generating facility. The reservoir began filling in January 1972 and reached normal pool level in November 1972; the reservoir filled more quickly than expected because of flooding induced by a hurricane. Benthic macroinvertebrates were sampled for the first three years after filling by means of artificial substrates placed on the bottom and retrieved with SCUBA. Lake Anna was well colonized by benthic macroinvertebrates during the summer season immediately after impoundment. The total density of organisms increased in each of the first three years. Major changes in the fauna occurred between the first and second years, but the changes between the second and third years were more subtle. The first colonizers appeared to be dependent upon the components of the former ecosystem for food and habitat. As autochthonous factors began to regulate succession, diversity increased and the dominant species shifted to an assemblage of second colonizers. These factors included: decomposition of terrestrial vegetation and detritus leaving bare substrate, sedimentation, improved food quality of the organic matter in the sediment because of ingestion and egestion by the organisms themselves, increased plankton populations, and appearance of macrophytes. As the second colonizers became firmly established in the third year, distinct patterns of spatial distribution began to appear among species with similar niches. Herbaceous vegetation and coarse detritus from the terrestrial system stimulate the early colonization, and pre-impoundment basins should be prepared with this in mind. (Moore-IVI)
W85-00425

USE OF THE CHANNELS OF FLATLAND RIVERS FOR INTERBASIN WATER TRANSFER,
For primary bibliographic entry see Field 8B.
W85-00452

ARTIFICIAL SEISMICITY, CONDITIONS AND POSSIBLE MECHANISM OF OCCURRENCE OF DAM EARTHQUAKES,
N. I. Kalinin, and I. P. Kuzin.
Hydrotechnical Construction, Vol. 16, No. 6, p 295-303, June, 1982. 4 Fig, 1 Tab, 13 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 6, p 12-16, June, 1982.

Descriptors: *Earthquakes, *Dam construction, *Toktogul Reservoir, Reservoirs, Safety, Water resources development, Tectonics, Seismic properties.

Examples are given of seismic activity caused by dam construction and reservoir filling. Observations in the zone of the Toktogul reservoir began 11 years before the start of filling. Spatial distribution of seismicity and its temporal variations were studied in the entire region (150 by 120 km), in the reach of the reservoir (40 x 70 km), and in the immediate vicinity of the dam (R = 15-20 km). Variations of seismic activity in 1972-76 in the immediate zone of the reservoir were clearly distinguished against the background of a general decline of seismic activity of the region. The number of relatively weak earthquakes increased by 2.5 to 4.0 times. Migration of the epicenters occurred toward the dam and lower pool. The earthquakes began to group along the Naryn River channel and Karasu fault. The range of depths of the foci narrowed from 0-15 km to 0-5 km, and more than 50% of the tremors began to occur at depths of 0-5 km. The cyclic nature of the seismic activity correlated with the rate of variation of the reservoir water level with a correlation coefficient of 0.59 and a two month lag time. The rise of the reservoir level above 100 m at the end of 1977 was followed by a marked relative increase in the number of weak earthquakes at the dam site. During triggering of induced earthquakes an interaction of several factors related to different structural features probably occurs. The action of the surcharge propagates almost instantaneously, whereas the thermoelastic stresses and pore pressure are redistributed in depth for years. (Baker-IVI)
W85-00466

CHANGE IN THE ICE AND THERMAL REGIME OF THE VILYUI RIVER IN THE LOWER POOL OF THE VILYUI I-II HYDROSTATION,
S. N. Nazarenko, and N. B. Sakharova.
Hydrotechnical Construction, Vol. 16, No. 8, p 431-435, August, 1982. 3 Fig, 5 Tab, 1 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 23-26, August, 1982.

Descriptors: *Water resources development, *Environmental effects, *Vilyui River, Hydroelectric plants, Thermal pollution, Ice, Temperature.

A comparison of the thermal discharges of the Vilyui River at the site of the Vilyui hydroelectric station during the natural period and years of operation of the hydrostation gives a picture of the redistribution of the thermal runoff that involved changes in the thermal and ice regime of the river at a great distance from the hydrostation. The changes in water temperature, time of freezeup and breakup, ice thickness, and levels of the ice period on a 200-1000 km stretch from the hydrostation were traced. Under natural conditions winter water levels gradually decreased as the discharges decreased. With the operation of the plant, an increase of the winter water levels was noted and traced on a stretch more than 1000 km long. A noticeable decrease of the water temperature in the summer months was noted on a stretch up to 800 km long, and an increase of temperature in the spring and fall months in a stretch 600 km long. Disturbances of the ice regime of the river do not extend farther than 400 km, in which case migration of the ice edge occurs in the 35-60 km stretch closest to the hydrostation and the formation of secondary polynyas in the ice cover is noted on riffle stretches at a distance up to 200 km. (Baker-IVI)
W85-00480

7. RESOURCES DATA

7A. Network Design

EVALUATION AND DESIGN OF A STREAMFLOW-DATA NETWORK FOR CONNECTICUT,

Geological Survey, Hartford, CT. Water Resources Div.
L. A. Weiss.
Connecticut Water Resources Bulletin No. 36, Dept. of Environmental Protection, Hartford, 1983. 30 p, 12 Fig, 8 Tab, 24 Ref.

Descriptors: *Surface water, *Statistics, *Network design, *Hydrologic data collection, *Regression analysis, Peak flow, Low flow, Average flow, Drainage area, Geology, Rainfall, Hydraulic geometry, Stochastic hydrology, Gaging stations, *Connecticut, Bayesian analysis, Streamflow-data networks.

A method of evaluating the transferability of streamflow information by regional regression analysis, intercorrelation of streamflow data, and Bayesian analysis was applied in Connecticut to several flow variables. The mean flow was chosen to represent the availability of water as a resource for development; the 2-year, 10-year, 50-year, and 100-year recurrence intervals of the annual peak series were chosen to represent flooding potential, and the 7-day and 30-day mean low flows for the 2-year and 10-year recurrence intervals were used to represent lowflow potential. The results indicate: (1) that the standard errors of estimate of the regression models are good approximations of the median true average errors of prediction of the Bayesian distributions of estimates of inaccuracy; and (2) for the streamflow variables used, little improvement can be expected in the regression relations by collecting more streamflow data. Improved regression models would be required to significantly reduce the errors. Future streamflow-data networks should contain only stations required for the design or operation of water-resources projects, monitoring long-term trends or riparian demands, the investigation of water resources, and support of water-quality investigations and flood-warning systems. (USGS)
W85-00052

7B. Data Acquisition

APPLICATION OF LANDSAT IMAGERY TO FLOOD STUDIES IN THE REMOTE NAHANNI KARST, NORTHWEST TERRITORIES, CANADA,
Georgia Univ., Athens. Dept. of Geography.
For primary bibliographic entry see Field 2A.
W84-00024

REMOTE SENSING OF SUBSURFACE WATER RESOURCES IN THE U.S. VIRGIN ISLANDS,
Caribbean Research Inst., St. Thomas, VI.
I. J. Canoy.
Technical Report No. 14, September 1983. 21 p, 3 Fig, 4 Tab, 30 Ref. OWRT Project No. A-016-VI (), Contract/Grant No. 14-34-0001-1150.

Descriptors: *Remote sensing, Groundwater availability, Soil-water-plant relationships, Subsurface Waters, *Groundwater exploration, Virgin Islands, Aquifer location.

Location of areas for groundwater exploitation has been a long standing problem in the Virgin Islands. In response to this need a project was designed to briefly assess the possibility of using plant pigments surveyed from aircraft or satellites to locate aquifers. The results of this project indicate that: (a) plant pigments can indeed be used to detect soil moisture changes, (b) the chlorophyll/carotinoid ratio is especially useful, (c) technical difficulties prevent the type of remote sensing tried from being useful. Recommendations are made for design changes.
W85-00065

BEHAVIOUR OF TURBINE, VORTEX AND ELECTROMAGNETIC FLOWMETERS,
Cranfield Inst. of Tech. (England). Dept. of Fluid Engineering and Instrumentation.
J. Baker, and J. Deacon.
Chemical Engineer, Vol. 401, p 13-15, March, 1984. 5 Fig, 4 Ref.

Descriptors: *Flowmeters, Testing, Mechanical equipment, Turbine flowmeters, Vortex flowmeters, Electromagnetic flowmeters, Two-phase flow.

Some recent tests on commercial flowmeters in air/water vertical upward flows are reported. Comparison is made with other published data. Results are presented which aim to give likely error envelopes for meter performance when a two-phase flow of low void fraction is present. The error being assessed is the error in the measurement of volume flow of the mixture. The tests indicated that the response of turbine meters in two-phase air/water flows, even at low void fractions, is unpredictable and liable to error; that for vortex flowmeters, vortex shedding appears to be stable up to about 10% air/water but that the bubbles may trigger the sensing elements leading to positive errors; and that electromagnetic flowmeters are likely to perform well even in quite severe two phase flow regimes. (Baker-IVI)
W85-00198

TIME-DOMAIN REFLECTOMETRY: SIMULTANEOUS MEASUREMENT OF SOIL WATER CONTENT AND ELECTRICAL CONDUCTIVITY WITH A SINGLE PROBE,
Agricultural Research Service, Riverside, CA. Salinity Lab.
F. N. Dalton, W. N. Herkelrath, D. S. Rawlins, and J. D. Rhoades.
Science, Vol. 224, p. 989-990, June, 1984. 2 Fig, 6 Ref.

Descriptors: *Soil water, *Measuring instruments, *Conductivity, Soil properties, Pore water, Salinity.

Two parallel metallic rods were used as a wave guide to measure the dielectric constant and electrical conductivity of soils having different electrical conductivities but the same water content. Measurements showed that the two parameters were sufficiently independent to permit simultaneous determinations of water content and bulk electrical conductivity. Only recently has the bulk medium electrical conductivity been used to estimate the pore-water electrical conductivity. Even in the best instances, two separate measurements are needed to determine soil water content and pore-water electrical conductivity. When time domain reflectometry is used in conjunction with known relations between medium electrical conductivity and soil water electrical conductivity, it provides a powerful new tool in soil water research because a single measurement can yield both soil water content and soil water salinity. (Baker-IVI)
W85-00220

MICROPROCESSOR-BASED DATA MONITORING AND CONTROL SYSTEM FOR A CONTINUOUS ION EXCHANGE PLANT,
Cape Town Univ. (South Africa). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 3A.
W85-00251

VADOSE ZONE MONITORING CONCEPTS FOR HAZARDOUS WASTE SITES,
Kaman Tempo, Santa Barbara, CA.
For primary bibliographic entry see Field 5A.
W85-00314

BOREHOLE COLLECTOR FOR IN-SITU CHEMICAL ANALYSES OF GROUND WATER,
Lawrence Livermore National Lab., CA.
J. E. Harrar, and E. Raber.
Ground Water, Vol. 20, No. 4, p 479-481, July-August, 1982. 1 Fig, 1 Tab, 5 Ref. DOE contract W-7405-ENG-48.

Descriptors: *Water sampling, *Groundwater, Chemical analysis, Dissolved oxygen, Hydrogen ion concentration.

An apparatus has been designed for collection of groundwater samples in locations of limited water flow when atmospheric contamination must be avoided. The apparatus impounds water for in-situ measurement of dissolved oxygen, pH, and Eh (and subsequent chemical analyses) with a minimum of alteration in chemical composition. The collector system comprises a commercially available packer assembly installed in the 3-inch diameter, 10-ft deep borehole. This allows the borehole itself to act as the container for the water. The oxygen probe, which is a commercially available electrochemical device, functions accurately without water flow or oxygen consumption. (Moore-IVI)
W85-00328

EVALUATION OF ELECTROMAGNETIC METHODS FOR RAPID MAPPING OF SALT-WATER INTERFACES IN COASTAL AQUIFERS,
University of South Florida, Tampa. Dept. of Geology.
M. T. Stewart.
Ground Water, Vol. 20, No. 5, p 538-545, September-October, 1982. 10 Fig, 3 Tab, 8 Ref.

Descriptors: *Saline-freshwater interfaces, *Mapping, *Electromagnetic methods, *Coastal aquifers, Saline water intrusion, Conductivity, Remote sensing, Terrain conductivity, Florida.

In coastal areas salt-water intrusion represents a significant threat to water quality in coastal aquifer systems. The electromagnetic (EM) method evaluated in this study proved to be rapid, very inexpensive, and it yields results which agree well with geologic and geochemical surveys using direct sampling. The instrument reads directly in conductivity units and the depth of investigation is constant for a particular spacing and orientation of the receiver and transmitter coils. Data can be obtained and interpreted by personnel with little technical training. Data interpretation normally involves producing terrain conductivity contour maps, but quantitative solutions can be obtained where the geoelectric section can be reasonably approximated by a two-layer section. Some problems were experienced with interference. However, interference sources usually were very localized and could be avoided. This study, conducted in two areas of Florida, demonstrates that the EM conductivity method is very useful for rapid, inexpensive ground-water surveys where the objective is to locate zones of conductive pore fluids at depths less than 30-40 meters. Although interpretation is indirect and qualitative, neither data aquisition nor interpretation require special training. This characteristic of the EM method makes it very suitable for use by agencies where highly-trained technical personnel are not available. (Author's abstract)
W85-00330

APPLICATION OF RESISTIVITY SURVEYS TO REGIONAL HYDROGEOLOGIC RECONNAISSANCE,
University of South Florida, Tampa. Dept. of Geology.
M. Stewart, M. Layton, and T. Lizanec.
Ground Water, Vol. 21, No. 1, p 42-48, January-February, 1983. 9 Fig, 1 Tab, 11 Ref.

Descriptors: *Resistivity, *Surveys, *Geohydrology, *Florida, Sounding, Water depth, Geophysics, Groundwater, Dissolved solids, Karst.

Vertical electrical soundings using DC resistivity methods have been completed along over 60 miles of survey lines in southwest Florida. The resistivity soundings were obtained in order to outline major hydrogeologic features as part of a regional hydrogeologic investigation covering approximately 400 square miles. The two significant hydrogeologic features which can be effectively mapped on a regional scale by DC methods are the presence of shallow, high resistivity limestones associated with late Tertiary reef complexes, and the approximate depth to waters with total dissolved solids concentrations well above the potable water limits. An aquifer evaluation test indicates that these units have high transmissivities and are potential high

yield aquifers. Both the low quality waters and the karstic limestones can be distinguished on the resistivity cross sections from their bulk resistivity values. Compared to traditional curve-matching techniques the automated procedure is much faster and produces equivalent solutions. Contouring resistivity versus depth for closely spaced soundings lessens the problem of equivalence by averaging adjacent sounding solutions. Direct interpretation programs for smaller computers and progammable calculators require additional interpretation effort, but produce more consistent and theoretically sound solutions than empirical methods. (Baker-IVI)
W85-00357

DIRECT ACQUISITION OF RAINFALL DATA ON SITE (SAISIE DIRECTE SUR LE SITE DE L'INFORMATION PLUVIOGRAPHIQUE),
Centre National de Machinisme Agricole du Genie Rural, des Eaux et des Forets, Paris (France).
R. Ferrero, and G. Galea.
Houille Blanche, Vol. 36, No. 7/8, p 471-478, 1981. 6 Fig.

Descriptors: *Rain gages, *Rainfall, *Automation, *Data acquisition, Data processing, On-site data collections, Meteorological data collections.

Due to human and mechanical restraints, data on rainfall accumulated over variable time intervals could not previously be exploited, without major bias, beyond an hour-long time interval for integrating rain intensity. These restraints have been alleviated with the development of an automated rainfall data collection and data analysis system that codes conditions directly on-site on magnetic cassette tape using off-line coders. The recorder has six input channels and a flexible layout using a single digital input channel served by the six electronic meters of six 'strappe' channels; observation time is six minutes and each record contains 26 bytes. Layout is in accordance with ECMA norms 341. Each of the six meters accumulates the impulses generated during six minutes at each tilt of the cup. After 36 minutes, the contents of the meters are transfered in a single block to magnetic storage. Data processing involves the use of a cassette deck and software designed on TEKTRONIX 16 K (read-in) and on IRIS 80 (processing), which are themselves integrated in the basic processing programs on hydrology and therefore articulated with the subsequent automatic processing. The system meets the conditions for acquisition and processing of rainfall data at an experimental catchment basin: temperature range of -75 C to 40 C; autonomy (power source for three months and cassette recording for 2.5 months); a six minute observation time which yields good knowledge of rainfall conditions over shorter periods (seven observation periods of two seconds to sixty minutes); and negligible time drift which guarantees adequate synchronization of rainfall events acquired by the various sensors. (Collier-IVI)
W85-00388

HYDROLOGICAL MEASUREMENT USING A PUBLIC TELEPHONE SYSTEM (TELEMESURE HYDROLOGIQUE PAR RESEAU TELEPHONIQUE COMMUTE),
Universite Catholique de Louvain, Louvain-la-Neuve (Belgium). Dept. de Genie Rural.
E. Persoons, and J. Laurent.
Houille Blanche, Vol. 36, No. 7/8, p 479-485, 1981. 7 Fig, 7 Ref.

Descriptors: *Hydrologic data collections, *Telemetry, *Rainfall, *Meuse, *Belgium, *Data acquisition, Automation, River forcasting, Data interpretation, Rain gages, Meteorological data collections, Flood forecasting.

A telemetering system using the public telephone system was designed for hydrological measurements. It includes a central call unit which dials the phone numbers and measures the messages, and on-site phone receivers. These receivers require no local power. The latter have the advantages of requiring no external source of input and of transmitting data in pure analogue mode. Data are either instantaneous or memorized locally. At the call-center, a central set managed by micro-processor enables calls to be sent out either automatically or manually; it can receive and measure the analog data received from the automatic receivers; and it can process this data in order to transform it into directly usable values which are then transferred to a mass memory. The receivers are compatible with all analog or digital receivers. The information is returned at a precision of around 0.1 %. Eight microprocessor calling sets and more than 200 field sets are in use on a permanent basis in Belgium. The Hydrological Study Service (HSS) equipped its measurement network with 65 telelimnimeters and 15 pluviographs. Using this network, the HSS was able to follow the flooding of the Meuse on July 20th and 21st, 1980 to a level recorded only once every hundred and fifty years; this real-time information enabled the duty officer to take the necessary precautions. (Collier-IVI)
W85-00389

7C. Evaluation, Processing and Publication

HYDRAULIC CONDUCTIVITY, SPECIFIC YIELD, AND PUMPAGE -- HIGH PLAINS AQUIFER SYSTEM, NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
R. A. Pettijohn, and H. H. Chen.
USGS Water-Resources Investigations Report 82-4014, 1983. 3 Maps, 15 Ref.

Descriptors: *Great Plains Province, *Nebraska, *Groundwater, *Aquifer, *Hydraulic conductivity, Specific yield, Pumpage, Application rates, Hydrologic data, *Maps, *High Plains aquifer system, Water-level decline, Irrigated acres, Irrigation-well development.

Hydrologic data used to evalute the ground-water potential of the High Plains aquifer system in Nebraska are presented on maps showing the hydraulic conductivity and specific yield of the aquifer system and the volume and distribution of water pumped for irrigation from the aquifer system during 1980. The High Plains aquifer system underlies 177,000 square miles in parts of eight states, including 64,770 square miles in Nebraska. It consists of the Ogallala Formation and Tertiary and Quaternary deposits that are saturated and hydraulically connected to the Ogallala. The hydraulic conductivity of the aquifer system varies from greater than 200 feet per day in parts of the North Platte, Platte, Elkhorn, and Republican River valleys to less than 25 feet per day in the northwestern part of the state. Specific yield of the aquifer system ranges from 10 to 20 percent in most of the state and averages 16 percent. The estimated volume of water recoverable from the aquifer system in Nebraska is 2,237 million acre-feet. Inches of water withdrawn from the aquifer system during 1980 varied from less than 1.5 in the sandhills of north-central Nebraska to more than 12 in the Platte River and Blue River basins. This withdrawal represents about 6,703,000 acre-feet of ground water. (USGS)
W85-00032

CONVEYANCE CHARACTERISTICS OF THE NUECES RIVER, COTULLA TO SIMMONS, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 4A.
W85-00033

HYDROLOGIC DATA FROM AN AREA SOUTHWEST OF TALLAHASSEE, FLORIDA, WHERE MUNICIPAL WASTEWATER EFFLUENT IS APPLIED BY SPRAY IRRIGATION,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. C. Yurewicz.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Open-File Report 83-769, 1983. 153 p, 9 Fig, 6 Tab, 9 Ref.

Descriptors: *Municipal wastes, *Spray irrigation, *Groundwater, *Monitoring, Hydrologic data, Well data, *Florida, *Floridan aquifer, Leon County.

The effects of spray irrigation using municipal wastewater effluent on a ground-water system (in particular, on the water of the Floridan aquifer) were investigated. The area irrigated was 4 miles southwest of Tallahassee, Florida, on an area covered in part by pine forest and in part by selected grasses and forage crops. Hydrologic and geologic data were collected from 1972 to 1981. Hydrologic data include ground-water levels, water quality, and spray-irrigation rates. Ground-water level measurements were made at 60 wells. Water-quality samples were collected at 1 municipal wastewater effluent site, 3 springs, 17 soil sites, and 64 wells. Water-quality data were obtained from physical, chemical, and bacteriological analyses. Geologic data include geophysical logs and lithologic descriptions of 34 wells. (USGS)
W85-00040

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN KANSAS--FISCAL YEARS 1981 AND 1982,
Geological Survey, Lawrence, KS. Water Resources Div.
J. F. Kenny, and L. J. Combs.
Available from the Ofss, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Open-File Report 83-932, 1983. 87 p, 9 Fig, 5 Tab.

Descriptors: *Groundwater, Aquifers, *Streamflow, Water quality, Water investigations, *Kansas.

One of the primary missions of the U.S. Geological Survey in Kansas is to investigate the occurrence, quantity, quality, distribution, and movement of surface and groundwater throughout the State. Primary activities include the systematic collection, analysis, and interpretation of hydrologic data, evaluation of water demands, and water-resources research. Hydrologic investigations are conducted through four basic types of projects: (1) data-collection programs, (2) local or areal investigations, (3) statewide or regional investigations, and (4) research projects. These projects are funded through cooperative agreements with State and local agencies, transfer of funds from other Federal agencies, and direct Federal funds. Forty-two water-related projects were funded during fiscal years 1981 and 1982 in Kansas. This report describes for each of these water-resources investigations the problem that initiated the study, the objectives of the project, and the approach designed to achieve this objective. Information on data-collection stations in Kansas is presented in maps and tables. A list of reports approved for publication by the U.S. Geological Survey, its cooperators, or technical and scientific organizations during fiscal years 1981 and 1982 is also provided. (USGS)
W85-00041

8. ENGINEERING WORKS

8A. Structures

STRESS-DEFORMATION PREDICTIONS FOR THE LG 4 MAIN DAM,
Societe d'Energie de la Baie James, Montreal (Quebec).
For primary bibliographic entry see Field 8D.
W85-00141

SAND DAM,
C. Y. Li, and J. Yague.
Civil Engineering, Vol. 54, No. 6, p 46-49, June, 1984. 2 Fig.

Descriptors: *Dam design, *Sand dams, *Earth dams, *La Vueltosa Dam, *Rio Caparo, *Venezuela, Design criteria, Dam foundations, Foundation piping, Embankments.

The La Vueltosa Dam is located in Rio Caparo bordering the southeast states of Barinas and Merida. At 135 m high, the dam is part of the 1,250 Mw Urbante-Caparo hydrodevelopment scheme undertaken by the government in Venezuela. The foundation and abutment rock consists of soft and friable interbedded sandstone and siltstone, moderately pervious with occasional open fissures and cracks. The soft rock foundation would not permit construction of a high concrete dam. An innovative sand embankment dam was selected. Sand, being highly erodible, pervious and liquifiable, is usually considered an inferior material for constructing a dam. To quard against embankment piping, the sand fill is completely confined to prevent migration of its fines by seepage flows in any direction. There is a clay and filter blanket over the entire foundation rock, a quadruple layer chimney drain downstream of the dam axis, and sand and gravel zones on outside dam slopes. To guard against foundation piping, there are multiple defense lines to control seepage through the foundation and abutments; a long seepage path, consolidation and curtain grouting, extensive drainage curtains in both abutments, and a complete drainage blanket under the downstream shell. (Baker-IVI)
W85-00157

HYDRAULIC CIRCUIT DESIGN AND ITS EFFECTS ON THE CIVIL ENGINEERING FEATURES OF LOCKS (LA CONCEPTION DES CIRCUITS HYDRAULIQUES ET SES REPERCUSSIONS SUR LE GENIE CIVIL DES ECLUSES),
For primary bibliographic entry see Field 4A.
W85-00371

LOCKS ON THE WIDE-GAUGE RHONE WATERWAY (LES ECLUSES D'UNE VOIE A GRAND GABARIT: LE RHONE),
For primary bibliographic entry see Field 4A.
W85-00372

EFFECT OF LOCK-CHAMBER WATER DEPTH AND WATER-SAVING BASINS ON LOCK-OPERATING TIME (INFLUENCE DU MOUILLAGE DANS LE SAS D'UNE ECLUSE ET DE LA PRESENCE DE BASSINS D'EPARGNE SUR LA DUREE D'ECLUSAGE),
. Michel.
Houille Blanche, No. 2/3, p 115-120, 1981. 10 Fig.

Descriptors: *Navigable waters, *Locks, Transportation, Efficiency, Design criteria, Locking cycles, Mathematical models.

The transport capacity of a navigable waterway is determined at least in part by the locking cycles. A locking cycle includes four boat movements - two entries and two exits, four gate operations - two openings and two closures, plus filling and emptying the lock chamber. The transport capacity of a waterway is therefore increased by shorter lock operating cycles. Plans for a future waterway link between the Saone and Rhone include a mathematical model study of lock filling and emptying conditions, allowing for adjacent canal reach dimensions and up to three water saving basins to make up for a possible water deficiency in the dividing reach, and a scale model study of the handling slope and possible movements of modern pusher units. (Baker-IVI)
W85-00373

LOCK-FILLING AND EMPTYING WAVES AND LEVEL VARIATIONS IN CANAL REACHES (ONDES ET MARNAGES DANS LES BIEFS DUS AU REMPLISSAGE ET A LA VIDANGE DES ECLUSES),
. Michel.
Houille Blanche, No. 2/3, p 135-140, 1981. 9 Fig.

Descriptors: *Waterways, *Locks, *Canals, Waves, Water level, Design criteria, Pumps, Rhone River, Rhine River, Canal du Nord, Mathematical models, Planning.

The transit time required to pass through the locks of a waterway determines the transport capacity of that waterway. Transit time in turn depends particularly on the lock chamber filling and emptying speeds. Conditions in the adjacent canal reaches must be carefully considered in attempting to manipulate lock chamber filling and emptying times. Locking waves should preferably not exceed 0.30 m in height, with slopes of less than 1/1000. As the wetted cross-section of the canal decreases, these problems become increasingly critical. A mathematical model and in-situ studies on the Canal du Nord were both used in planning the design of the future Saone-Rhine waterway link. Many sections of this link are planned primarily around navigational requirements and thus the effect of lock operation on the canal reaches was of paramount concern. Water saving basins and booster pump stations will be supplied for some of the locks on this new waterway in order to make up for the deficiency in supplies to the dividing reach. Also included in the mathematical model studies were several parameters which affect the level variations in the reaches such as locking, pump operation, and traffic. (Baker-IVI)
W85-00374

SMALL HYDROELECTRIC INSTALLATIONS IN THE DEVELOPING COUNTRIES (LES PETITES INSTALLATIONS HYDROELETRIQUES DANS LES PAYS EN VOIE DE DEVELOPPEMENT),
J. Francou.
Houille Blanche, No. 4/5, p 237-242, 1981. 3 Fig.

Descriptors: *Developing countries, *Hydroelectric plants, *Energy, Water resources development, Topography, Cost analysis.

The most immediate solution to satisfying the need for electricity by small industries or isolated centers is the use of a diesel generator. The drawbacks to this solution are well known in countries which do not produce oil. Small hydroelectric installations constitute an alternative under suitable circumstances which may prove to be extremely cost effective. The topography, hydrology and technical qualifications of the community in question must all be considered in examining each case in question on its individual merit. (Baker-IVI)
W85-00380

CHARACTERISTICS OF THE STATE OF STRESS AND STRAIN OF THE GRAVITY DAM AT THE KURPSAI HYDROELECTRIC STATION,
G. Yu. Berdichevskii, and Yu. P. Kornev.
Hydrotechnical Construction, Vol. 16, No. 1, p 1-7, January, 1982. 6 Fig, 1 Tab, 6 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 7-11, January, 1982.

Descriptors: *Stress analysis, *Dam construction, *Dam stability, *Kurpsai Hydroelectric Station, *USSR, Dams, Design criteria, Gravity dams, Hydroelectric plants.

The Kurpsai hydroelectric station is being constructed on the Naryn River 40 km downstream from the Toktogul hydrostation. An analysis was made of the characteristics of the state of stress and strain of the dam. Through various calculations determinations were made of the distribution of the external hydrostatic load between the vertical elements and system of horizontal elements regarded as beams under shear or a transverse force in the case of a monolithic dam or only under a transverse force for the offset dam. The seismic load was determined for independent cantilevers in conformity with construction specifications and regulations. The load distribution obtained was used in calculations of the stability and stress strain state of the dam. For checking the stability of each section the shearing load was assumed equal to the sum of the corresponding cantilever load and reaction of the horizontal element at the common support point with the cantilever. The stability of the structure was also checked experimentally. The experiments showed that a gravity dam of an unsectionalized design in a canyon has increased stability to shear compared to the stability of the highest section in the case of its independent work. An increase in stability was found to be due to the occurrence of a longitudinal force which is the reaction of the channel sections to elastic displacements of the bank section downslope, and the formation within the dimensions of the dam of a secondary arch as a consequence of zero tensile strength across the joints and the occurrence of thrust increasing the restraining force at the dam contact. The occurrence of zones of tensile stresses across the concrete-rock contact causing decompression of the contact zone of rock under the upstream face of the bank sections is a result of the three-dimensional behavior of the dam. (Baker-IVI)
W85-00427

OPTIMIZATION OF SITE SURVEYS BASED ON PRELIMINARY DESIGN ANALYSIS,
Yu. A. Fishman.
Hydrotechnical Construction, Vol. 16, No. 2, p 59-65, February, 1982. 4 Fig, 8 Ref. Translated from Gidrotechnicheskoe Stroitel'stvo, No. 2, p 11-15, February, 1982.

Descriptors: *Construction, *Design criteria, *Sites, Dam construction, Planning, Decision making.

The effectivess of hydrotechnical construction depends on the interrelation between its surveys and designing. The traditional approach to planning surveys is inadequate. Not simply is a close contact between designing and surveys needed, but also their mutual overlapping, with the use of the so-called feedback principle, without which it is difficult to expect to obtain optimal results. One of the most effective ways of optimizing surveys is found at the junction between surveys and designing and consists of conducting calculations and designing studies for analyzing the effect of geological factors on the preliminary designs, which makes it possible to reveal the most important factors and to arrange the types of surveys according to the degree of their significance for the given hydrostatic and necessary detail of investigation. It is necessary to introduce into design and survey practice a preliminary calculated design analysis at the stage of contract and, especially, detail designs, making it possible to establish the most optimal composition, scope, and method of surveys. (Baker-IVI)
W85-00435

CALCULATION OF THE THREE-DIMENSIONAL STRESS-STRAIN STATE OF AN EARTH-ROCK DAM,
L. N. Rasskazov, and A. A. Belyakov.
Hydrotechnical Construction, Vol. 16, No. 2, p 66-77, February, 1982. 6 Fig, 14 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 2, p 6-22, February, 1982.

Descriptors: *Dam stability, *Stress analysis, *Earth dams, Rockfill dams, Canyons, Mathematical models, Design criteria.

The design and construction of high earth-rock dams require a comprehensive study of their state of stress and strain and the effect of various topographic, construction, and technological factors on the operational capability and reliability of these structures. In recent years calculations of the stress strain state of earth dams under conditions of the two dimensional problem have been so successful and the computational programs so economical that investigations based on the solution of series of two-dimensional problems with the use of factor analysis were undertaken. When solving two-dimensional problems, many factors (mainly topographic) are not examined. A study of the three-dimensional state of stress and strain of earth dams provided additional information on the behavior of the dam and permited a more realistic evaluation of its performance. The behavior of an earth-rock dam in a canyon with a site coefficient equal to 2 is characterized by a substantial arching effect between the canyon walls and, since the level of normal stresses in the core is low, it is desirable to take technical steps to increase the crack resistance of the core. The results of solving the three-dimensional problem confirm the intense decrease of

horizontal displacements in the dam core, noted in on-site observations. A canyon shape curved in plan substantially increases the stability of a dam. (Baker-IVI)
W85-00436

DYNAMICS OF THE FORMATION OF AN ICE PRISM ON RESERVOIR SLOPES OF A PUMPED-STORAGE STATION,
V. M. Kondrat'ev, M. N. Rubanik, V. F. Kanarskii, and P. D. Gavrish.
Hydrotechnical Construction, Vol. 16, No. 3, p 132-137, March, 1982. 5 Fig, 8 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 3, p 14-16, March, 1982.

Descriptors: *Pumped storage, *Reservoirs, *Ice prism, *Kiev Reservoir, *USSR, *Slopes, Streamflow, Wind, Waves, Weather, Design criteria, Freezing.

The on-site investigations being conducted at the Kiev pumped-storage station include observations of the state of the dike slopes of the reservoir, weather conditions, and wind wave and ice regimes. In all cycles of fluctuations of the water level in the pumped storage reservoir under conditions of negative air temperatures and positive water, concrete and soil temperatures of the slope, a redistribution of stresses occurs in the prism of layered ice, which at first is accompanied by viscous plastic and elastic deformations and then by the development of cracks alternately in the upper and lower zones of the prism working according to the accordion principle, which gives rise to the characteristics of the structure and mechanical strength of the ice in different prism zones. The formation of the multilayered ice prism is considerably promoted by the alternation of drawdown and pumping. The wind and presence of ice in the broken zone had a considerable effect on the rapid cooling of the exposed parts of the slope and ice prism and also on the freezing rate on the slope and ice prism. During a rise and drop of the water level at slow rates there occurs periodic wetting of the vertical face of the prism, freezing of ice on it, and freezing of individual floes driven from the broken zone or circulating water to it. Such relationships may be used as grounds for developing as a first approximation a method of designing revetments of dike slopes of pumped storage reservoirs for the effect of ice. (Baker-IVI)
W85-00441

ON-SITE OBSERVATIONS AT THE ATBASHI HYDROELECTRIC STATION,
I. N. Sakharov, A. N. Zhirkevich, V. Ya. Chichasov, and A. G. Zyryanov.
Hydrotechnical Construction, Vol. 16, No. 4, p 189-195, April, 1982. 5 Fig, 3 Tab, 5 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 6-10, April, 1982.

Descriptors: *Hydroelectric plants, *Reservoirs, *Flushing, *Atbashi hydroelectric station, Spillways, Membranes, Films, Storage reservoirs, Sediments, Ice.

The Atbashi hydroelectric station with an installed capacity of 40,000 kW began operation early in 1970. The total capacity of its reservoir is 9.58 million cu m, the useful capacity of 4.34. million cu m at normal pool levels of 154 m and the dead storage level is 145 m. Since there is an excess of sediment and spongy ice lumps for proper operation of the hydrostation, deep annual flushing with complete drawdown of the reservoir during recession of the flood is necessary. Flushing was planned in stages with alternation of a partial rise of the water level in the reservoir and discharge of the water for washing out the deposits formed in the lower pool. Periodic deep flushing is supplemented by constant flushing in the summer and fall by discharging surplus water at the 145 m dead storage level. The optimal flushing discharge should be 0.4-0.6 of the total discharge of the spillway at the normal pool level. Duration of flushing should be no more than 24-90 hr. In the case of flushing by repeated cycles, filling should be done to the normal pool level and this level maintained for 10-12 hr. During flushing there were no substantial secondary adverse phenomena either in the lower pool or on the structures of the hydrostation. During flushing the chamber of the radial gate of the spillway, the gate itself, floors, and enclosures are covered with a layer of mud from several millimeters to several centimeters thick, which in the cold season freezes and hampers operations. Increased seepage through the grout curtain in the rock walls is leading to discharge of seepage waters on the downstream shoulder of the dam. Drainage should be installed in the downstream slope of the dam with discharge of the water below the depth of freezing. (Baker-IVI)
W85-00448

HYDROCHEMICAL METHODS IN INVESTIGATION OF SEEPAGE IN THE FOUNDATION OF STRUCTURES OF THE IRKUTSK HYDROELECTRIC STATION,
M. D. Nikolaeva, and V. P. Kalenov.
Hydrotechnical Construction, Vol. 16, No. 4, p 203-209, April, 1982. 1 Fig, 4 Tab, 9 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 14-18, April, 1982.

Descriptors: *Hydroelectric plants, *Seepage, *Measuring, *Irkutsk Hydrostation, Subsurface water, Chlorides, Carbon dioxide, Carbonates, Concrete, Cracks.

Hydrochemical methods of investigating the seepage flow under conditions of the Irkutsk hydrostation should be used in combination with traditional methods of observing the condition of the structures. As indicators of the seepage flows and subsurface waters it is possible to use, along with mineralization of the water, the content in water of chloride ions and the sum of the derivatives of carbonic acid carbon dioxide, which in certain cases give a more accurate idea about the seepage flow in the foundation when determining the effect of water on concrete of the structures and grout curtain. Having distributed the content of the indicator in the piezometers along the equipotential lines of the seepage flow net, one obtains a clear picture of the distribution of seepage flows and subsurface waters in the foundation and body of the structures. The seepage flow net obtained by calculation or on the electrohydrodynamic analogy instrument does not always correspond to the actual picture of seepage, which somewhat reduces the accuracy of the proposed method. The preliminary conclusions about the mechanism of interaction of the seepage flow with concrete of structures require further refinement by setting up broader hydrochemical investigations of seepage, including seepage through cracks in the concrete. (Baker-IVI)
W85-00450

EXPERIENCE IN RESTORATION OF THE SPILLWAY DISSIPATOR OF THE HEAD HYDROELECTRIC STATION OF THE CHIR-YURT SEQUENCE,
S. E. Bravarnik.
Hydrotechnical Construction, Vol. 16, No. 4, p 234-238, April, 1982. 3 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 50-52, April, 1982.

Descriptors: *Hydroelectric plants, *Spillways, *Restoration, *Dissipators, Earth dams, Dam construction, Chir-Yurt Resevoir, Reservoirs.

The Chir-Yurt No. 1 hydroelectric station was constructed in 1962. At the dam site the maximum discharge over the course of many years was observed after the hydrostation was put into operation and amounted to 2120 cu m/sec. The earth dam has a wide central loam core and gravel shoulders, height of 37.5 m, and crest length of 450 m, creating a head of 32 m. The gates of the waste outlets are operated by chain mechanisms with a lifting capacity of 2 x 150 tons. The other gates are operated by a gantry crane with a capacity of 2 x 75 tons. In 1976 the sediments were flushed from the Chir-Yurt reservoir, totaling about 3 million cubic m of sediments being washed into the lower pool. Inspection in 1977 revealed the position of the dissipator bottom in its upper chamber did not correspond to the design. The foundation slabs in the upper chamber of the dissipator had been ripped from their places and shifted 1.5 to 2 m in plan and the height position of the central slabs was considerably below design. Operators should not violate the rules of operating gates established in designs on the basis of hydraulic investigations. An increase of the resistance of uplift and withdrawal of the apron slabs of the bottom of a dissipator should be achieved primarily by anchoring them to the foundation, which also saves construction materials. Protection of the surface of slabs and blocks of a dissipator from abrasion is achieved by placing on the slab surface a wear-resistant layer of high grade, heavily reinforced, well compacted and cured concrete prepared with strong crushed rock. (Baker-IVI)
W85-00456

NEW TYPE OF STILLING BASIN (SEVAN CASCADE IN ARMENIA),
S. M. Isaakyan.
Hydrotechnical Construction, Vol. 16, No. 6, p 333-335, June, 1982. 2 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 6, p 32-33, June, 1982.

Descriptors: *Stilling basins, *Design criteria, *Sevan Cascade, *Armenia, Settling basins, Basins, Conduits, Scour, Deflectors.

A new design for a stilling basin is suggested for use in the transition section between pools of free-flow conduits with different hydraulic parameters. The primary area of use of this design is a lower pool of unlimited width having an erodible bottom and a small length along the flow. The design presented, in addition to the usual rectangular basin, has a deflector along the upper edge of the basin. The dimensions of the basin of the new design are smaller compared to a basin without a deflector. The advantage of the new design consists in the more concentrated dissipation of kinetic energy of the nappe and more uniform distribution of the water over the width of the lower pool, thus protecting the lower pool from the scouring action of the flow. (Baker-IVI)
W85-00472

NEW PROBLEMS AND METHODS OF ENGINEERING-GEOLOGICAL EVALUATION OF FOUNDATIONS OF LARGE DAMS,
A. A. Borovoi, A. A. Varga, L. A. Molokov, I. A. Parabuchev, and L. V. Tolmachev.
Hydrotechnical Construction, Vol. 16, No. 7, p 401-405, July, 1982. 1 Tab, 16 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 7, p 37-40, July, 1982.

Descriptors: *Water resources development, *Evaluation, *Dam foundations, Dam construction, Foundations, Hydraulic engineering, Remote sensing, Surveys.

Research is currently being performed to develop a set of scientifically founded methods and technical procedures for optimizing surveys. These include the expansion of the area of use of remote-sensing methods, including satellite and aerial landscape surveying, for substantiating engineering geological mapping, studying seismotectonic structures and landslide hazardous areas and observing the character and extent of alterations of the environment in the zones of influence of reservoirs; the provision of the maximum information content of each prospect hole with the use of the arsenal of field methods; optimization of the system of engineering-geological testing as a whole on the basis of scientifically founded principles; the increase of the role of geophysical methods in survey works; the wider use in survey practice of quick field methods of investigating soils and rocks; a further increase of the role of quick methods in experimental seepage studies, automation of monitoring operations and processing of the results of hydraulic testing of boreholes; and the use of hydrochemical methods of investigations during drilling and regime observations for obtaining important addi-

onal characteristics for solving a wide range of ngineering-geological problems. (Baker-IVI)
V85-00477

IECHANICAL EQUIPMENT OF GATE 'HAMBERS OF HIGH-HEAD SPILLWAYS,
F. Kochanov, and S. V. Farmakovskii.
Iydrotechnical Construction, Vol. 16, No. 8, p 63-469, August, 1982. 1 Fig, 4 Tab, 4 Ref. Trans-ted from Gidrotekhnicheskoe Stroitel'stvo, No. p 45-50, August, 1982.

Descriptors: *Mechanical equipment, *Design cri-eria, *Spillways, Hydraulic engineering, Gates.

or the first time in design practice mechanical quipment of a gate chamber of a deep spillway as been designed with a vertical lift and radial egulating gates for passing discharges up to 2250 u m/sec at heads up to 200 m with an area of an utlet being closed up to 50 sq m. The variant with n emergency-guard slide gate with an upstream e-shaped contour of the seal located on the gate nd a main slide gate with an upstream flat closed ontour of the seal located on the casing was taken the main variant when developing the specifica-ons. The high velocity jet is diverted from ele-ents of the downstream part of the chamber at all penings of the main gate by appropriate selection the orifice dimensions and shapes of the lower dge of the upstream skin plate of the main gate. hen designing the number of bays of the gate amber it is advisable to strive for the creation of andard-size mechanical equipment in order to nprove its quality, increase operating reliability nd increase the rate of construction works. The troduction of the developed equipment on the version tunnels on the I and II levels of the ogun hydrostation makes it possible to reduce the st of the gate chambers by 3.2 million rubles and unify the mechanical equipment of the spillways the hydrostation. (Baker-IVI)
V85-00484

XPERIENCE IN THE OPERATION OF VERFLOW BUTTRESS DAMS UNDER EVERE CLIMATIC CONDITIONS,
or primary bibliographic entry see Field 4A.
V85-00486

IVERSION OF STREAM THROUGH HY-ROELECTRIC STATIONS WITH HIGH AMS DURING CONSTRUCTION,
K. Kuz'min.
ydrotechnical Construction, Vol. 17, No. 9, p 9-424, September, 1983. 3 Fig. Translated from idroteckhnicheskoe Stroitel'stvo, No. 9, p 1-5, eptember, 1983.

escriptors: *Dam construction, *Diversion chan-els, Tunnels, Spillways, Powerplants, Hydroelec-ic plants.

he scheme of diverting the flow according to eps of construction of especially high dams is the sis of the site organization plan and also has a bstantial effect on the design and layout of the ain structures of a hydrostation. The best scheme constructing a dam is that for which stream version is carried out through one level of spill-ays, later used as the service level. If it is impossi-e to accomplish this scheme, it is necessary to ovide the possibility of operating a lower level of illways until the higher level is completely ready r passing the flow, including floods. Designs of illway gates of high dams, including the materi-s used in them, should be tested on simpler and ss important structures. The layout of even tem-orary gates should provide the possibility of pair of the movable parts and seals. The configu-tion of the spillway channels and the location of e regulating gates should be designated so as to minate or limit the possibility of the occurrence conditions for the development of cavitation ocesses. The best solution in this case is to locate e regulating gate at the outlet of the pressure rt of the spillway. The scheme of dissipating the ergy of the flow in a stilling basin at heads of ore than 120 m also has substantial shortcomings complicating the preparation of the structures for stream diversion. (Baker-IVI)
W85-00487

SEEPAGE IN THE FOUNDATION OF THE KRASNOYARSK DAM,
A. P. Epifanov, V. A. Ulyashinskii, V. K. Semenov, and V. B. Idel'son.
Hydrotechnical Construction, Vol. 17, No. 9, p 425-428, September, 1982. 2 Fig, 3 Tab, 1 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 6-8, September, 1982.

Descriptors: *Seepage, *Dam foundations, *Krasnoyarsk Dam, Piezometers, Drainage wells, Foundations, Dam stability, Monitoring, Drainage system.

The Krasnoyarsk hydroelectric statio.. has been operating since 1967. The foundation of the dam is composed of strong jointed granites, including individual veins of porphyrites, vogesites, and syenites. Zones of tectonic crushing with a thickness up to 3 m run under the first column of sections 12-18 and 42-49. In the bank sections the heads measured by piezometers as a whole exceed the allowable values, but considering the absence of negative consequences of bypass seepage the observed values of the heads in these sections do not cause hazards. An analysis performed with the data from a large number of piezometers at the site and drain wells shows that intensification of seepage processes is not observed as a whole for the structure. The tendency toward an increase of the piezometric head noted for individual piezometers and toward an increase of discharge noted for drain wells has a local character. Rearrangement of the foundation associated with its inhomogeneity is still continuing, which is indicated by the observed tendencies toward change in the piezometric heads and discharges. Observations and seepage monitoring in the dam foundation should therefore be continued. (Baker-IVI)
W85-00488

EXAMPLES OF A COMBINED LAYOUT OF HYDROSTATIONS UNDER CONFINED MOUNTAINOUS CONDITIONS,
O. V. Sitnin.
Hydrotechnical Construction, Vol. 17, No. 9, p 467-470, September, 1983. 5 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No.9, p 38-41, September, 1983.

Descriptors: *Hydroelectric plants, *Mountains, *Diversion structures, Construction, Dam construction, Streamflow, Earth dams, Canyons, Tunnels.

Hydropower construction under mountainous conditions is hampered by the complex terrain, remoteness and difficult accessibility of the construction site, and the absence of transportation and power lines. The organization of the passage of the streamflow in many cases predetermines the design of the main structures and layout of the hydrostation as a whole. Two layouts are presented of hydrostations for mountainous conditions which solve the problem of passing diverted and operating flows by combining various functions in one structure. In one scheme a layout with an earth rock dam is suggested for the site of a station located in a V-shaped canyon with a slope steepness of 20-30 degrees in the absence of floodplain stretches. In the second example a station is located in a narrow canyon-type gorge with steep rock banks. Water is fed to the units of the hydrostation by bank tunnel penstocks or by penstocks in the body of the dam. The layout of a shift-type hydrostation with the use of a diversion tunnel as the operating spillway and penstock has a number of advantages compared with other layouts possible for this site. (Baker-IVI)
W85-00495

TECHNICAL ASSISTANCE OF THE USSR IN THE CONSTRUCTION OF HYDROELECTRIC STATIONS ABROAD,
N. A. Lopatin.
Hydrotechnical Construction, Vol. 17, No. 10, p 481-487, October, 1983. 1 Tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 1-6, October, 1983.

Descriptors: *Hydraulic engineering, *Hydroelectric plants, *Argentina, *Peru, *Vietnam, Dam construction, Hydraulic structures, Developing countries, Regional development.

In the Soviet Union the development of hydropower engineering is being accomplished generally on the basis of constructing large integrated hydropower developments. Detailed engineering surveys, thorough analysis and consideration of all possible acting factors in the calculation schemes of the structures, and conducting of model investigations has lead to a high reliability of the Soviet structures. The activities of the Soviet design organizations in hydraulic engineering undertakings in other parts of the world are described including the the Gabcikovo-Nad'maros hydropower system, the Euphrates hydrostation, Al-Hadithah hydrostation, Al-Baas Dam, the Hao-binh hydropower development on the Da River in Vietnam, the Salto Grande hydroeletric station in Argentina, Olmos hydro complex in Peru, and the Chapeton hydropower development on the Parana River in Argentina. (Baker-IVI)
W85-00498

SOME TRENDS IN THE DEVELOPMENT OF GATE CONSTRUCTION ABROAD,
V. Ya. Martenson.
Hydrotechnical Construction, Vol. 17, No. 10, p 487-495, October, 1983. 3 Fig, 4 Tab, 21 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 6-12, October, 1983.

Descriptors: *Dam construction, *Reviews, *Gates, Grooves, Mechanical equipment, Design criteria, Cavitation, Vibration.

Increasing attention is being devoted to increasing the reliability of outlet works and gates as a very important aspect of dam construction. For this purpose, types of gates, grooves, and mechanisms already checked in practice are used on newly constructed dams, and the main efforts of designers are aimed at improving their designs and layouts on structures. A trend is noted toward a substantial reduction of the number of types of gates being used. Serious attention is also being devoted to methods of preventing cavitation and vibration. An individual drive for each gate, generally electrohydraulic, having a number of operational advantages compared with cranes is gaining greater popularity. Reliability factors are considered also in the operating instructions which stipulate the need for periodic testing of the mechanical equipment. One of the current trends is a more cautious approach to the use of gates with high design parameters, considering that failures of a large gate substantially reduce the discharge capacity of the dam. (Baker-IVI)
W85-00499

ARCHITECTURE OF FOREIGN HYDROELETRIC STATIONS,
For primary bibliographic entry see Field 6B.
W85-00500

CUTOFF WORKS AT THE HAO-BINH HYDROSTATION IN VIETNAM,
N. V. Imitriev, and I. G. Gal'perin.
Hydrotechnical Construction, Vol. 17, No. 10, p 21-25, October, 1983. 4 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 21-25, October, 1983.

Descriptors: *Hydroelectric plants, *Dam construction, *Cutoffs, *Da River, *Vietnam, *Hao-bih, Construction, Flood control, Powerplants, Earth dams.

The hydraulic structure of the Da River in the region of Hao-binh city in Vietnam will be a large flood-control and power development consisting of an earth dam 125 m high and 700 m long, a service spillway for a discharge of 3800 cu m/sec, a hydroelectric station with eight units having a

total capacity of 1926 MW, and, in the future, locks. The site of the dam is V-shaped with a channel width of 250 m and slope steepness of 25-30 degrees. There is almost no floodplain and the width of the valley at the normal pool level is 700-800 m. Permeability coefficients of the fine and medium grained sands vary from 31.0 to 63.8 m/day, and those of the gravel-pebble deposits vary from 83.5 to 390.0 m/day. After creating the reservoir with a NPL of 215 m, the barrier zone will include: the slideprone mass of the Elephant Ridge on the side of the right bank abutment of the dam; an earth dam with a central loam core; the main concrete structures - spillway and underground powerhouse - in the left bank abutment of the dam on the left bank, the karstified limestones of the Chai-Nhianh massif; and on the left bank, in the future, the upper single lock. Work in each of these areas is described. (Baker-IVI)
W85-00501

EXPERIENCE IN OPERATING THE STRUCTURES OF THE MANSOUR EDDAHBI HYDROPOWER DEVELOPMENT,
For primary bibliographic entry see Field 4A.
W85-00502

DOKAN HYDROELECTRIC STATION IN IRAQ,
A. K. Fink, and I. D. Ostrizhnov.
Hydrotechnical Construction, Vol. 17, No. 10, p 519-522, October, 1983. 5 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 30-32, October, 1982.

Descriptors: *Hydroelectric plants, *Design criteria, *Dokan hydroelectric station, *Iraq, Concrete, Hydraulic engineering, Cranes, Dam foundations.

The design of the Dokan hydroelectric station corresponds for the most part to the traditional designs of reservoir stations. Distinctive features include: the construction in the right bank abutment of the station to the assembly area of a reinforced concrete trestle in the zone of one unit for delivering equipment by gantry crane to the floor of the generator room in the zone serviced by the bridge crane of the station; the layout of the powerhouse and administration production building is based on a combination of the massive volume of the generator room and more openwork structure of the building; sectionalization of the foundation slab of the draft tubes by joints from the piers, their anchorage by means of anchors in the rock mass, and relief of seepage and uplifting forces on the foundation slabs by means of relief wells; the ceiling of the turbine room resting through a reinforced concrete cone on the turbine stator; and construction in the rock surfaces of the end abutments of systems of vertical and inclined drainage ditches which were covered by channel iron when concreting the end walls of the station - this makes it possible to drain the water flowing through cracks into the rock mass during showers. (Baker-IVI)
W85-00503

ENGINEERING-GEOLOGIC ASSESSMENT OF THE CHALK STRATA OF THE TABQA HYDROELECTRIC STATION ON THE EUPHRATES RIVER WITH CONSIDERATION OF OPERATING DATA,
V. A. Moshchanskii, and I. A. Parabuchev.
Hydrotechnical Construction, Vol. 17, No. 10, p 36-38, October, 1983. 6 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 36-38, October, 1983.

Descriptors: *Hydroelectric plants, *Dam construction, *Euphrates River, *Syria, Alluvial soil, Chalk, Permeability, Seepage, Dam foundations.

The hydropower development at As-Saurah in Syria has a multiple purpose and is one of the largest hydraulic structures in the Near East. In the foundation of the powerhouse of the hydroelectric station and floodplain-channel dam occur only Oligocene chalks covered by a thin layer of modern alluvium which was removed both in the zone of the foundation pit for the powerhouse and from under the central part of the earth dam. The greatest difficulties for siting the powerhouse arose, owing to the presence in the chalk strata of bentonite interlayers, for which the design strength after a thorough laboratory and field study was determined. The facility has been in operation more than 6 years under a full head and the design has been proved to be completely stable. The permeability of the chalk strata was estimated from the results of pumping and injection tests. Permeability of the chalks proper is extremely small. On-site observations of seepage on the floodplain channel part of the earth dam show that the seepage line behind the dam core for all five piezometric monitoring cross sections exceeds by only 1.0 m the lower pool level, and the gradient to the head in the alluvial interlayer behind the dam core are about 0.0016-0.0020. (Baker-IVI)
W85-00506

GROUTING WORKS IN THE FOUNDATION OF THE DAM OF THE AL-HADITHAN HYDROPOWER DEVELOPMENT ON THE EUPHRATES RIVER IN IRAQ,
N. V. Dmitriev, and L. I. Malyshev.
Hydrotechnical Construction, Vol. 17, No. 10, p 534-542, October, 1983. 6 Fig, 1 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 41-47, October, 1983.

Descriptors: *Grouting, *Earth dams, *Dam construction, *Euphrates River, *Iraq, Dolomites, Soil properties, Sand, Gravel, Construction materials, Concrete, Permeability, Dam foundations.

The combined earth dam with a central part of the dolomites, shoulders of sand-gravel materials, and an asphaltic concrete cutoff wall has a maximum height of 57 m, base width of 325 m, and crest width of 20 m. A grout curtain with a depth up to 100 m and total length in plan of about 16 km is provided for in the foundation and bank abutments of the dam, and a drainage system is provided in the base of the downstream shoulder of the dam. The parameters of the grout curtain (depth, number of rows, and spacing of the grouting holes), technology of performing the works, and criteria of the quality of grouting ensure reliability of the structure. The groutability of the rocks along the front and over the depth of the curtain is substantially different. A high effectiveness and density of grouting is achieved in layers of the Ana suite; grouting is less dense in the rocks of the Euphrates and Baba suites owing to the presence of pore permeability. The rocks on the completed sections of the curtain are well grouted, solidity of the curtain is provided, and the actual specific water absorption in cross sections of the curtain are less and the effective thickness of the curtain is greater than those calculated according to the design. Grouting and hydraulic testing in the fractured porous dolomites of the Euphrates suite are possible only with a gradual increase of pressure and limitation of the injection rate. The permissible rate of 20-80 l/min depends on the particular geological conditions and on the condition of the rocks and their surcharge. (Baker-IVI)
W85-00507

8B. Hydraulics

GRAVITY CURRENT UPSTREAM OF A BUOYANT INFLUX IN AN OPEN-CHANNEL FLOW: A NUMERICAL STUDY,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Mechanical and Industrial Engineering.
D. T. Valentine, and T. W. Kao.
Journal of Fluid Mechanics, Vol. 140, p 303-327, March, 1984. 17 Fig, 1 Tab, 23 Ref. NSF grants NSF 77-01496 and CEE-83-08405.

Descriptors: *Open channels, *Channel flow, *Flow profiles, *Gravity currents, Diffusion equations, Navier-Stokes equation, Froud number, Laminar flow, Buoyant fluids, Cooling water systems, Boundary layers, Velocity.

The establishment of an upstream intrusion of a buoyant fluid discharged into an open-channel flow of uniform density and finite depth is studied numerically using the full Navier-Stokes and diffusion equations. The problem is posed as an initial boundary-value problem for the laminar motions of a Boussinesq fluid. The equations are integrated numerically by finite-difference methods. The flow patterns produced are controlled by the influx of buoyancy; therefore they are characterized by an inflow densimetric Froude number. A comparison with available experimental data provides favorable support to the theoretical predictions. The critical value of densimetric Froude number of the source of a vertically downward inflow at the free surface of a channel is determined. For densimetric Froude number less than critical, an intrusion is established on the upstream side of the source. Because dissipative mechanisms associated with viscosity take a finite time to intervene, the intrusion starts as an inviscid gravity current with a propagation speed greater than the surface velocity of the stream. The front speed is proportional to the phase velocity of long internal waves. Subsequently, the front decelerates as the interfacial friction, and, if applicable, the boundary frictional forces increase simultaneously with mass entrainment across the interface. The current slows down towards a two-zone equilibrium: (1) the zone encompassing the current behind the frontal zone, where a steady state is approached with respect to the inertial frame of reference; (2) the frontal zone, where the upstream speed approaches a steady speed of frontal advance, albeit small. The upstream intrusion alters the flow pattern of the ambient stream dramatically. A significant feature of both the upstream and downstream currents is the presence of surface convergence with concomitant downwelling near the fronts. As the upstream front decelerates, wavelike disturbances are excited just behind the front at frequencies characteristic of internal waves. As the front approaches steady state, these disturbances appear to be damped. This problem has practical implications in the design of once-through cooling-water systems for power plants taking their cooling water from rivers. (Author's abstract)
W85-00175

TURBULENT NON-BUOYANT SURFACE JETS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnam, and J. A. Humphries.
Journal of Hydraulic Research, Vol. 22, No. 2, p 103-115, 1984. 8 Fig, 2 Tab, 14 Ref.

Descriptors: *Jets, *Diffusion, *Turbulence, Lakes, Rivers, Stagnant waters, Thermal pollution, Stratification, Mixing, Plumes.

An experimental study was performed on the diffusion of plane and bluff turbulent surface jets. For plane surface jets, it was found that its length scale grows at the same rate as a plane wall jet with its velocity scale being about 0.9 times the corresponding value for the plane free jet. For bluff surface jets, the vertical length scale increases at about the same rate as bluff wall jets whereas its transverse length scale grows at about half the rate of the corresponding bluff wall jets. The velocity scale decays inversely with the longitudinal distance, but the constant in the velocity scale relation is somewhat higher than that for the corresponding free circular jet. By studying the diffusion of relatively simpler non-buoyant plane and bluff surface discharges into deep stagnant surroundings, the effects of density differences and freestream influences could be separated out. The results can be used as a basis for studying the influence of the source Richardson number for buoyant discharges and the influence of the Richardson number plus the ratio of the velocity of the surface discharge to that of the freestream while dealing with a moving ambient. (Baker-IVI)
W85-00195

NON-BUOYANT AND BUOYANT CIRCULAR SURFACE JETS IN COFLOWING STREAMS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnam.

Journal of Hydraulic Research, Vol. 22, No. 2, p 117-140, 1984. 17 Fig, 2 Tab, 3 Ref.

Descriptors: *Jets, *Turbulence, *Coflowing streams, Stream flow, Velocity, Channels, Thermal pollution, Buoyant surface jets, Circular jets.

One method of discharging thermal effluents into rivers is to use circular surface jets discharging in the same direction as the river flow (surface jets in a coflowing stream). Based on an experimental study on the diffusion of circular turbulent buoyant surface jets in coflowing streams of large width and depth, it was found that the velocity distribution in the center plane as well as in the planes containing the maximum velocity with respect to the freestream are similar. The velocity scale as well as the vertical and transverse length scales have been analyzed using the excess momentum thickness as the length scale and the source Richardson number as a parameter. The variation of the velocity scale is not affected to any significant extent by the buoyancy effects whereas the transverse spreading rate is increased and the vertical spreading is almost zero for longitudinal distances greater than a few times the momentum thickness. Some preliminary observations have also been made on the effect of shallow depths in the channel on the diffusion of the buoyant surface jets. (Baker-IVI)
W85-00196

STUDY OF THE BEHAVIOR OF BOATS AND UNITS UNDER CROSS-CURRENT AND WIND ACTION AT THE ENTRANCE TO THE FOS-RHONE CANAL LINK (ETUDE DE L'EVOLUTION DES BATEAUX ET CONVOIS SOUMIS AUX COURANTS TRAVERSIERS ET AU VENT, A L'ENTREE DU CANAL DE LIAISON FOS-RHONE),
J. Megard, and P. F. Demenet.
Houille Blanche, Vo. 2/3, p 151-158, 1981. 8 Fig.

Descriptors: *Navigable waters, *Water resources development, *Fos-Rhone Canal Link, Waterways, Decision making, Planning, Model studies.

A river link between the industrial and harbor areas at Fos-sur-Mer close to the Mediterranean is to be provided by a scheme to develop the Rhone for navigational purposes. Studies are underway of the various river engineering problems which will be encountered in carrying out the scheme. A model study was made of the intake configuration of the canal to the Rhone in order to prevent the canal entrance from silting up with sand and to ensure suitable velocity distributions in the entrance for shipping. These two requirements proved to be somewhat contradictory and a compromise solution was finally adopted which met the necessary requirements for navigation. Calculation and graphical methods were used to investigate unit manuverability on the basis of flow velocity patterns determined by model studies. Due allowance was made for both unit characteristics and wind action. (Baker-IVI)
W85-00378

EFFECT OF SUSPENDED SEDIMENTS ON HYDRAULIC RESISTANCES OF A CHANNEL,
N. B. Bekimbetov, and K. I. Baimanov.
Hydrotechnical Construction, Vol. 16, No. 1, p 37-39, January, 1982. 7 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 29-31, January, 1982.

Descriptors: *Hydraulic resistance, *Channels, *Suspended sediments, *Amu Darya, Sediments, Canals, Scouring, Turbidity, Irrigation canals, Hydraulic roughness.

Investigations of the kinematic structure of the flow and effect of the content of suspended sediments in the flow on the hydraulic resistance were carried out in a number of unlined canals of the basin of the Amu Darya River. The distribution of the longitudinal flow velocities was measured at 6 points on the vertical. Water samples were taken for determining the turbidity along the vertical as well as near bottom turbidity. With a decrease of flow, a large amount of sediment accumulated in the near-bottom zone while suspended sediments passed both into a traction state and into bottom deposits. In canals of the Amu Darya irrigation system, in the absence of scouring and silting, the value of the roughness coefficient with increasing dimensions, decreases and has a certain value characterizing a stable state of the canals, whereas, in the presence of scouring, conversely, the value of n increases. With a decrease in dimensions of the canals the value of n also increases owing to the nonuniform roughness of the bottom and effect of the side walls. Near bottom turbidity and various operating regimes of the canals were interrelated. In channels with a rough bottom the intensity of transport by turbulent fluctuations increases and the dimensionless velocity gradient decreases with increases in the height of the roughness projections. (Baker-IVI)
W85-00431

DETERMINATION OF THE HYDRAULIC ROUGHNESS OF A VEGETATED FLOODPLAIN,
For primary bibliographic entry see Field 2E.
W85-00437

CALCULATION OF THE SEEPAGE OF RESERVOIR DIKES OF PUMPED-STORAGE STATIONS,
P. D. Gavrish, V. M. Kondrat'ev, M. N. Rubanik, V. F. Kanarskii, and V. K. Rudakov.
Hydrotechnical Construction, Vol.16, No. 3, p 143-148, March, 1982. 3 Fig, 2 Tab, 5 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 3, p 20-22, March, 1982.

Descriptors: *Dikes, *Design criteria, *Pumped storage, Slope stability, Seepage, Stability, Slopes, Mathematical equations, Free surfaces.

When designing reservoir dikes with daily regulation of the water volume the problem of calculating the seepage stability of the slopes of these structures arises. To solve this problem it is necessary to predict the dynamics of the free surface of the seepage flow in the earth dike under conditions of considerable daily fluctuations on the water level in the reservoir. The seepage flow in dikes of daily storages in the period of drawdown of the water levels from the normal pool level to the dead storage level and standing of the water at the dead storage level can be schematized in the form of an extended groundwater mound. In plan the mound represents a strip located inside a homogeneous bed not bounded over the length of the structure and bounded over the width by the reservoir, drainage, grout curtain, or other type of boundary contours. The character and rate of mound spreading depend on the soil properties, initial size of the mound, boundary conditions, and other factors. Mathematical equations are derived the solution of which provides the rate of spreading of the groundwater mound in dikes of daily storages and predicts the character and effectiveness of the action of the water of the mound on the slope as a function of the design of the structure. (Baker-IVI)
W85-00444

EFFECT OF THE RESERVOIR FILLING REGIME ON THE STRESS AND STRAIN STATE OF AN EARTH-ROCK DAM,
Yu. K. Zaretskii, and V. V. Orekhov.
Hydrotechnical Construction, Vol. 16, No. 3, p 155-160, March, 1982. 3 Fig, 6 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 3, p 26-29, March, 1982.

Descriptors: *Earth dams, *Design criteria, *Reservoir operation, Stress analysis, Stress-strain curves, Deformation, Clay.

When substantiating the selection of a rational design of an earth-rock dam in relation to the geotechnical properties of the local construction materials and construction technology and conditions, its stress and strain state should be predicted. Such a prediction is especially important for determining the crack resistance of watertight elements of the dam, deformations of the dam in the construction and operating periods, and also in cases when systematic deep drawdown of the reservoir is carried out. For a more complete consideration of the properties of clay soils which serve as the material of watertight elements and are multiphase systems the reported calculated predictions are based on solving equations of the theory of consolidation, which examines processes of long term consolidation of saturated soils. From the analysis it is concluded that the effect of the loading trajectory associated with the reservoir filling regime is substantial on the behavior of an earth rock dam. This factor is taken into account in the frameworks of the theory of plastic gain in strength in calculations of the state of stress and strain on earth dams. (Baker-IVI)
W85-00445

USE OF THE CHANNELS OF FLATLAND RIVERS FOR INTERBASIN WATER TRANSFER,
Ya. R. Polyakov.
Hydrotechnical Construction, Vol. 16, No. 4, p 217-220, April, 1982. 1 Tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 23-24, April, 1982.

Descriptors: *Floodplains, *Channels, *Interbasin transfers, *Water transfer, *Dnepr-Conbas Canal, Canals, Environmental effects, Sedimentation, Dredging.

The construction of the first phase of the Dnepr-Donbas canal with intake of water from the Dneprodzerzhinsk reservoir on the Dnepr River and its discharge into the Northern Donets River has been completed. Many specialized research organizations have been engaged in foecasting the consequences of a change in the hydrological regime of the river and hydrogeological setting of the floodplain. The passage of increased dry-weather discharges in individual stretches of flatland rivers has a favorable effect on the development of flora and fauna of the floodplain. In the case of interbasin water transfer, a decrease of bottom sediments will occur due to the discharge of clarified water, which in the future will lead to a further increase of the channel capacity. The use of channels of flatland rivers for interbasin transfer without performing dredging works produces a substantial economic effect. The theoretical investigations and development works performed and also the planned full-scale investigations can be used when working out interbasin water transfer projects with the use of the channels of existing rivers. (Baker-IVI)
W85-00452

REFLECTION OF A SURGE FROM A VERTICAL WALL,
For primary bibliographic entry see Field 2E.
W85-00454

MEASUREMENT OF DISCHARGE IN PRESSURE CONDUITS BY MEANS OF SEGMENTED CONSTRICTORS,
B. M. Levin, and A. N. Lopatin.
Hydrotechnical Construction, Vol. 16, No. 6, p 317-323, June, 1982. 6 Fig, 1 Tab, 11 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 6, p 24-27, June, 1982.

Descriptors: *Orifice flow, *Pressure conduits, Measuring, Flow, Orifices, Discharge, Resistance.

Systematic investigations of segmented constrictors were conducted, the use of which is prospective for measuring the discharge of suspension transporting flows in large-diameter water lines operating in hydraulic and drainage systems and at large pumping stations of reclamation systems. The experiment was conducted with segmented orifices with a sharp inlet edge in smooth pipes with a diameter of 105 and 143 mm by the angle pressure lead method. On the basis of the experimental data the initial discharge coefficient was determined as a function of the relative area of the orifice m in the range 0.5 is less than or equal to m which is less than or equal to 0.957. The confidence interval is

plus or minus 0.75% with a 95% confidence level. An advantage of segmented orifices is the possibility of using them at large values of m, up to 0.957. The flow resistances in this case are small, and the orifice installed in the upper half of the pipe section unimpededly passes the solid suspension. The manufacture, installation, and dismantling of the orifices with large m are uncomplicated also for large diameter pipes. Blunting of the inlet edge has less effect on the readings of the segmented orifices than on the readings of normal orifices. (Baker-IVI)
W85-00469

NEW METHOD OF DETERMINING THE STABLE CROSS SECTION OF A CHANNEL IN COHESIONLESS SOILS,
Yu. A. Ibad-Zade, M. Ya. Krupnik, and E. A. Asadullaeva.
Hydrotechnical Construction, Vol. 16, No. 6, p 335-341, June, 1982. 4 Fig, 1 Tab, 8 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 6, p 34-37, June, 1982.

Descriptors: *Channels, *Cohesionless soils, Soil properties, Stability analysis, Mathematical studies, Suspended sediments.

The method for calculating a stable cross section of a channel was obtained on the assumption of the absence of sliding of soil particles on the canal bottom. Adhering to this principle, the form of a stable channel cross section is constructed. The forms of the channel were calculated for the Kara-Kum and Upper Karabakh canals on the Minsk-32 computer. The results showed that Ibad-Zade's method, the tractive force method, and the proposed method give a relatively good convergence with the actual profile. The divergence between the transverse profiles constructed by these methods and the actual profiles did not exceed 6-7% on average. The method described in the article can also be extended to inhomogeneous soils of a canal in which a suspended load will be transported. (Baker-IVI)
W85-00473

EFFECT OF BREAKING WAVES ON STRUCTURES WITH AN INCOMPLETE VERTICAL PROFILE,
O. Yu. Birskaya, and G. D. Natal'chishin.
Hydrotechnical Construction, Vol. 16, No. 6, p 354-357, June, 1982. 2 Fig, 1 Tab, 2 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 6, p 45-47, June, 1982.

Descriptors: *Waves, *Breakwaters, *Hydraulic structures, Construction, Vertical distribution, Dam construction, Coastal zone management.

Structures with an incomplete vertical profile over which water is allowed to flow due to lowering the elevation of the top are sometimes used in the construction of breakwaters and coast protection works. In the standards, there are no recommendations for determining the wave loads and coefficient of wave suppression when breakers act on structures having an incomplete vertical profile. Investigations were conducted in a wave flume measuring 30 x 1.4 x 1 m, where at a scale of 1:30 the profile of the sea bottom from the water line to a depth of 12.0 m was prepared. The model of the breakwater was installed at a depth of 10 m, 100 m from the water line. An equation was derived which can be recommended for determining the coefficient of wave suppression by a structure with an incomplete vertical profile. To determine the wave loads from breaking waves on structures with an incomplete vertical profile, one can use the appropriate recommendations of SNiP 11-57-75 with consideration of the described corrections with respect to calculating the horizontal and uplifting forces of the wave pressure. (Baker-IVI)
W85-00474

DETERMINATION OF WATER PRESSURE IN PRESSURE TUNNELS AND CONDUITS UNDER A SEISMIC LOAD,
D. N. Kilasoniya, and G. P. Mamradze.
Hydrotechnical Construction, Vol. 16, No. 6, p 357-364, June, 1982. 4 Fig, 2 Tab, 9 Ref. Translated from Gidroteckhnicheskoe Stroitel'stvo, No. 6, p 47-51, June, 1982.

Descriptors: *Seismic properties, *Pressure, *Tunnels, *Conduits, Construction, Mathematical equations, Decision making, Water pressure, Computers.

During seismic oscillation of the ground a dynamic water pressure occurs in pressure tunnels or conduits which in certain cases exceeds the value of the static pressure. It evidently has also a substantial effect on the seismic stress state of the tunnel lining and adjacent ground. The problem of determining the seismic pressure of water in pressure tunnels and underground conduits was investigated. Oscillations of water pressure in a pressure system are described by water hammer equations which for a system performing seismic oscillations is presented. Within the scope of the two-dimensional problem of elasticity theory and on the basis of the finite-element method, a method and program were developed for computer calculation of the seismic stress state of a tunnel lining with consideration of the seismic water presssure preliminarily determined as a result of numerical calculations. (Baker-IVI)
W85-00475

OUTLINE OF AN INCLINED HEAD WALL OF A DEWATERING OUTLET,
Ya. R. Berman.
Hydrotechnical Construction, Vol. 16, No. 8, p 459-462, August, 1982. 2 Fig, 6 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 8, p 41-43, August, 1982.

Descriptors: *Flow, *Water pressure, Head wall, Multiphase flow, Concrete dams, Drainage, Irrigation, Pressure, Conduits, Tunnels.

The two dimensional problem of flow of an ideal incompressible weightless fluid past an inclined head wall is examined. Under conditions of a real flow the problem of flow past the head wall is three dimensional, since outlets have comparatively small transverse dimensions. The use of projecting piers at the head wall leads to a plane-parallel flow at the entrance of the outlet. The flow can be considered as two dimensional both in the head wall and in the initial section of the conduit. Proposed outlines of head walls with inclined pressure faces have greater compactness than elliptical head walls. The recommended method makes it possible to reduce laboratory investigations to a check of the result found by calculation. It is possible to find the dimensions of the head wall from the minimum dimensions of the gate closing the inlet opening. The method of calculating the coordinates of head walls proposed here can be used when designing the openings of dewatering outlets, diversion outlets of concrete dams, head walls equipped with projecting piers such as the head wall of the diversion tunnel of a hydrostation and head walls of closed conduit offtake regulators of irrigation and drainage systems. (Baker-IVI)
W85-00483

OPTIMIZATION OF THE FILLING AND DRAWDOWN REGIMES OF A REGULATING RESERVOIR OF THE KUBAN' CASCADE,
For primary bibliographic entry see Field 3B.
W85-00485

PARAMETERS OF LOCAL SCOUR IN THE REGION OF A SINGLE CYLINDRICAL PIER AND FACTORS DETERMINING THEM,
N. D. Kanarskii.
Hydrotechnical Construction, Vol. 17, No. 9, p 457-462, September, 1983. 3 Fig, 11 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 30-34, September, 1983.

Descriptors: *Scour, *Fluid mechanics, *Piers, Flow, Bridges, Towers, Foundations, Stability, Soil types, Velocity, Bed erosion.

Causes of the formation of local scouring near structures of the pier type have been investigated. They appear to be caused by two types of separation: three-dimensional, producing scour proper, and two-dimensional, a consequence of which is sucking of the soil scour particles into the low presssure zone behind the body. An analysis of the phenomenon of local scour in the region of a single cylindrical pier with the use of methods of similarity and dimensional theory made it possible to establish the form of the dimensionless equations determining the noneroding velocity and dimensions of the scour pocket near the pier. Formulas were obtained for determining the noneroding velocity and for the parameters of local scour which are valid for conditions of medium and coarse grained sands and circular cylindrical piers. (Baker-IVI)
W85-00493

8C. Hydraulic Machinery

GUIDELINES FOR EFFICIENCY SCALING PROCESS OF HYDRAULIC TURBOMACHINES WITH DIFFERENT TECHNICAL ROUGHNESSES OF FLOW PASSAGES,
Technische Hochschule, Darmstadt (Germany, F.R.).
J. Osterwalder, and L. Hippe.
Journal of Hydraulic Research, Vol. 22, No. 2, p 77-102, 1984. 22 Fig, 14 Ref.

Descriptors: *Pumps, *Turbines, *Scale effects, *Hydraulic roughness, *Model studies, Pumped storage, Corrosion, Mechanical equipment.

Pumps and turbines of radial to semi-axial flow are considered. Such pumps are frequently used in water power and pumped storage plants. The scaling process as described is known in the literature and is presented in an abridged form in an easily intelligible way. To simplify practical application, clearly set out diagrams are used which permit a quick determination of efficiency scaling. The fundamental laws are briefly reviewed with reference to the relevant bibliography in order to provide a better understanding. Of particular interest is the relation between the efficiency loss due to roughness and an economically justifiable extent of surface finishing of flow passages. Another important criterion is the surface roughness characterized by the term hydraulically smooth. Relevant numerical data can easily be determined on the basis of suitable diagrams. (Baker-IVI)
W85-00194

DYNAMIC RESPONSE OF CHECK VALVES,
City Univ., London (England). Thermo-Fluids Engineering Research Center.
D. Thorley.
Chemical Engineer, Vol. 402, p 12-15, April, 1984. 4 Fig, 4 Ref.

Descriptors: *Valves, *Testing, *Check valves, Mechanical equipment, Design criteria.

The important features of good check valve design are deduced and criteria for selecting low-loss, non-slam valves are suggested. For arduous conditions of service such as those associated with high head, multi-pump duty it is suggested that in the interests of avoiding check valve slam the following criteria should be applied when selecting a suitable non-return valve: low inertia of the moving parts; short travel distance/angle and; air- or coil-spring assistance of closure, commencing at about 70% of the rated flow. Further controlled tests are needed to compare different valve types having previously tuned each one to give its optimum performance in the selected test facility. (Baker-IVI)
W85-00199

EVALUATING AND IMPROVING EXISTING GROUND-WATER SYSTEMS,
California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W85-00319

ECHNOLOGICAL DEVELOPMENT OF ATED WEIRS ON NAVIGABLE WATER-VAYS (EVOLUTION TECHNOLOGIQUE DES ARRAGES MOBILES SUR LES VOIES NAVI-ABLES),
I. A. Petitjean.
ouille Blanche, No. 2/3, p 141-144, 1981. 3 Fig.

escriptors: *Navigable waters, *Waterways, Weirs, Reviews, Barriers, Dams, Gates, Design iteria, Construction, Hydraulic engineering, uices, Sluice gates.

brief historical review of technical develop-ents dealing with navigable waterways is offered. uring the past ten years two particular types of eir were most frequently employed on water-ays. These were: flap-gate weirs (economical for ice widths up to 30 m and gates less than 5 m gh); and segment gate weirs with or without an erspill flap (for gate heights over 5 m but sluice dths only up to 20 m). Each type of closure is nsidered for its particular advantages and disad-ntages and various design improvements of each er the past decade are reviewed. Other techno-gical developments are briefly noted including ergency stoplogs, fixed components, construc-n methods and automation. (Baker-IVI)
85-00375

ONSTRUCTION OF A GATED WEIR ON A ATERWAY CARRYING HEAVY TRAFFIC ONSTRUCTION D'UN BARRAGE MOBILE R UNE VOIE NAVIGABLE A FORT AFIC),
Lefoulon.
uille Blanche, No. 2/3, p 145-148, 1981. 2 Fig.

scriptors: *Navigable waters, *Waterways, eirs, *Marckolsheim Barrage, *Rhine River, nstruction, Design criteria, Hydraulic engineer-, Gates.

nstruction stages for the Marckolsheim barrage the Rhine River are reviewed. Out of difficul- which arose during this engineering project, eral changes in construction methods were in-uted during the construction of the next bar-e, built at Rhinau. As these changes proved to satisfactory, particularly for navigation require-nts, they have since been adopted into the ndard practices for barrages built downstream n Rhinau. These changes make the gated weir icularly suitable for any navigable waterway rying heavy traffic. (Baker-IVI)
5-00376

TED WEIRS: TECHNOLOGICAL DEVEL-MENTS AND AUTOMATION (LES BAR-GES MOBILES. EVOLUTION TECHNOLO-QUE ET AUTOMATISATION),
Morand.
ille Blanche, No. 2/3, p 149-150, 1981.

criptors: *Waterways, *Weirs, *Automation, nputers, Navigable waters, Gates, Hydraulic neering, Planning, Decision making, Flow, es, Stability.

possible operating conditions were taken into unt during the design stages for the automatic rol equipment at the Rhone River develop-t sites, each of which is equipped with gated s. This includes from low water conditions to ighest known high water discharges. Automa-did not entail any major technological changes pt in those instances where operating reliabil-eeded to be improved. It is suggested that e attention be given to situations in which weir ation is controlled by computer. When pro-ming automatic control equipment particular tion must be given to hydraulic problems such ow, waves, and stability. In order to ensure rate adjustment, particularly under transient itions, it is usually essential to have available nsive major hydraulic measurements. (Baker-

-00377

IMPACT LOADS OF SHIPS ON STRUCTURES (PROBLEMES DES CHOCS DE BATEAUX SUR LES OUVRAGES),
P. Dubois, P. Cornier, J. Mamet, and M. Corbic.
Houille Blanche, No. 2/3, p 159-168, 1981. 12 Fig.

Descriptors: *Locks, *Safety, *Impact load, *Ships, Rhone River, Navigable waters, Waterways, Regulations, Piers, Hydraulic engineering.

Safety equipment used in the Compagnie Nationale du Rhone locks is reviewed. Systems for stopping downstream-bound boats in the bottom of locks are described. Such a need arose with the coming of a new generation of boats using the Rhone, including pusher units in 1975 and river/sea freighters in 1978. Brief descriptions are offered of techniques applied for locks at Bollene, Montelimar, Sablons, Vaugris and Avignon. Local river traffic conditions played a large part in designing the pier seatings and foundations of bridges across diversion canals of the Rhone. In harbor areas bridges were designed with allowance for possible pier impact loads as under current regulations. On sections possibly carrying traffic, bridge design of piers was done according to probable traffic, with provision for subsequent addition of impact protection equipment. A description is included of a study by the Institut de Recherches de la Construction navale, prepared for the French Transport Ministry's Service Central des Ports Maritimes et des Voies Navigables to determine the impact load of a pier hit by a ship. (Baker-IVI)
W85-00379

MICRO HYDROELECTRIC STATIONS WITH POWERS UNDER 100 KW (MICROCENTRALES HYDROELECTRIQUES D'UNE PUISSANCE INFERIEURE A 100 KW),
Ch. Petit.
Houille Blanche, Vol. 36, No. 4/5, p 249-257, 1981. 12 Fig.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Turbines, Electric power production, Hydraulic turbines, Kaplan turbines.

In order to respond to the growing demand for low-power micro hydroelectric stations, the firm Leroy Somer has developed the HYDROLEC range of micro stations. These hydroelectric sets comply with two essential objectives: simplicity and reliability. Their design simplifies problems of installation, use, and maintenance. The range covers heads of one to 25 m and turbined flows of 100 to 2500 L/s; the electrical powers per unit vary according to the type from between two to 50 kW. The installed power can be multiplied by placing several microstations in parallel. In the standard version, the sets deliver three-phase low-voltage AC current: 380 V at 50 Hz or 460 V at 60 Hz. The sets form a single block; their reduced weight and volume simplify transport and installation. They use Kaplan turbines with blades adjustable when stationary. Continuous control of flow is obtained by manual alteration of blade angle. Series H units (one to 10 m of head, two to 50 kW) are compact hydroelectric sets that operate submerged in the downstream spillway channel. This arrangement offers numerous advantages; there is no superstructure and they are unaffected by flood conditions and the prevailing weather. The whole is designed with continuous concern for simplicity and reliability; the construction is robust using tried technologies; parts are calculated for a working life of 100,000 hours, and maintenance is virtually zero. The set can be installed in any position, behind a power penstock or directly in a water chamber. (Author's abstract)
W85-00382

RECOVERY OF HYDRAULIC ENERGY: SMALL INSTALLATIONS ASSOCIATED WITH MAJOR HYDRAULIC PROJECTS (RECUPERATION D'ENERGIE HYDRAULIQUE: PETITES INSTALLATIONS D'ENERGIE ASSOCIEES A DE GRANDS PROJETS HYDRAULIQUES),
J. P. Rouyer, and C. Le Plomb.
Houille Blanche, Vol. 36, No 4/5, p 259-268, 1981. 10 Fig.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *France, Electric power production, Economic efficiency, Energy recovery, Economic aspects, Navigation dams, Return flow.

Economic and technical aspects of energy recovery, which is the alternative to simple discharge of the reserve flow in major hydraulic projects, are examined. New small, low cost installations linked to existing equipment have become economically justified; the projects of Electricite de France (EDF) and Compagnie Nationale du Rhone (CNR) represent a production of 280 million kWh and a power of nearly 50,000 kW. Illustrations of recent EDF developments are: the Strasbourg return plant (1MW, 8 GWh); the return plant at Nepes, downstream of the St. Etienne Cantales dam (2.8 MW, 8.7 GWh); and the project for equipping the navigation dams on the Moselle (32 MW, 180 GWh). Recent CNR developments are Chautagne (2 sets, 1.6 MW, 9.6 GWh/y); Belley (1 set, 0.7 MW, 4.8 GWh/y); Bregnier Cordon (2 sets, 4.4 MW, 33.8 GWh/y); St. Pierre de Boeuf; Lavours; Charmes; and Pierre Benite. (Collier-IVI)
W85-00383

THERMAL ENERGY FROM THE SEA: STATIONS USING THE CLOSED THERMODYNAMIC CYCLE (ENERGIE THERMIQUE DES MERS: LES CENTRALES A CYCLE THERMODYNAMIQUE FERME),
R. Thiennot.
Houille Blanche, Vol. 36, No. 4/5, p 323-330, 1981. 11 Fig, 1 Tab.

Descriptors: *Thermal energy, *Seawater, *Tahiti, Heat transfer, Thermodynamics, Electric powerplants, Hydraulic machinery, Site selection, Water temperature.

In intertropical regions, the surface of the sea is at a temperature of about 28 C. At depths of about 1000 m, the water temperature is about 4 C. The surface water to a depth of 20 or 30 meters represents an immense reserve of stored solar energy. A closed cycle thermodynamic energy plant designed for Tahiti is evaluated. Closed-cycle stations on land sites are found to be perfectly feasible. The cold-water conduit constitutes a very important element in the system. The hydraulic problems posed by its siting are described in principle. (Moore-IVI)
W85-00385

HYDRAULIC PROBLEMS POSED BY DIRECT-CYCLE TES STATIONS OFFSHORE (PROBLEMES HYDRAULIQUES POSES PAR LES CENTRALES ETM A CYCLE DIRECT AU LARGE),
Societe Grenobloise d'Etudes et d'Applications Hydrauliques (France).
M. F. Gauthier, and J. Zaoui.
Houille Blanche, Vol. 36, No. 4/5, p 331-333, 1981. 1 Fig.

Descriptors: *Hydraulic equipment, *Offshore, *Powerplants, *Thermal energy, Heat transfer, Electric power production, Floating powerplants.

For an open-cycle floating thermal-energy from the sea (TES) power station, the hydraulic problems involve three aspects: the conditions for aspiration of hot and cold sources and the risks of recirculation; the internal hydraulics of circuits installed on a mobile platform and the coupling of the different circuits; and the influence of sea conditions. These three problems are presented and the specific aspects of this type of project under development by the CGE-Alsthom-Atlantique-ETPM Group are discussed. (Author's abstract)
W85-00386

EFFECT OF OPERATING HYDRAULIC TURBINES AT LOW HEADS ON WEAR OF BLADING ELEMENTS,
N. N. Kozhevnikov.
Hydrotechnical Construction, Vol. 16, No. 1, p 40-43, January, 1982. 3 Fig, 5 Tab, 3 Ref. Translated

from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 37-40, January, 1982.

Descriptors: *Turbines, *Low head, *Wear, Cavitation, Hydraulic equipment, Pressure head, Vibration.

When solving the problem of starting up units at head substantially lower than the minimum permissible with respect to cavitation conditions, it is necessary to perform a power and economic analysis to select the most rational variant, such as the use of permanent or temporary runners, permanent generators at the rated rotational speed or temporary ones with a reduced speed. The indicated analysis should take into account the duration of operation of the units at low heads, the expected rate of cavitation erosion, vibration of the supporting parts of the unit as a consequence of increased pressure fluctuations in the flow, and other factors affecting the selection of the optimal variant. (Baker-IVI)
W85-00432

PROBLEMS OF RELIABILITY OF MECHANICAL EQUIPMENT OF HYDRAULIC STRUCTURES,
I. V. Martenson.
Hydrotechnical Construction, Vol. 16, No. 2, p 56-58, February, 1982. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 2, p 10-11, February, 1982.

Descriptors: *Mechanical equipment, *Design criteria, Monitoring, Prediction, Reliability, Gates.

When designing mechanical equipment such as gates for hydraulic structures it is necessary to take into account not only the one-time expenditures on its production and assembly but also its operational reliabilty, maintenance, annual costs for upkeep and repair of equipment, labor efficiency, and working conditions of the operating personnel. One way to increase the reliability of mechanical equipment is to develop standard criteria of its condition, such as longevity, technical life, no-failure operation, maintainability, etc., which permit a confident determination of the actual reliability indices and prediction of its operational capability. For developing the criteria, determining numerical reliabily indices of operating equipment, and determining the regularities of the change of these indices with time or as a function of the actual cumulative operating time of the equipment, it is necessary to generalize the available data and collect missing data on the actual condition of mechanical equipment, its operation, and repair. To increase the quality of evaluating the technical condition of mechanical equipment it is necessary to develop on the basis of technical diagnostic principles a method of evaluating the actual condition of equipment and instructions on predicting its further operational capability. It is necessary to design portable diagnostic and monitoring and measuring equipment for conducting inspections in a volume sufficient for an objective evaluation of the condition and for predicting the actual reliabiliy indices of mechanical equipment. (Baker-IVI)
W85-00434

CHARACTERISTICS OF THE OPERATION OF THE MECHANICAL EQUIPMENT OF THE DAM OF THE KRASNOYARSK-2 HYDROELECTRIC STATION,
S. V. Seleznev, S. M. Klimov, and O. B. Vaulina.
Hydrotechnical Construction, Vol. 16, No. 2, p 101-104, February, 1982. 1 Fig, 2 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 2, p 38-40, February, 1982.

Descriptors: *Mechanical equipment, *Design criteria, Dam construction, Spillways, Hydroelectric plants, Gates, Ice.

On the basis of experience gained in the operation of the mechanical equipment of a hydroelectric station dam, a number of recommendations are made which could be beneficially taken into account when designing analogous hydrostations. For hydrostations with a small storage capacity of the reservoir located under harsh climatic conditions it is often necessary to provide for the possibility of passing ice through spillway outlets of the dam and to take into account dynamic ice loads when designing mechanical equipment. For repairing the spillway part of the dam it is expedient to use caisson gates, and for newly designed hydrostations to provide for fixed parts of the guard gate. Low-cycle fatigue and stress concentration can be one of the possible causes of destruction of the gates. The existing methods of determining the load on the wheel supports of the service gates give a sufficient margin ensuring their long-term operation. The method of determining the load on the side guides of the gates with two points of suspension requires correction. It is recommended that a gantry crane be provided for servicing the mechanical equipment of overflow dams having two or more outlets. (Baker-IVI)
W85-00438

ASSEMBLY OF THE PENSTOCKS OF THE SHAMBA HYDROELECTRIC STATION,
G. A. Polonskii.
Hydrotechnical Construction, Vol. 16, No. 3, p 115-122, March, 1982. 5 Fig, 1 Tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 3, p 2-6, March, 1982.

Descriptors: *Penstocks, *Design criteria, Pipelines, Materials, Steel, Hydroelectric plants, Cranes.

The Shamba hydroelectric station is the second reach of the Vorotan series of hydroelectric stations. The pressure conduit of the Shamba hydrostation starts from an intake located in the Toloros reservoir. From the reservoir the water flows into a single line diversion pipeline and penstock. Several progressive technical procedures were used in the construction of the facility. A decrease in the consumption of metal due to using high-strength steel in the manufacture of the pipes saved 300 tons of steel. The designed t's and y's provided a minimum number of assembly units and thereby increased the technological efficiency in the manufacture and assembly of the pipe. The technology for assembling pipes in a 212 m deep vertical shaft and in horizontal tunnels with a small annular was developed for the first time. Self-propelled mechanisms, which made it possible not only to deliver links to the assembly site over a distance of 1.5-2 km, but also to adjust them for assembly, were used for the first time. The pipe was assembled in the 212-m vertical shafts by means of a 40/10 ton gantry crane, and emergency and construction hoists, which provided complete safety of the works. Newly developed suspended platforms were also used for the vertical shaft instead of labor intensive, material consuming scaffolding over the entire height of the shaft. (Baker-IVI)
W85-00439

EFFECT OF THE OUTLET ANGLE BETA-2 ON THE CHARACTERISTICS OF LOW SPECIFIC-SPEED CENTRIFUGAL PUMPS,
V. I. Veselov.
Hydrotechnical Construction, Vol. 16, No. 5, p 267-273, May, 1982. 13 Fig, 4 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 5, p 21-25, May, 1982.

Descriptors: *Pumps, *Design criteria, *Centrifugal pumps, Pumping plants, Hydraulic equipment.

An increase of head, delivery, and efficiency of pumps promotes a decrease in the ude of metal, electric power, and floor space of pumping stations. For low specific-speed pumps, changing the geometry of the vaning of the impeller increases the head considerably without a decrease of pump efficiency. The major feature changed is the outlet angles of the vanes which are increased to values where 90 degreees < or = beta-2 < or = 130 degrees. Short intermediate vanes are installed in the passages between the main vanes. For centrifugal pumps with a volute and diffuser whose impellers have a different number of main vanes, the most rational move is to install three intermediate vanes in each vane passage with a change in the direction of the flow by the main vane toward an increase of the outlet angle on diameter D2 for fecal pumps and pumps with short vanes. The of the new impeller design is particularly effec for high rotative-speed pumps. For multistage mersible pumps with a guide vane apparatus a inlet and axial outlet, the optimal variant is installation of one intermediate vane with a sta the change in the flow direction. All tests conducted without modifying the casing branch pipes, which leaves room for a fur increase of the head developed by pumps with new type of impeller. (Baker-IVI)
W85-00460

8D. Soil Mechanics

VALIDITY OF DENSITY-LIQUID LIMIT P DICTIONS OF HYDROCOMPACTION,
Water and Power Resources Service, Sacrame CA. Mid-Pacific Region.
N. P. Prokopovich.
Bulletin of the Association of Engineering Ge gists, Vol. 21, No. 2, p 191-205, May, 1984. 13 4 Tab, 30 Ref.

Descriptors: *Compaction, *Hydrocompact *Density-liquid limit, *San Joacquin Valley, *C fornia, Stability, Soil properties, Subsidence.

Hydrocompaction, which can cause severe dam to canals, dams, pipelines, roads, and building one of the most destructive forms of subside The reliability of density-liquid limit for delin ing between stable areas and areas potentially ceptible to hydrocompaction is investigated. evaluation was based on some 10,700 samples tained from more than 1,100 test holes in the w central part of the San Joaquin Valley in Cali nia. The apparently logical and simple den liquid limit method for prediction of areas susc ble and nonsusceptible to hydrocompaction yi nonreliable results. The method should not be for practical engineering purposes in this area. validity of the method in other areas should carefully verified prior to usage. The poor reli ity of the method can be attributed to either poor quality of field and laboratory data o mistaken theoretical assumptions. The basic sumption of the method is that susceptibility hydrocompaction requires the pore volume of disturbed sediments to be large enough to hold volume of water needed to bring the sediment the liquid limit condition. (Baker-IVI)
W85-00136

PREDICTIONS OF FUTURE SUBSIDEN ALONG FRIANT-KERN CANAL IN CALIF NIA,
Water and Power Resources Service, Sacrame CA. Mid-Pacific Region.
N. P. Prokopovich.
Bulletin of the Association of Engineering Ge gists, Vol. 21, No. 2, p 215-228, May, 1984. 15 1 Tab, 16 Ref.

Descriptors: *Subsidence, *Canals, *Construct *Friant-Kern Canal, *California, Prediction, C rehabilitation, Groundwater level, Tecto Costs.

The Friant-Kern Canal is 244.3 km long, mo concrete lined, and formed an early key facilit the Central Valley Project of the Bureau of Re mation. The Canal extends from Friant Dam to Kern River near Bakersfield in the southeas part of the San Joaquin Valley in California. diversion capacity is 170 cu m/sec. About 48.3 of the alignment, between mileposts 95 and 125 on the periphery of the major Tulare-Wasco siding area. Postconstruction subsidence within reach locally exceeded 1.5 m. The exact cause subsidence along the canal are not known. Mo probably caused by a distant irrigational overd of confined ground water aquifer systems. tonic movements are also possible. In general postconstruction ground water levels along canal are rising. In 1976-77 interference from sidence caused a 26.67 km long reach of the c to be rehabilitated. Also necessary was the rai of three subsided pumping plants in 1979-81, total cost of about $4,700,000. While the qualit

ıre levelings along the canal is doubtful due to apparent instability of reference bench marks, recommended that systematic measurements of th of water be conducted at check structures selected bridges in the standstill canal. In 1979- such measurements indicated the possibility of ıe local tectonic uplift and downwarp. Al- ıgh the existence of land subsidence along the ınt-Kern Canal was realized during its con- ction, apparently no design modification to ıpensate for future subsidence was made at that e. Continuous construction-postconstruction ıidence along the canal locally exceeded 1.37 and eventually interfered with normal canal ration and maintenance. The approximate cost anal rehabilitation to the present time has been ıt $4,700,000. (Baker-IVI)
5-00137

ESS-DEFORMATION PREDICTIONS FOR E LG 4 MAIN DAM,
ete d'Energie de la Baie James, Montreal ebec).
Pare, N. S. Verma, H. M. S. Keira, and A. D. Connell.
adian Geotechnical Journal, Vol. 21, No. 2, p 222, May, 1984. 12 Fig, 1 Tab, 7 Ref.

criptors: *Stress analysis, *Rockfill dams, *De- ation, *Quebec, *La Grande River, Earth s, Abutments, Strain, Hydraulic fracturing, ning, Dam design, Curvature.

main dam at LG 4 is situated 463 km from the th of the La Grande River in the James Bay tory, northern Quebec, about 1000 km from treal. The dam is composed of 19000000 cu m l materials. The design of the dam is charac- ed by a zoned earth-rockfill section based on a ious use of the limited quantities of various rials available, a 70 m high abutment in the valley with a steep inclination of about 55 ees, and a 50 m high section of the dam with tis curved in the downstream direction. De- l stress-deformation analyses were carried out ıe critical sections of the dam using finite ent methods to verify any presence of arching ıydraulic fracturing potentials in the nonplas- l core. The analysis indicated that only minor ng may be expected between the core and the ent sand and gravel zones, especially in view ıe modified compaction requirements. The s of curvature of 700 m of the dam axis in the dary valley is sufficient to avoid adverse ef- of downstream curvature on the tangential es in the core. Near the steep abutment, al- gh no arching is indicated in terms of the bution of the major principal stress, some ness is indicated by the reduction of the r principal stress within the plane of the longi- al section. The simple analytical approach has satisfactory in providing the answers to the on related to the performance of the dam in ritical areas of zone interfaces, steep abut- , and reverse curvatures. (Baker-IVI)
00141

IZONTAL DRAINS TO STABILIZE CLAY PES,
nto Univ. (Ontario). Dept. of Civil Engineer-

Lau, and T. C. Kenney.
dian Geotechnical Journal, Vol. 21, No. 2, p 49, May, 1984. 10 Fig, 11 Ref. National Sci- and Engineering Research Council of da grant A4543, Ministry of Natural Re- es, Ontario, grant GR-7.

iptors: *Drainage systems, *Slope stabiliza- *Clay, Slopes, Stability, Permeability, Soil rties, Slope stability, Piezometry, Hydraulic ary.

horizontal drains were installed in a natural lope and the piezometric heads in the slope monitored with piezometers. The measured tions of piezometric levels at the test site l by the installation of horizontal drains dem- te that horizontal drains can be used to im- the stability of clay slopes. In clay soils g small values of coefficient of consolidation the piezometric levels at depths greater than about 7 m below the ground surface are stable and are insensitive to changes of hydraulic conditions at the ground surface. It follows that reductions of piezometric levels at these and greater depths due to horizontal drains may be considered as permanent reductions that are independent of precipitation and other climatic events. Estimates were made of changes of piezometric level resulting from installation of horizontal drains based on consolidation theory, the computer program TRUST, soil properties, and hydraulic boundary conditions determined through field measurements. Comparisons between estimated and measured values showed good agreement, indicating that the method of prediction is sufficiently reliable to use for design. The effectiveness of horizontal drains to improve the stability of clay slopes depends on drain spacing, drain diameter, and drain location with respect to the critical slip zone. It also depends on the drains remaining pervious to groundwater, a subject not investigated in this study. Most slopes have different soil hydraulic and geometric characteristics and therefore the design of drainage systems to improve slope stability should be done on an individual basis. (Baker-IVI)
W85-00143

HORIZONTAL FROST HEAVE THRUST ACTING ON BUTTRESS CONSTRUCTIONS,
Academia Sinica, Lanzhou (China). Lanzhou Inst. of Glaciology and Cryopedology.
T. Changjian, and S. Zongyan.
Engineering Geology, Vol. 18, 259-268, 1981. 3 Fig, 4 Tab, 2 Ref.

Descriptors: *Frost heaving, *Frost thrusting, *Soil water, *Buttresses, Soil temperature, Freezing, Silt, Clay.

In cold regions, many buttress constructions suffer from inclination, horizontal displacement, cracking, shear fracture, and concave sinking of the foundations due to the freezing of the soil and rick which have been retained by these constructions. From the results of measurements at actual engineering sites and from model tests in the laboratory, it is clear that (at the time of freezing) the horizontal frost heave force of the the soil body at the restraining wall is quite large. Its amplitude is closely related to the material composition and the water content of the in-filling soil body, and also to the degree of deformation of the construction. When the water content of the soil is less than its plastic limit, the horizontal frost heave thrust of soil does not appear. When the water content of the soil is greater than its plastic limit, the frost heave thrust increases with increasing water content and when the water content is a little over its liquid limit, it reaches a maximum value. The horizontal frost heave thrust of soil varies with temperature; it increases as the temperature falls, until it reaches a maximum value at about -7 degrees C. The distribution of the horizontal frost heave thrust along the lateral surface of the structure is not always uniform; its value is greatest at the middle, less at the bottom, and least at the top. Frost heave thrust varies according to the content of fine silt clay particles. The higher its content, the greater the horizontal frost heave thrust. The maximum value generally appears at the place where the depth is about 60-80% of the depth of frost penetration. The amplitude of horizontal frost heave thrust has minimum values of 0.3-0.4 kg/sq cm, but it is generally between 1-3 kg/sq cm, with maximum values between 4.1-4.2 kg/sq cm. (Moore-IVI)
W85-00274

DESIGN CONSIDERATIONS FOR EARTH LININGS FOR SEEPAGE CONTROL,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
H. Bouwer.
Ground Water, Vol. 20, No. 4, p 531-537, September-October, 1982. 6 Fig, 13 Ref.

Descriptors: *Linings, *Earth linings, *Seepage control, *Design criteria, Pond liners, Channel liners, Permeability coefficient, Head, Unsaturated flow, Clay, Wastewater ponds, Water pollution control.

Darcy's equation and unsaturated-flow theory are used to calculate flow through earth linings that are placed in ponds or channels to reduce seepage. The procedure utilizes the relation between unsaturated hydraulic conductivity and pressure head of the underlying material as calculated from the measured saturated hydraulic conductivity and the relation between water content and pressure head. The method enables the selection of the liner (thickness and hydraulic conductivity) that will keep seepage below a certain maximum limit. Since the hydraulic conductivity of clays is affected by the cationic composition and the salt concentration of the soil solution, the chemical composition of the liquid moving through the liner must be taken into account. This applies also to other chemicals, including solvents and other organic compounds that may be in the water. Travel times of water from the surface impoundment to the underlying ground water are calculated from the seepage rate and the corresponding water content in the vadose zone. Accumulation of solids (mine tailings, for example) can further reduce the seepage from the pond. Proper design of wastewater ponds also requires analysis of the response of the underlying ground water (mound buildup) and the movement of pollutants in the vadose zone and aquifer. In view of the high costs of earth liners, prediction of the seepage is necessary to make sure that the selected lining material, the thickness of the liner itself, and the method of construction will produce the desired results. (Author's abstract)
W85-00329

CALCULATION OF THE EFFECT OF SEISMIC LOADS ON EARTH DAMS BY THE LINEAR SPECTRAL METHOD,
A. P. Troitskii, and S. C. Shul'man.
Hydrotechnical Construction, Vol. 16, No. 1, p 13-20, January, 1982. 8 Fig, 3 Tab, 17 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 15-20, January, 1982.

Descriptors: *Earth dams, *Dam stability, *Linear spectral method, *Seismic load, Soil properties, Dam foundations, Dam construction, Design criteria.

Certain basic stages of the linear spectral method are examined for calculating various types of earth dams. Attention is given to the considerations of nonlinear deformability of the material, the effect of the foundation, and the saturation of soil of the dam. The calculation schemes and corresponding numerical results show that the available information on the properties of soil materials and methods of calculation permit evaluating the seismic stability of earth dams within the scope of the standard method with approximate consideration of the most characteristic features for such structures. (Baker-IVI)
W85-00429

USE OF WEAK ROCKS IN DAM CONSTRUCTION ABROAD,
For primary bibliographic entry see Field 8E.
W85-00433

CALCULATION OF THE THREE-DIMENSIONAL STRESS-STRAIN STATE OF AN EARTH-ROCK DAM,
For primary bibliographic entry see Field 8A.
W85-00436

DEVELOPMENT OF A MANUFACTURING METHOD FOR PRECAST ELEMENTS OF REINFORCED-CONCRETE PIPES OF THE ZAGORSK PUMPED-STORAGE STATION USING ELECTRIC HEATING OF THE CONCRETE MIX,
N. V. Yudina, A. D. Osipov, V. V. Slozhenikin, and T. M. Davydova.
Hydrotechnical Construction, Vol. 16, No. 3, p 126-131, March, 1982. 4 Fig, 2 Tab, 4 Ref. Translated from Gidrotekhnickeskoe Stroitel'stvo, No. 3, p 10-12, March, 1982.

Descriptors: *Pipes, *Pumped storage, *Concrete, *Heat treatment, Steel, Reinforced concrete, Precast concrete, USSR.

Construction of the steel and reinforced-concrete pipes of the Zagorsk pumped-storage station having an inside diameter of 7.5 m and total length of 5 km is supposed to be accomplished in a precast variant. The precast elements of the pipes - rings 4.4 m long - will be manufactured in a casting yard located near the site of the pipelines and equipped with a 200-ton-capacity crane. The volume of concrete of the ring is 44 cu m. It is manufactured in a vertical position. Electric heating of the concrete mix in buckets immediately before pouring the concrete into the mold with subsequent aging of the ring formed from the host mix until it acquires installation strength, is adopted as the main method of heat treatment of the precast elements. Experiments with additive-free mixes showed that after heating at a temperature above 40 degrees these mixes set during aging for 2 hr. The duration of their vibration to a dense state far exceeded the prescribed time of 30 sec. This was grounds for rejecting the use of the additive free mixes in combination with electric heating. The results of investigations of heat treatment with the use of a hot concrete mix and also further development of this method under production conditions will form the basis of the appropriate section of the technical specifications for the manufacture of precast elements of pipes of the Zogorsk RSS. (Baker-IVI)
W85-00440

OPERATING CONDITIONS OF EARTH DAMS ON UNDERMINED TERRITORIES,
V. I. Teleshev, V. F. Markevich, and G. Ya. Bulatov.
Hydrotechnical Construction, Vol. 16, No. 3, p 149-155, March, 1982. 4 Fig, 1 Tab, 14 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 3, p 23-26, March, 1982.

Descriptors: *Dam construction, *Earth dams, *Undermining, Safety, Dam stability, Dam foundations, Deformation, Design criteria.

The operating conditions of a dam on undermined territories substantially differ from those under ordinary conditions without undermining. This necessitates a special approach to the design and operation of such dams, since the use of the experience of conventional hydraulic engineering is not possible. The occurrence of cracks in the foundation in the case of undermining unloads the soil mass adjacent to them. Further deformation of the mass occurs due to an increase in the size of the primary cracks, practically without the occurrence of new ones, which is the main characteristic of deformation of earth dams on undermined territories. The use of nonsoil materials for watertight elements (WTE) of dams cannot completely eliminate and cannot change the regular mechanism of cracking in their body; consequently disruption of the continuity of such elements is possible. The use of the indicated nonsoil materials as WTE, in principle, requires further study. (Baker-IVI)
W85-00443

EXPERIENCE IN CONSTRUCTING RADIAL WELLS IN FINE SANDS,
V. E. Anpilov, Yu. V. Ponomarenko, V. P. Lugovoi, V. S. Kuz'kin, and F. S. Malatskovskii.
Hydrotechnical Construction, Vol. 16, No. 3, p 178-181, March, 1982. 3 Fig, 3 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 3, p 50-52, March, 1982.

Descriptors: *Drainage, *Test wells, *Sand, Drilling, Construction, Silt, Wells, Soil properties, Permeability.

Industrial tests were performed of radial drainage on the subirrigated grounds of a mining and concentration plant composed of fine sands not only to determine the effectiveness of the method for draining sands, but also to develop the technology of drilling radial wells in sands and equipping the wells with filters to expand the area of their usefulness. The area was composed of inhomogeneous fine sands containing discontinuous layers and lenses of yellow-gray and light-gray compact clay with a thickness from 0.4 to 5.0 m. Ferruginous sandstone interlayers were found in the fine sands. The sands are deposits of large rivers, oxbows, and near channel lakes. The silt fraction in the sands was not constant, varying from 0.5 to 25.5%, averaging 10.2%. Thickness of the fine sands vaired from 6-10 to 15-19 m, the permeability coefficient varied from 0.5 to 2-8 m/day. Favorable drainage results were obtained. (Baker-IVI)
W85-00447

PROSPECTS OF IMPROVING METHODS OF CONSTRUCTING FROZEN-TYPE EARTH DAMS,
G. F. Biyanov, V. I. Makarov, and A. A. Plotnikov.
Hydrotechnical Construction, Vol. 16, No. 5, p 239-245, May, 1982. 3 Fig, 1 Tab, 4 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 5, p 5-9, May, 1982.

Descriptors: *Dam construction, *Frozen ground, *Earth dams, Arctic zone, Freezing, Construction, Hydraulic engineering, Soil water.

Current technology for constructing frozen-type dams insufficiently takes into account the use of the natural conditions found in the Far North. The basic difference between frozen and thawed dams is that seepage is not permitted through the body and foundation of such dams. This is achieved by artificial freezing of the soils in the dam core with the mandatory condition that the frozen cutoff wall in the core be interlinked with the permanently frozen soils in the foundation. It is suggested that the soil, before freezing, be saturated with water until all pores are filled, contrary to current practices. However, an increase of the soil moisture content does hamper its artificial freezing. To freeze saturated soil it is expedient to construct watertight elements from lumps of cooled frozen soil placed as layers by drenching with water and allowing natural freezing of the layers by turns. Any local soil may be used and the natural cold becomes a constructive factor, thus reducing costs. The possible rate of construction was determined along with the possibility of controlling the temperature regime of the ice-soil elements for the purpose of controlling their state of stress and strain. The greatest difficulties in formulating the problem for study were assigning the boundary condition on the surface of the freshly placed saturated layer. The real possibility of a comparative analysis of various designs was demonstrated on the basis of numerical modeling of thermal processes in structures, their elements, and also when performing various technological operations. A considerable improvement of designs and methods of constructing frozen-type dams by using these techniques was substantiated. (Baker-IVI)
W85-00457

DYNAMIC STRENGTH OF COHESIONLESS SOILS,
A. G. Chernilov, B. D. Chumichev, and Sh. B. Mukhamedaminov.
Hydrotechnical Construction, Vol. 16, No. 5, p 248-254, May, 1982. 4 Fig, 1 Tab, 12 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 5, p 11-14, May, 1982.

Descriptors: *Cohesionless soils, *Soil strength, Strength, Dynamics, Soil properties, Earthquakes, Hydraulic enginering, Hydraulic structures, Contruction.

When estimating the dynamic stability of earth structures and foundations during earthquakes, determining the effect of cyclic alternating loads on the strength parameters of soil is problematic. While various studies suggest that soil strength parameters are practically independent of the type of loading, the method used to process the experimental data seems extremely important to the final outcome. To check the effect of cyclic loading on the strength parameters of cohesionless soils, two devices for studying the strength and deformation characteristics of sand and coarse-fragmental soils under static and dynamic loads were created. Each device consists of a stabilometer, hydraulic pulsator, and a control panel which permits assi regulating, and monitoring the parameters experiments. Despite the practical equality ultimate intensities of shear stresses and para of the yield condition in static and cyclic re of loading cohesionless soils, an analysis o deformability shows that cyclic loading le the development of considerable additional ments of both volume and shear strains. The opment of additional plastic shear strains lead considerable decrease of the dynamic shear lus with respect to the static, which is exh especially clearly for loose and moderately pact cohesionless soils. An accumulation of tional volume strains as a result of cyclic loa soils can lead to the development of a consid dynamic pore pressure during cyclic loadi soils and, as a consequence, to a decrease of tive stresses. (Baker-IVI)
W85-00459

DENSITY OF PLACING SAND-GRAVEL PEBBLE SOILS IN DAMS,
S. V. Bortkevich.
Hydrotechnical Construction, Vol. 16, No. 324-328, June, 1982. 4 Fig, 1 Tab, 11 Ref. Tra ed from Gidroteckhnicheskoe Stroitel'stvo, N p 28-30, June, 1982.

Descriptors: *Cohesionless soils, *Dam cons tion, *Sand, *Gravel, *Nurek Dam, Construc Design criteria, Soil types, Soil properties, D ty, Hydraulic engineering.

An analysis of world dam construction prac shows that the required relative density of sionless soils in dams is presently J(sub-D)= 0.9. In order to better define these requiren during the construction of the Nurek Dam, inv gations of the compaction of pebble soils of cle-size distribution and evaluation of the effe the degree of compaction on their mecha characteristics were carried out. It is most rati to compact gravel-pebble and sand-gravel soi dams to a relative density of J(sub-D)=0.8. creasing the relative density from this indic control level leads to a marked increase in en expenditure on compacting the soil. A lower suggested relative density leads to incomplete of the strength and deformation properties of soil. Such deviations require adjustments in design. It is necessary to consider that the inv gated soils, generally, contain silt and clay p cles, and therefore have an optimum moisture tent whose value can be determined experime ly. In the absence of experimental values of extreme density, the dry density of gravel-pe and sand-pebble and sand-gravel soils can be signed on the basis of their actual values in nat (Baker-IVI)
W85-00470

USE OF LOW-STRENGTH SOILS FOR C STRUCTING DAMS,
V. G. Mel'nik.
Hydrotechnical Construction, Vol. 16, No. 8 442-452, August, 1982. 4 Fig, 3 Tab, 7 Ref. Tra lated from Gidrotekhnicheskoe Stroitel'stvo, 8, p 31-37, August, 1982.

Descriptors: *Soil properties, *Dam constructi Hydraulic engineering, Weathering, Argilli Siltstone, Shale, Stability, Dam stability, Safe

Low strength soils can be divided into four clas according to their construction properties. T first two classes of these materials have h strength characteristics, practically equivalent strong rocks, and are suitable for placement in shoulders of dams without restrictions. Materials Class III can be used both in shoulders and watertight elements of dams. To obtain high ch acteristics of low strength soils it is necessary place them in the structure with a high degree density, not less than 0.9, which in absolute dens figures is 1.85-2.0 tons/cu m, depending on particle size distribution of the soil. The soil sho be placed in the dam by the method of layer-b layer rolling in layers of 0.4-0.6 m with an avera optimal moisture content of 8-12% depending

content of fine earth. Slope stability of dams on rong foundation is provided when the gradient he slopes is equal to 2 and flatter. The deforma- is of dams of low strength soils depend on the ree of compaction, and for a relative density ater than 0.9 the settlements of the construction od will not exceed 6% of the height and of the rating period 1%. Weathering of well compact- low strength soils of classes I, II, and III has ctically no effect on the stability and deformabi- of dams constructed of these materials. Weath- g occurs only from the surface of the structure depth of not more than 3 m and can be nated by a formula which is provided. The erience of using argillites, siltstones, and shales wed the possibiltiy of their year-round, highly ctive placement and in all investigated cases e it possible to obtain a substantial savings due he use of materials presently available, the uction of the distance of hauling soil, a reduc- in the volume of the dam in the case of using strength materials with high strength charac- ics analogous to rocks, and the protection of environment from dumping of previously ed soils. (Baker-IVI)
-00481

BILITY OF SLOPES OF CONSTRUCTION S IN RUBBLE SOILS,
. Kolichko, and A. V. Andrianov.
rotechnical Construction, Vol. 16, No. 8, p 455, August, 1982. 1 Fig, 2 Tab, 4 Ref. Trans- from Gidrotekhnicheskoe Stroitel'stvo, No. 37-39, August, 1982.

criptors: *Slopes, *Stability, Soil properties, e stability, Foundation, Roads, Hydraulic en- ering, Construction.

bstantiated increase in the steepness of slopes undation pits and road cuts has a considerable t on reducing the time and cost of construct- hydraulic structures. The angles of stable es for loose and cohesive soils are usually lated from the data of laboratory investiga- , but for coarse-fragmental soils such investi- ns are either extremely costly or practically ssible. The state of upper slopes of roads and pits of deposits of construction materials vated at various locations in Uzbekistan, Tadz- n, and Kirgiz was analyzed. Several general- were revealed as a result of processing the on existing slopes in rubble talus and proluvial and densely consolidated alluvial gravels. The ness of the slopes depends considerably on aspect. The steepness of the slopes decreases increases in their height, however, up to a t of 2-3 m the steepness of slopes is practical- dependent of height. The main factors disturb- he stability of slopes are erosion, rockfalls, collapses, and more rarely landslide phenom- In this case the slopes oriented toward the and northeast are subjected to a greater e to erosion than slopes oriented toward the and southeast. In addition, higher slopes are cted to greater erosion. The erosion processes displayed most intensely during the first 5-7 of existence of the slopes, but these processes ot have a substantial effect on normal oper- of the investigated slopes. (Baker-IVI)
00482

ECT OF ARCH SHAPE ON THE PER- MANCE OF A HIGH ROCKFILL DAM,
Belyakov.
otechnical Construction, Vol. 17, No. 9, p 48, September, 1983. 4 Fig, 1 Tab, 5 Ref. lated from Gidrotekhnicheskoe Stroitel'stvo, , p 19-22, September, 1983.

riptors: *Rockfill dams, *Dam construction, ning, Canyons, Dam construction, Design cri- Hydraulic engineering, Cracking, Stress anal-

constructing high earth dams in narrow ns the danger arises that unloading in the body as a consequence of the arching effect en the walls can lead to hydraulic fracturing e watertight core. The solution of three-di- onal problems of the stress strain state of a rockfill dam in a plastic formulation under conditions of stepwise construction and filling of the reservoir permits evaluating the effect of the arch shape on the stress state of the dam and crack resistance of its core. A dual effect of arching on the stress state of the core is noted. The thrust occurring increases the level of normal stresses in the core and, on the other hand, the transverse component of the load from the water pressure of the upstream pool on the arched upstream face reduces the level of normal stresses near the wall abutments. The ocurrence of thrust is more perceptible near the steeper wall and in the lower part of a dam, where the distance between walls is less. In the upper part of a dam a positive effect of arching on crack resistance of the core is not noted. The results obtained for a 335 m high dam in a canyon with a site coefficient of 2 with a slightly inclined core permit recommending optimal arching with a rise of 50 m on the crest, which amounts to 0.068 of the crest length of the dam and corresponds to an arch with a central angle of 34 degrees. (Baker-IVI)
W85-00491

EARTH DAM OF THE AL-HADITHAH HYDROPOWER DEVELOPMENT ON THE EUPHRATES RIVER,
N. M. Kamnev, N. A. Sonichev, and N. A. Malyshev.
Hydrotechnical Construction, Vol. 17, No. 10, p 530-533, October, 1983. 2 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 38-41, October, 1983.

Descriptors: *Water resources development, *Dam construction, *Earth dams, *Al-Hadithah, *Iraq, *Euphrates River, Hydroelectric plants, Powerplants, Hydraulicking,.

Construction of the Al-Hadithah hydropower development on the Euphrates River in Iraq began in 1977, including an earth dam and hydroelectric station combined with an overflow spillway, indoor electrical equipment and an administration building. The earth dam was designed considering the availability of local building materials in sufficient amounts. The existing large quarries of the sand-gravel mixture made it possible to use the hydraulicking method of excavation and delivery to the dam or to intermediate stockpiles with subsequent dry placement in the dam. The abutment of the mealy dolomites to the sand-gravel mixture is made without transition layers. An asphaltic concrete cutoff wall is provided for in the central dolomite part of the dam separating the central dolomite part into upstream and downstream parts. The mealy dolomites on compacting with an optimal water content have good structural bonds due to the large content of fine earth. The shoulders of the dam are made of sand gravel soils characterized by considerable nonuniformity, with an average particle diameter from 0.24 to 16.7 mm, and coefficient of uniformity from 4 to 300 and higher. A reinforced concrete gallery with inside dimensions of 4 x 4.5 m is provided for in the foundation of the earth dam with a length of 100 m on the right bank and 500 m in the river channel. The asphaltic concrete cutoff wall rests on the roof of the gallery. The variable depth grout curtain under the dam is two rows with a distance of 1.5 m between rows and a distance of 3 m between holes in the rows. (Baker-IVI)
W85-00505

8E. Rock Mechanics and Geology

GUIDELINES FOR INSPECTION OF DAMS FOLLOWING EARTHQUAKES.
United States Committee on Large Dams, New York.
Report, August, 1983. 40 p, 2 Append.

Descriptors: *Dam inspection, Earthquakes, *Earthquake engineering, Disasters, *Earthquake damage, *Dam failure, *Dam breaches, Earth movements, Shock waves, Stress.

This publication was prepared by the Earthquakes Committee of the United States Committee on Large Dams (USCOLD) to provide a guide for the inspection of dams following an earthquake. Inspection immediately following an earthquake is most crucial to decisions regarding continued operation of the structure. A followup inspection will provide more detailed information on structural performance under seismic loading. Inspection requirements for a dam can be made more meaningful by tailoring them for a specific dam using these guidelines. There are two phases to such an inspection procedure: (1) an immediate inspection by the dam operator (dam tender), and (2) a followup inspection by dam engineering professionals. These procedures apply if an earthquake occurs or one has been reported to have occurred with a Richter magnitude of 4.0 or greater within a 15-mile radius, 5.0 or greater within 30 miles, 6.0 or greater within 50 miles, 7.0 or greater within 80 miles, or 8.0 or greater within a 125-mile radius from the site. One appendix lists the intensity numbers for the Modified Mercalli Intensity Scale of 1931 (Abridged); a second appendix details inspection checklists to be used following an earthquake.
W85-00043

METHOD OF CALCULATING THE STABILITY OF ROCK SLOPES OF HYDRAULIC STRUCTURES,
E. G. Gaziev, and V. I. Rechitskii.
Hydrotechnical Construction, Vol. 16, No. 1, p 30-36, January, 1982. 3 Fig, 10 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 26-29, January, 1982.

Descriptors: *Stability analysis, *Dam construction, *Rocks, Safety, Dam stability, Slope stability, Mathematical equations, Dam foundations.

The reliability of rock masses which are the foundation of structures or the enclosing medium determines to a considerable extent the reliability and safety of these structures. Methods are proposed for calculating and analyzing the stability of rock slopes. These methods make it possible to obtain reliable results with consideration of the possible characters of failure and degrees of reliability of the initial information. These methods were widely used in practical calculations of the stability of rock masses and slopes when planning stabilization measures to be used in the reservoirs of the Tolorossy and Zaramag dams, Akhuryan dam, when investigating and designing the lock of the Dnepr-2 hydroelectric station, and when investigating and designing the Middle Enisei storage station along with the Southern Ukraine power complex. (Baker-IVI)
W85-00430

USE OF WEAK ROCKS IN DAM CONSTRUCTION ABROAD,
M. V. Vitenberg, and V. G. Mel'nik.
Hydrotechnical Construction, Vol. 16, No. 2, p 47-56, February, 1982. 9 Fig, 2 Tab, 19 Ref. Translated from Gidrotechnicheskoe Stroitel'stvo, No. 2, p 4-10, February, 1982.

Descriptors: *Earth dams, *Rock properties, Construction materials, Sedimentary rocks, Metamorphic rocks, Costs, Compaction.

The requirements imposed on rock material of earth dams have changed along with the development of civil engineering techniques for the excavation and compaction of materials and expansion and refinement of knowledge about the behavior of soils in dams. The use of low strength sedimentary or metamorphic rocks significantly reduced the cost of earth dam construction. Soft soils are currently finding wide use in dam construction with their rational use in many cases permitting not only a substantial reduction in cost but also in time for constructing the dams. Depending on the properties of the initial rock and technology of excavating and compacting the material, soils from soft rocks (agrillites, siltstone, shales) can be placed in various elements of dams including shoulders, transition sections, cores, and blankets. The experience of using soft soils in dam construction shows that

such soils compact well and in a compacted state have high strength properties, comparable to the characteristics of rock fill of strong hard rocks. (Baker-IVI)
W85-00433

STRENGTH OF INFILLED ROCK FILL,
O. A. Pakhomov.
Hydrotechnical Construction, Vol. 16, No. 4, p 213-217, April, 1982. 4 Fig, 3 Tab, 6 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 20-23, April, 1982.

Descriptors: *Construction materials, *Strength, *Rock fill, Earth dams, Testing procedures.

Investigations of unstrengthened and strengthened materials using a large testing device confirmed earlier conclusions concerning the effectiveness of filling in rock fill for increasing the strength of earth masses. Use of noninfilled and infilled rounded stone broadens the area of use of boulders and cobble in construction, where presently such material is graded out. The low compressibility and high shear strength of infilled rock fill may allow its wider introduction into hydrotechnical construction if strenthening of the shoulders by infilling is mastered. A wide range of laboratory, field, and theoretical investigations is needed. It is stressed that filling in rock fill complicates the technological process and should be technically and economically justified and coordinated with the local construction conditions. (Baker-IVI)
W85-00451

SOME FACTORS AFFECTING VERTICAL DISPLACEMENTS OF THE FOUNDATION OF THE INGURI ARCH DAM,
G. Kh. Khakimova.
Hydrotechnical Construction, Vol. 16, No. 4, p 229-233, April, 1982. 3 Fig, 3 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 36-38, April, 1982.

Descriptors: *Arch dams, *Foundation rocks, *Vertical displacement, Rocks, Dam construction, Hydroelectric plant, Inguri Hydroelectric Station, Stress, Foundation.

The arch dam of the Inguri hydroelectric station with a height of 271.5 m and crest length of 758 m is being constructed under complex conditions in a region characterized by a high background seismicity. The foundation is composed of limestones, dolomitized limestones, and dolomites, the beds of which have a steep monoclinal dip toward the lower pool. Foundation rocks are strong but severely fractured with moduli of deformation in discharge zones from 4-8 GPa and less and in zones of natural preservation to 13 GPa and more. A rise in the dam foundation during filling of the reservoir was noted and studies have shown that the rise occurs because under certain hydrogeological conditions the state of stress and strain of a rock foundation of a dam depends on the seepage forces and this must be taken into account when examining the interaction of the dam and foundation. (Baker-IVI)
W85-00455

CONSIDERATION OF YIELDING OF A ROCK FOUNDATION WHEN CALCULATING ARCH DAMS,
G. K. Gabrichidze, and L. M. Izashvili.
Hydrotechnical Construction, Vol. 16, No. 5, p 246-248, May, 1982. 3 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 5, p 9-10, May, 1982.

Descriptors: *Yield equations, *Arch dams, *Foundations, Vogt method, Dam construction, Model studies, Rock mechanics, Rocks.

When calculating various effects of arch dams, the well known Vogt method is widely used to account for yielding of the rock foundation. The basic principles of the method are: the foundation is regarded as elastic, homogeneous, and isotropic; the displacements of the rock foundation regardless of the shape of the canyon are determined on the assumption of the effect of reactive loads on a semi-infinite solid; Vogt's formulas in combination with the procedure developed by the U.S. Bureau of Reclamation are used for determining displacements of the rock foundation. The first two principles have a clear physical significance and the area of their use can be determined rather distinctly. The procedure for using Vogt's formulas is seen as somewhat insufficiently argued in the technical literature. A comparison is made with the use of Vogt's method showing that consideration of yielding of the rock foundation by the method on the assumption of an elastic, isotropic, and homogeneous canyon having gently sloping walls gives a satisfactory qualitative picture of the distribution of the reaction force on the contact of the dam with the rock foundation, under the effect of the hydrostatic pressure of water. The quantitative difference of the results obtained by two methods of calculation have reached 60% at some points. (Baker-IVI)
W85-00458

USE OF THE PROBABILISTIC METHOD OF CALCULATING STABILITY WHEN DESIGNING ROCK SLOPES,
V. I. Rechitskii.
Hydrotechnical Construction, Vol. 16, No. 6, p 312-317, December, 1982. 3 Fig, 8 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 6, p 21-24, June, 1982.

Descriptors: *Slopes, *Design criteria, Rocks, Decision making, Hydraulic engineering, Dam construction, Construction, Stability.

A new method is proposed for calculating the stability of rock slopes based on the use of a statistical probabilistic method of processing the measurements of orientations of potential shear joints and taking as the criterion of stability of slopes their reliability value. The practical use of the method when designing the rock slopes of foundation pits of the Southern Ukraine power complex showed the advantages and prospects of the probabilistic approach to estimating the stability of masses. In particular, use of the method made it possible to design some steeper slopes, which as a whole for the complex will permit avoiding additional excavation of tens of thousands of cubic meters of rock. The results of calculating slope stability for various values of the hydrostatic pressure indicate the need for special investigations to determine the shape of the line of seepage in masses and the expediency of refining this line during excavation. (Baker-IVI)
W85-00468

CALCULATION OF THE PARTICLE-SIZE DISTRIBUTION OF BLASTED ROCK,
R. Ya. Strausman, and V. M. Borychev.
Hydrotechnical Construction, Vol. 16, No. 6, p 328-332, June, 1982. 2 Fig, 4 Tab, 2 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 6, p 30-32, June, 1982.

Descriptors: *Hydraulic engineering, *Dam construction, *Blasting, Rock fill, Particle size, Explosives.

In hydrotechnical construction one of the important requirements imposed on the quality of blasting is the provision of a prescribed particle-size distribution of the blasted rock. This requirement is especially important when preparing material for filling the shoulders of rock-fill dams, when the particle-size distribution of the material should meet the conditions of maximum density of placing the rock. The existing instructions on calculating charge for a prescribed degree of crushing contain substantial errors with respect to the values of the calculated coefficients and do not consider the conditions of distributing the explosive charge in the rock mass being blasted. Among the many factors influencing the degree of crushing of rocks by a blast in the zone of the hole charge, the most important is the basic powder factor, which determines the amount of energy transmitted to the rock on detonating the charge. The optium diameter of the hole and the corresponding parameters of the arrangement of the charge and the main indices of blasting operations, such as the powder factor a size of the average piece of blasted rock, are det mined by calculation by the given program f conditions of multirow short-delay blastin (Baker-IVI)
W85-00471

METHODOLOGICAL PRINCIPLES OF A ON-SITE STATISTICAL POINT ESTIMATIO OF THE PARTICLE-SIZE DISTRIBUTION O A ROCK MASS,
V. A. Kuznetsov.
Hydrotechnical Construction, Vol. 16, No. 7, 420-426, July, 1983. 5 Fig, 3 Tab, 5 Ref. Translat from Gidretekhnicheskoe Stroitel'stvo, No. 7, 47-50, July, 1982.

Descriptors: *Rocks, *Particle size, *Dam co struction, Evaluation, Decision making, Constru tion, Hydraulic engineering.

The particle-size distribution is the most importa characteristics of a lumpy rock mass, determini the strength and seepage properties of rockf structures and also the effectiveness of blastin excavating, transporting, and other mining a construction work. An on-site statistical point es mation was devised which can be carried out the surface of blasted rock piles, on the slopes dumps, and on the surface of natural rock falls a slides. The method is distinguished by simplicit promptness, and comparatively small labor inten ty while providing a high accuracy of results. T main works in the method include selection of t sizes of the fractions being recorded, inspection the rock pile making a diagrammatic represent tion of it and selection of the measuring areas a profiles, taking statistical samples, estimates, a auxiliary measurements, and processing and tran forming the results. To increase the accuracy estimating the size distribution it is recommende to originally determine the content of the fracti for each measuring area and then to calculate t weighted average value with respect to the vo umes of the rock pile corresponding to individu areas. The following distortion factors must kept in mind: the armor effect - sieving of the fi fractions through larger fractions, leading to overestimation of the content of large fractions the surface layer of the pile; the effect of incon plete visibility of the rock lumps during estimatio and local accumulations of oversize in certa zones of the pile and segregation of the rock ma on steep slopes. (Baker-IVI)
W85-00478

8F. Concrete

PERMEABILITY OF GROUT SEALS SUR ROUNDING THERMOPLASTIC WEL CASING,
Auburn Univ., AL. Dept. of Civil Engineering
C. E. Kurt, and R. C. Johnson, Jr.
Ground Water, Vol. 20, No. 4, p 415-419, July August, 1982. 5 Fig, 9 Ref. OWRT project A-07 ALA.

Descriptors: *Grouting, *Permeability coefficien *Well casings, Thermoplastics, Plastics, Cements Calcium chloride, Bentonite.

An experimental test program was conducted t measure the longitudinal permeability of a groute thermoplastic water well casing system. A nea cement grout, with and without calcium chlorid or bentonite admixtures, was placed in the annulu of a simulated well. Test pressure and specime configuration was shown to influence the meas ured coefficient of permeability. A neat grout wit a water/cement ratio of 2.0 had a much highe permeability coefficient than the same grout with water/cement ratio of 0.46. Once the bond lin between the grout and casing was broken, th permeability of the system was generally highe than for the initial test. Specimens with a bel coupling included had a slightly higher permeabil ity than specimens with straight pieces of casing The effect on permeability of the admixtures in th grout was not conclusive. However, the additio of a bentonite slurry to the test water was observed

to decrease the permeability coefficient when tested under low pressure. The permeability coefficient of the basic neat grout casing system ranged from 0.0002-0.0010 cm/sec at low test pressure. It was concluded that the casing has an impact on the longitudinal permeability of the system since the coefficients of permeability measured were significantly higher than other published values. However, the coefficients of permeability measured were in the range of soils with low permeability such as silts. (Moore-IVI)
W85-00321

CONCRETING THE DIVERSION DEWATERING OUTLETS OF THE ZEYA HYDROELECTRIC STATION,
Ya. P. Mirzaev.
Hydrotechnical Construction, Vol. 16, No. 1, p 8-12, January, 1982. 2 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 12-14, January, 1982.

Descriptors: *Dam construction, *Spillways, Concrete, *Zeya Hydroelectric Station, *USSR, Cantilevers, Portals, Hoists, Hydraulic equipment.

During construction of the Zeya hydroelectric station, diversion of the river past the concrete structures of the spillway part of the dam was accomplished by a three stage scheme. In the first stage the design discharge of 1% probability, equal to 14,500 cubic m/sec, was discharged through four 8-m wide bays of the comb and two 8 m wide extreme bays. On the upstream and downstream sides the comb is closed by slide gates by means of a gantry crane from the downstream pool and by existing gear from the upstream pool. As the dam was created the comb was reconstructed into 10 dewatering outlets of the first phase. The use of poured concrete with plasticizer GKZh-94 in difficult to access parts of structures, such as the plug of dewatering outlets, is effective with respect to the conditions of delivering the concrete to the placement site and considerably reduces labor expenditures on its compaction. The overconsumption of cement for poured concrete is compensated for by the reduction of labor expenditures on delivering the concrete mix to the placement site and its compaction. Under conditions of Siberian rivers with large diversion discharges, it is necessary to have several sets of mechanisms and equipment for closing the outlets - hydraulic hoists, cantilevers, portals, rods, guard gates - for increasing the rate of construction and eliminating downtimes in unforeseen or emergency situations. (Baker-IVI)
W85-00428

USE OF STEEL FIBER-REINFORCED CONCRETE FOR GROOVE ELEMENTS OF GATES,
R. Freishist, and D. G. Yaroshenko.
Hydrotechnical Construction, Vol. 16, No. 3, p 173-177, March, 1982. 3 Fig, 1 Tab, 5 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 3, p 49-50, March, 1982.

Descriptors: *Reinforced concrete, *Steel, *Hydraulic gates, Concrete, Construction, Dams, Gates, Bearings, Stress.

The possibility of using steel fiber-reinforced concrete for the groove elements of gates was examined during investigations of heavily loaded slide gates of vertical lift gates at the Nurek hydroelectric station conducted for the purpose of finding a rational method of transmitting the load from the track to the concrete. Prior to this time, volume-dispersed reinforcement by segments of steel wire or steel shavings was sometimes used for concrete for embedded parts of the main parts of radial gates of hydraulic structures. The bearing capacity of the concrete based under the gate with various reinforcement methods was compared during the study. The state of stress of the concrete base of the groove element under a load was investigated with two configurations of rails. Failure of the concrete in all cases occurred before the occurrence of plastic deformation in the rail. Concrete fragments of steel fiber reinforced concrete withstood a load on the average 30% higher than concrete fragments with meshes and 80% higher than for concrete fragments without reinforcement, indicating the prospects of using steel fiber-reinforced concrete in the groove elements of gates. The dependence of the mechanical characteristics of steel fiber-reinforced concrete on the character of reinforcement was then studied. In all cases failure of the steel fiber reinforced concrete specimens was preceded by the development of a dense network of fine cracks. (Baker-IVI)
W85-00446

CAST CONCRETES WITH FROSTPROOFING ADDITIVES IN UNDERGROUND CONSTRUCTION,
R. P. Burba, E. M. Glazunov, A. I. Matyukhina, and M. V. Zaitsev.
Hydrotechnical Construction, Vol. 16, No. 5, p 283-288, May, 1982. 7 Fig, 3 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 5, p 31-34, May, 1982.

Descriptors: *Concrete, *Construction materials, *Strength, Reinforced concrete, Temperature effects, Frost protection, Underground structures.

Cast concretes with frostproofing additives are most effective when constructing elements with unlimited striking times at negative ambient temperatures not below minus 15 degrees. Sodium nitrite-nitrate and phosphated calcium chloride are recommended for cast concrete with fine sands. Phosphated calcium chloride is most effective in cast fine-sand concrete for constructing unreinforced structures in the case of alternating and moderately negative ambient temperatures. Sodium nitrite-nitrate is most effective in cast concretes hardening at lower temperatues when constructing both reinforced and unreinforced elements of underground structures. These additives plasticize the cast concrete mix, increasing the cone slump within 25 to 45%. The strength of cast fine sand concretes with frostproofing additives, at least for a low water/cement (W/C) ratio of not less than 0.4, obeys the regularities established for high and low slump mixes and correlates with the W/C ratio with respect to the known relations. The replacement of medium sand by fine in cast mixes of equal strength increases the content of cement by 10-15%, just as in stiff and plastic concretes of equal flowability and equal strength. The strongest combinations of frostproofing additives, which include ammonia water, cannot be used under underground conditions owing to toxicity upon evaporation. (Baker-IVI)
W85-00463

SELECTION OF ECONOMIC THICKNESSES OF REINFORCED-CONCRETE ELEMENTS OF HYDRAULIC STRUCTURES,
I. P. Pomazueva.
Hydrotechnical Construction, Vol. 16, No. 5, p 292-293, May, 1982. 2 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 5, p 49-50, May, 1982.

Descriptors: *Reinforced concrete, *Economic aspects, Construction materials, Decision making, Concrete.

Massive reinforced-concrete elements are finding wide use in hydrotechnical construction. The amount and cost of construction and assembly works of such elements are considerable, and the search for more advantageous solutions when designing the plants will produce a perceptible economic benefit. A variety of equally strong reinforced concrete cross sections with different thicknesses and reinforcement can be selected for use based on job specifications. The costs of equally strong reinforced concrete elements has been analyzed as a function of their thickness and reinforcement for a number of power facilities being constructed in Central Asia. The economic effectiveness of the element increased with decreases of the grade of concrete. An increase of the concrete grade does not allow reducing the amount of reinforcement enough to obtain an economic effect for the element as a whole. The selection of the class of reinforcement does not affect the results of the analysis. Preference should be given to reinforcement of a higher class. In eccentrically compressed reinforced-concrete elements there is a direct relation between the decrease of cost of the element and the decrease of its thickness. In the case of eccentric compression with very large eccentricities, when the compressive force can be neglected, the regularities characteristic for flexural elements come into force. (Baker-IVI)
W85-00465

EVALUATION OF THE EFFECTIVENESS OF MEASURES TO SHORTEN THE CONSTRUCTION TIME OF MASS CONCRETE STRUCTURES OF HYDROELECTRIC STATIONS,
For primary bibliographic entry see Field 6B.
W85-00476

CREEP OF CONCRETE UNDER MULTIAXIAL COMPRESSION,
E. A. Kogan.
Hydrotechnical Construction, Vol. 17, No. 9, p 448-452, September, 1983. 4 Fig, 1 Tab, 9 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 22-25, September, 1983.

Descriptors: *Concrete, *Creep, *Dam construction, *Compression, Multiaxial compression, Elasticity, Linear creep, Stress analysis, Poisson Ratio.

The characteristics of elasticity and creep of mature concrete under uni-, bi-, and triaxial compression in the region of linear creep do not depend on the type of stress state and can be determined in ordinary uniaxial experiments. The assumption of equality of Poisson's ratios of elastic strains and creep and their constancy in time made in the linear theory of an elastically creeping body is admissible. The usual assumption of independence of the action of forces in various directions with consideration of Poisson's strains is confirmed by experiments with the long action of time constant compressive stresses not exceeding 30-40% of the ultimate strength. (Baker-IVI)
W85-00492

INTENSE METHODS OF WINTER CONCRETING OF UNDERGROUND HYDRAULIC STRUCTURES IN THE FAR NORTH,
E. M. Glazunov, A. I. Matyukhina, M. N. Rozin, and V. A. Rumyantsev.
Hydrotechnical Construction, Vol. 17, No. 9, p 463-466, September, 1983. 1 Tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 35-37, September, 1983.

Descriptors: *Dam construction, *Cold weather construction, *Concrete, Hydraulic engineering, Construction materials, Additives, Costs, Gunite, Formwork.

A specific feature of the technology of constructing linings of underground structures in regions of the Far North is the need to create conditions for hardening of concrete at low natural temperatures of the air and surrounding rocks. Methods for concreting tunnels are proposed for these regions which make it possible to reduce energy expenditures several fold, increase the rate of constructing linings by 1.5 to 2 times, to reduce total labor expenditures fo 2.0 to 2.5 times, and to reduce expenditure of manual labor by 30-40%. For the wide introduction of the concreting methods developed it is necessary to considerably broaden the range of concrete additives presently used in underground construction. When designing concrete plants it is necessary to provide for special production lines for introducing these additives. Attention should first of all be given to the creation of optimal designs of thermoactive formwork with an adjustable heating regime and units for the preparation, heating, and transport of the solution of the gunite additives during construction. (Baker-IVI)
W85-00494

PROBLEMS OF CALCULATING THE STRENGTH OF MASSIVE CONCRETE AND REINFORCED-CONCRETE ELEMENTS OF COMPLEX HYDRAULIC STRUCTURES,
S. B. Smirnov.

Hydrotechnical Construction, Vol. 17, No. 9, p 471-476, September, 1983. 1 Fig, 10 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 41-45, September, 1983.

Descriptors: *Concrete, *Strength, *Reinforced concrete, Construction materials, Dam construction, Hydroelectric plants, Hydraulic engineering.

An attempt was made to solve urgent problems of the strength of three dimensional concrete and reinforced concrete elements of a hydrostation. Solutions were sought through the selection of the cross sections of reinforcement of three directions on the basis of six components of the stress tensor; strengthening of concrete in compressed-extended zones of triaxially reinforced reinforced-concrete elements with consideration of the squeezing effect of tensile reinforcement; provision of strength of triaxially stressed concrete under complex loading; and strengthening of contact layers and block joints of concrete. (Baker-IVI)
W85-00496

8G. Materials

GUIDELINES FOR INSPECTION OF DAMS FOLLOWING EARTHQUAKES.
United States Committee on Large Dams, New York.
For primary bibliographic entry see Field 8E.
W85-00043

EPOXY-BITUMEN WATER PROOFING OF HYDRAULIC STRUCTURE,
V. I. Sakharov.
Hydrotechnical Construction, Vol. 16, No. 5, p 274-277, May, 1982. 2 Fig, 2 Tab, 2 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 5, p 26-28, May, 1982.

Descriptors: *Pipelines, *Coatings, *Waterproofing, *Epoxy, *Bitumen, *Water distribution, Drinking water, Cracking, Leakage, Water storage, Water quality.

When constructing hydraulic and water management structures related to the passage and treatment of drinking water, the need arises for using waterproof coatings which will not harm the quality of the water. Tests were conducted on specimens of epoxy-bitumen waterproof compositions to determine the physical and mechanical properties of the coatings, their adhesion, hardness, elasticity, and crack resistance. The coatings proved acceptable both technically and economically for the passage of water, as well as its storage and treatment of drinking water. The most effective area for use of epoxy-bitumen coatings is for waterproofing thin walled non-crack resistance components and structures. (Baker-IVI)
W85-00461

USE OF ULTRASOUND FOR CHECKING THE FROST RESISTANCE OF CONCRETE,
A. M. Filonidov.
Hydrotechnical Construction, Vol. 16, No. 5, p 278-283, May, 1982. 4 Fig, 4 Tab, 6 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 5, p 28-31, May, 1982.

Descriptors: *Concrete, *Testing procedures, *Ultrasonics, *Frost protection, Construction materials.

Tested methods of producing concrete with a prescribed frost resistance have been developed, but the method of testing the resistance of the concrete is very laborious. A new method was developed for determining the frost resistance of concrete on a known design after only one freezing cycle. The method proved satisfactory for prompt checking of the quality of concrete and for evaluating the frost resistance in structures under construction and in operation on the basis of cores. The method is based on a comparative testing method using calibrated relations between compressive strength, ice content, ultrasound velocity, and frost resistance of concrete of known designs. A relatively high accuracy of determining frost resistance, equal to plus or minus 15% can be obtained in 95-98% of the cases. (Baker-IVI)
W85-00462

8H. Rapid Excavation

HYDRAULICKING AT THE CONSTRUCTION OF THE ZAGORSK PUMPED-STORAGE STATION,
L. A. Tolkachev, S. N. Semenenok, and A. M. Shtin.
Hydrotechnical Construction, Vol. 16, No. 3, p 138-142, March, 1982. 6 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 3, p 17-19, March, 1982.

Descriptors: *Hydraulicking, *Pumped storage, *Zagorsk Pumped Storage Station, *USSR, Construction, Earthworks, Borrow pits.

The Zagorsk pumped storage station (PSS) is the first large pumped storage station in a series of unified PSS being constructed in the central zone of the European USSR. On the basis of construction experience the following suggestions are offered. When using hydraulicking methods of constructing earthworks for pumped storage stations with borrow pits located in flood plains of rivers it is necesssary to take into account the following circumstances: the high inhomogeneity of borrow pits both horizontally and vertically, which precludes an estimation of the particle size distribution the basis of the average grading curve; siltation of borrow pits by clay and silt material with boulder and wood inclusions; there is no method of reliability determining the content of boulders and wood inclusions over the vertical section; and the special role of small rivers in the European USSR, which compel complete isolation of the areas of hydraulicking works from the main channel. (Baker-IVI)
W85-00442

8I. Fisheries Engineering

SELECTING SITES OF PROJECTED FISH PASSES,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
M. A. Skorobogatov, D. S. Pavlov, A. Sh. Barekyan, and L. G. Shtaf.
Doklady Biological Sciences, Vol. 272, No. 1-6, p 508-510, September, 1983. 2 Fig, 5 Ref. Translated from Doklady Akademii Nauk SSSR, Vol. 272, No. 1, p 250-253, September, 1983.

Descriptors: *Dam design, *Fish passages, Fish behavior, Hydroelectric plants, Spillways, Planning, Decision making, Roach, Fish migration.

One of the most important problems arising in the planning of areas for fish to pass through a dam is choosing the sites of the passes in the system at the hydroelectric center. A procedure for this choice is presented based on a comparison of the probable working efficiency of a fish pass at each possible location site. Hydraulic-biological studies carried out a few years ago make it possible to ascertain the factors influencing the formation of the paths of motion of fish, as well as the reactions of fish to various flow characteristics. The behavioral features of each school of fish are taken into account by finding the deviations of the transverse and longitudinal fish velocities from the average values. In order to determine the efficiency of a fish pass for a known flow structure in the tailwater of a hydroelectric system, all possible paths of fish motion from the initial point to the entry [illegible] the fish collecting chute are calculated. As [illegible] example, the efficiency was calculated for [illegible] operating regime of a model hydroelectric cent[illegible] with a fish pass located in the middle of the spi[illegible] way, for passage through the system of schools [illegible] roach with an average length of 25.4 mm. Th[illegible] approach provides an objective evaluation of t[illegible] likelihood that fish will enter a fish pass and inc[illegible] cates the optimum location of the pass in t[illegible] hydroelectric system, as well as the optimum ope[illegible] ating regime. In order to apply this approach [illegible] specific planning operations, it is advisable to car[illegible] out studies in two possible directions: to seek sma[illegible] experimental fish with behavior similar to that [illegible] spawning migrants and to study the reactions [illegible] fish likely to pass through hydroeletric center[illegible] (Baker-IVI)
W85-00159

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

NISQUALLY GLACIER, MOUNT RAINIER WASHINGTON, 1857-1979: A SUMMARY O THE LONG-TERM OBSERVATIONS AND COMPREHENSIVE BIBLIOGRAPHY,
Geological Survey, Tacoma, WA. Water Re sources Div.
For primary bibliographic entry see Field 2C.
W85-00039

ANNOTATED BIBLIOGRAPHY OF REMOT SENSING FOR HIGHWAY PLANNING AN NATURAL RESOURCES,
Connecticut Univ., Storrs. Dept. of Natural Re sources Conservation.
D. L. Civco, W. C. Kennard, and M. W. Lefor.
Storrs Agricultural Experiment Station Bulleti No. 456, January 1980. 136 p, 152 Ref.

Descriptors: *Remote sensing, *Bibliographies, In frared imagery, *Wetlands, *Aerial photography *Satellite technology, *Sensors, *Telemetry, Eco nomic aspects, Engineering, Publications, High ways, Roads.

Remote sensing is the art and science of gatherin information from a distance such as from aircra or satellites. Earth surface features and phenomen can be detected, identified, delineated and analyze through interpretation of the imagery collected These procedures have proven valuable in natura resource planning, environmental impact asses ment, and engineering activities. The bibliograph is divided into five sections, each containing ab stracts, many of which deal with the subject o freshwater wetlands, as well as with color infrare photography itself. The complete citation is give for each publication abstracted, together with de tails on the problems, approach, equipment, result and conclusions. Each abstract is followed by a lis of keywords which indicates the subject matter o the publication. In addition, an author index, keyword index, and a list of abbreviations an acronyms used are provided. The five sections i the annotated bibliography are: (A) highways an remote sensing applications (53 abstracts); (B) env ronmental impact of highways and corridor selec tion methods (23); (C) wetlands and remote sensin applications (14); (D) economics of remote sensin (11); and (E) general remote sensing application (51). Among the abstracts related to general appli cations are those concerned with proposed free way extensions, delineating forest cover types, an military geographic intelligence. (Garrison-Omni plan)
W85-00047

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BOOKSTACKS
DOCUMENTS

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 18, NUMBER 2
FEBRUARY 1985

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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 18, NUMBER 2
FEBRUARY 1985

W85-00508 -- W85-01117

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1985.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

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01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

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SELECTED WATER RESOURCES ABSTRACTS

NATURE OF WATER

Properties

PERATURE DEPENDENCE AND MEAS-MENT OF RESISTIVITY OF PURE ER,
oro Co., MA.
Light.
ytical Chemistry, Vol. 56, No. 7, p 1138-1142, 1984. 4 Fig, 7 Tab, 18 Ref.

riptors: *Resistivity, *Conductivity, *Water erature, Ionic impurities, Sodium hydroxide, xchange, Pure water.

purity water with ionic impurities of less 0.1 micro g/kg is commercially available. Its y may be monitored by resistivity measure- corrected for temperature and trace impuri- The resistivity measurements of pure water the temperature range 0-70 degrees C and the ation of conductivity cells was accomplished apparatus consisting of a digital resistivity or and sensors and a nuclear grade mixed bed change resin cartridge. The sensors used resistivity cells (cell constant of 0.100/cm) self contained temperature sensors and con- g electrodes made of titanium. Improved the- al resistivity, conductivity, temperature coef- , and pH values for water from 0 to 100 es C, were calculated. These values are re- l for the first time from 100 to 300 degrees C. esistivity measurement of pure water is sensi- nough for the detection of trace ionic impuri- low as 0.1 micro g/kg (ppb). At 25 degrees sodium hydroxide concentration correspond- the maximum resistivity of water is approxi- 0.8 micro g/kg and the pH is slightly e at pH 7.04. (Collier-IVI)
0945

WATER CYCLE

General

ER RESOURCES OF WESTERN DOUG- OUNTY, OREGON,
gical Survey, Portland, OR. Water Re- s Div.
Curtiss, C. A. Collins, and E. A. Oster.
Water-Resources Investigation Report 83- 984. 81 p, 18 Fig, 9 Tab, 56 Ref.

ptors: *Groundwater, Streams, Lakes, r quality, Aquifers, Hydrogeology, Stream- *Surface water, Douglas county, Areal in- tion, *Oregon, Umpqua River.

stern Douglas County, Quaternary coastal ands and marine terrace deposits may have st potential for ground-water development. of 200 gallons per minute have been report- m wells completed in Quaternary fluvial s along the lower Umpqua River. The area is underlain by Tertiary marine sedi- that yield quantities of water barely ade- for domestic use. On the basis of wells d and the constituents analyzed, ground- quality was generally good, but the recom- d criteria level of 300 micrograms per liter n was exceeded in about one-third of the s. Average annual runoff from eight streams ern Douglas County was estimated to range .4 cubic feet per second per square mile for eek to 6.8 cubic feet per second per square r Scholfield Creek. The estimated 7-day, 20- w flow ranges from 0.01 cubic foot per per square mile for Weatherly Creek to 3.6 eet per second per square mile for the Smith The dissolved-solids of the Umpqua River is nd stable, with little seasonal and yearly n. Likewise, the eight small streams in the area have small dissolved-solids but have bly higher nitrite plus nitrate nitrogen con- ions than those of the Umpqua River. All es in the project area have dissolved-solids trations of less than 100 milligrams per liter and, except for Loon Lake, have limited phosphorus available for algal production. Tahkenitch and Elbow Lakes are considered to be the most active in terms of biological productivity. (USGS)
W85-00590

PRELIMINARY ASSESSMENT OF THE HYDROLOGIC CHARACTERISTICS OF THE JAMES RIVER IN SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
R. D. Benson.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4077, 1983. 115 p, 37 Fig, 25 Tab, 13 Ref.

Descriptors: *Surface water, *Runoff, *Streamflow, Flow, Flood recurrence interval, James River, *South Dakota.

The James River in South Dakota has very restricted channel capacities within the Lake Dakota Plain. Channel capacities in Brown County are as little as 200 cubic feet per second, and spring flooding can be expected on an average of every other year. The river has potential for extended periods of flooding an average of once in 10 years. Extended periods of no flow during late-summer and winter also can be expected. Excluding flows of a very large magnitude, average travel time between Columbia and Scotland (a distance of 382 river miles) is estimated to be 25-30 days for most flows. The upstream reach of the James River within the Lake Dakota Plain generally loses discharge with distance whereas the downstream reach generally gains discharge with distance. Ground water - surface water interaction does not appear to be significant along upstream reaches of the James River. Some interaction, although not quantified, does occur in Hanson, Davison, and Yankton Counties. Sand Lake National Wildlife Refuge, located just downsteam from the State line and containing Sand and Mud Lakes (combined capacity = 24,600 acre-feet), is a major source of water loss between LaMoure, N. Dak. and Columbia, S. Dak. Gross evaporation losses from the lakes during 1969-81 is estimated to have been slightly more than 29,000 acre-feet per year. Unaccounted-for losses in the lake system are estimated to have been slightly more than 19,000 acre-feet per year. (USGS)
W85-00592

GLACIER OUTBURST FLOODS FROM 'HAZARD LAKE', YUKON TERRITORY, AND THE PROBLEM OF FLOOD MAGNITUDE PREDICTION,
British Columbia Univ., Vancouver. Dept. of Geophysics and Astronomy.
G. K. C. Clarke.
Journal of Glaciology, Vol. 28, No. 98, p 3-21, 1982. 5 Fig, 2 Tab, 16 Ref.

Descriptors: *Hazard Lake, *Yukon, *Glacial lakes, *Flood peak, *Outburst floods, Glaciohydrology, Flood hydrographs, Mathematical models, Creep closure, Jokulhlaups, Glacier tunnels, Simulation, Roughness coefficient.

The 1965-66 surge of Steele Glacier, Yukon Territory displaced ice as much as 9.5 km. The normal stream channel of Hazard Creek became icedammed, forming a proglacial lake called 'Hazard Lake'. In August 1978 'Hazard Lake' released 19,620,000 cu m of water through a subglacial tunnel beneath Steele Glacier. The discharge during the outburst flood was measured by recording lake level changes with time, and a peak discharge of approximately 640 cu m/s was estimated from the data. An attempt was made to model the 1978 flood from 'Hazard Lake' using an adaptation of a theoretical model for jokulhlaups. The aim was to calibrate the model as a first step toward using it as a peak discharge estimator for other glacier-dammed basins. The agreement between measured and simulated hydrographs is good. The creep closure, though included in this analysis, appears to play an insignificant role in limiting the discharge of 'Hazard Lake'. Release of thermal energy from the relatively warm lake water is the dominant factor contributing to tunnel enlargement. The Manning roughness of outlet channels from glacier-dammed lakes is not known a priori and must either be assumed or estimated after the fact from the flood hydrograph. For 'Hazard Lake' the fit implies Manning roughness in the range n' = 0.105 m to the -1/3 power s, consistent with Nye's estimate of n' = 0.12 m to the -1/3 power s for the 1972 Grimsvotn flood and an estimate of n' = 0.12 m to the -1/3 power s for the 1967 Summit Lake flood. If the Manning roughness for flood conduits lies within a narrow range, this would constrain one of the least certain variables of the model. By making several simplifying assumptions, the model is reduced to a simple mathematical description involving dimensionless numbers characterizing reservoir geometry and the relative magnitudes of creep closure and tunnel enlargement by melting. The influence of lake temperature, reservoir geometry, and creep closure on the character of flood hydrographs can be conveniently studied in this simplified form. (Moore-IVI)
W85-00670

DEVELOPMENT OF A GROUNDWATER RECHARGE MODEL FOR HONG KONG,
Hong Kong Public Works Dept. Geotechnical Control Office.
B. Leach.
Hydrological Sciences Journal, Vol. 27, No. 4, p 469-491, December, 1982. 17 Fig, 4 Tab, 24 Ref.

Descriptors: *Hong Kong, *Groundwater recharge, *Mathematical models, Soil water, Rainfall runoff, Storms, Soil water suction, Rainfall intensity, Slope stability, Evapotranspiration.

A conceptual model of the infiltration/soil moisture storage/groundwater recharge process may provide a better understanding of the relationship between rainfall and the incidence of slope instability. Such a model was developed and calibrated for Hong Kong, which has a sub-tropical climate in which rainfall is typically of short duration and high intensity. The model, which operates on a 200 s time base, estimates soil moisture deficits, runoff coefficients and recharge for individual storm events and event sequences. Modelled outputs are compared with field measurements of soil suction, runoff, observed and numerically-modelled piezometer responses. In order to assess the sensitivity of the recharge estimate to the various input parameters, the model was run using the rainfall and potential evapotranspiration data as measured for 1980. The estimated annual recharge is especially sensitive to the evapotranspiration rates and the root constant input to the model. Comparisons of the model outputs with equivalent field observations indicated the success of the model in the particular geological and climatic conditions under consideration. It is essential that the time intervals over which the soil moisture balance computations are undertaken are comparable with the minimum storm durations: in this case 30 min or less. (Moore-IVI)
W85-00693

NEW CHEMICAL APPROACH TO THE STUDY OF WATERS OF MT. FUJI ENVIRONS,
Sagami Chemical Research Center, Sagamihara
K. Sugawara, T. Yoshihara, K. Yanagi, and M. Ambe.
Archiv fur Hydrobiolgie, Vol. 94, No. 3, p 269-285, 1982. 1 Fig, 9 Tab, 39 Ref.

Descriptors: *Mt. Fuji, *Fuji Five Lakes, *Japan, *Water chemistry, Groundwater movement, Springs, Runoff, Trace elements, Precipitation, Volcanoes.

The large area (19 sq km) of the slope of Mt. Fuji is largely covered with rather uniform andesitic volcanic ejecta and fallen precipitation is easily sucked into the ground to run along old diagenated lavaflow layers to finally issue as a number of springs at lower levels. The spring water is loaded with major elements from rocky material on its passage while trace elements are removed to a considerable extent. Fuji Five Lakes water is fed from two different areas, the south-eastern on Mt.

Fuji side where the fallen precipitation is largely sucked into the ground with no remarkable surface discharge, while the north-western consisting of Tertiary impervious rocks where the fallen water is discharged into the lakes as surface-runoff with no remarkable change from meteoric water. Calculation indicates that about 70-80% of the total supply to the lakes is supplied by subsurface discharge of underground water from the northeastern side. (Moore-IVI)
W85-00760

INLAND WATERS AND HUMAN CULTURE (BINNENGEWASSER UND KULTUR),
G. H. Schwabe.
Archiv fur Hydrobiologie, Vol. 95, No. 1/4, p 445-461, 1982. 24 Ref.

Descriptors: *Human culture, *Water, *Social aspects, Irrigation, Rice, Limnology, Hydrologic cycle.

Water is indispensible to life. Its unique occurrence in three physical states in the biosphere is crucial to the hydrological cycle and atmospheric thermodynamics, and has shaped many features of the earth's surface. Culture, language and customs of all nations reflect its biological and ecological significance; hydrological conditions essentially determined settlement patterns, place names reveal its significance in daily life, and water is a recurring focal point of mythology. Other artistic references are obvious although the influence on spiritual development may have been disregarded. Natural water affected material developments, yet these caused changes which interfered with the landscape. All early urban settlements were based on artificial irrigation; subsequently developed social structures ensuring continued exploitation of irrigation systems, deepened and broadened the spiritual significance of water. The basic foodstuff for half the world's population today is rice, probably the oldest crop, and areas irrigated for its growth cover 1,400,000 sq km. In spite of their extent and variety such systems have not yet received due limnological study. Constructive water use blossomed into culture; modern misuse of this essential endangers mankind's future. (Author's abstract)
W85-00774

USE OF RAINFALL-SIMULATOR DATA IN PRECIPITATION-RUNOFF MODELING STUDIES,
Geological Survey, Denver, CO. Water Resources Div.
G. C. Lusby, and R. W. Lichty.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4159, 1983. 59 p, 36 Fig, 10 Tab, 12 Ref.

Descriptors: *Rainfall simulators, *Hydrologic models, *Runoff plot, *Overland flow, *Small watersheds, Infiltration rate, Experimental basins, *Colorado, Elbert County, Willow Gulch drainage basin.

Results of a study using a rainfall simulator to define infiltration parameters for use in watershed modeling are presented. A total of 23 rainfall-simulation runs were made on five small plots representing four representative soil-vegetation types of the study watershed in eastern Colorado. Data for three observed rainfall-runoff events were recorded by gages on four of the plots. Data from all events were used to develop best-fit parameters of the Green and Ampt infiltration equation. The hydraulic conductivity of the transmission zone, KSAT, grossly controlled the goodness of fit of all modeling attempts. Results of fitting KSAT to reproduce runoff from rainfall simulator runs and results of fitting KSAT to reproduce runoff from observed rainfall-runoff events are inconsistent. Variations in results from site to site and at different times of the year were observed. (USGS)
W85-00837

EFFECTS OF TEMPORAL DECOMPOSITION ON PARAMETER ESTIMATION FOR HYDROLOGICAL MODELS (DER EINFLUSS DER ZEITLICHEN UNTERGLIEDERUNG AUF DIE PARAMETERSCHATZUNG IN HYDROLOGISCHEN MODELLEN),
Technische Hochschule, Aachen (Germany, F.R.). Lehrgebiet Wasser-Energie-Wirtschaft.
M. W. Ostrowski, and U. Wolf.
Deutsche Gewasserkundliche Mitteilungen, Vol. 28, No. 2, p 37-40, May, 1984. 8 Fig, 4 Tab.

Descriptors: *Rainfall-runoff relationships, *Hydrologic models, Model studies, Water resources development, Management, Rainfall intensity.

The values of hydrological parameters in deterministic rainfall-runoff models are highly dependent on the chosen temporal decomposition. This is caused by the deviation of the differential from the difference quotient of cumulative rainfall. Large variations may be observed in both multiple applications of a single model to several basins with similar characteristics and the application of similarly structured models to the same basin. Possibilities to reduce differences between estimated and physical parameter values are demonstrated. The chosen time-step has to be reversely proportional to the actual rainfall intensity or related to the occurrence of runoff components, respectively. In addition, the variable temporal decomposition has considerable economic advantages as compared to constant time intervals. (Baker-IVI)
W85-00898

SPATIAL VARIABILITY IN RAINFALL DISTRIBUTION AND RUNOFF PROCESS IN SMALL CATCHMENT AREAS (RAUMLICHE NIEDERSCHLAGSVERTEILUNG UND ABFLUSSPROZESS IN KLEINEN EINZUGSGEBIETEN),
H. G. Mendel.
Deutche Gewasserkundliche Mitteilungen, Vol. 28, No. 2, p 53-54, May, 1984.

Descriptors: *Rainfall-runoff relationships, *Small watersheds, *Catchment area, Radar, Precipitation, Runoff, Sewer systems, Spatial distribution.

The double-faceted problem of spatial variation of precipitation and the influences on runoff (bedrock, soil moisture, slope of the terrain, surface properties) in small catchment areas was discussed at a workshop of 15 participants held in February 1983 in Hannover, Federal Republic of Germany. The problems of runoff from sewer systems and the possibilities for its control as well as the use of radar to measure precipitation load on the ground were of special interest. (Gish-IVI)
W85-00901

NEW ELECTRONIC EVAPORATION AND RAIN MEASURING EQUIPMENT,
Eotvos Lorand Univ., Budapest (Hungary). Dept. of Atomic Physics.
For primary bibliographic entry see Field 7B.
W85-01062

2B. Precipitation

RAINFALL PATTERNS IN THE WESTERN UNITED STATES,
Commonwealth Scientific and Industrial Research Organization, South Melbourne (Australia). Div. of Chemical Technology.
R. G. Vines.
Journal of Geophysical Research, Vol. 87, No. C9, p 7303-7311, August, 1982. 12 Fig, 22 Ref, 1 Append.

Descriptors: *Rainfall, *Filter analysis, Sunspot cycle, Lunar cycle, Climatology, Time series analysis, Spectral analysis, Statistical methods.

Rainfall figures from World Weather Records, for towns west of the Mississippi in the United States, have been subjected to filter analysis. Time series comprising sets of annual rainfall data are analyzed in terms of the outputs of four filters. Filter IV reproduces what is essentially the moving-average rainfall over a long term. Filter III responds to any periodic fluctuations in precipitation in the range ca. 13 to 30 years with high acceptance from 15 to 24 years. Filter II has corresponding response from ca. 8 to 13 years with high acceptance from 9 to 12 years. Filter I responds to fluctuations from 6 to 8 years. The combined response of all four filters is nearly flat from about 6.5 years to infinity and all fluctuations with periods less than about 5.5 to 6 years are suppressed. The rainfall patterns obtained suggest substantial coherence of the data throughout much of the entire area. The results agree well with earlier work that reported a relationship between the incidence of drought, based on tree-ring data, in the western United States and the double (ca. 22 year) sunspot cycle. However, an additional correlation with the (ca. 18 year) lunar cycle is also apparent, particularly on the west coast. These findings have been verified by simple spectral analysis. Correlations using rainfall data alone might prove of use in future studies of climatic variability. (Collier-IVI)
W85-00513

MODEL FOR THE RELATIONSHIPS BETWEEN PRECIPITATION D/H RATIOS AND PRECIPITATION INTENSITY,
New Mexico Univ., Albuquerque. Dept. of Geology.
C. J. Yapp.
Journal of Geophysical Research, Vol. 87, No. C12, p 9614-9620, November, 1982. 7 Fig, 1 Tab, 20 Ref.

Descriptors: *Chemistry of precipitation, *Isotope ratios, *Precipitation intensity, *Deuterium, *Hydrogen, Wake Island, Johnston Island, Isotope studies, Meteoric water, Mathematical models.

A simple quantitative model has been developed which predicts that a parametric correlation between the isotopic composition of precipitation and precipitation intensity can exist as a consequence of the condensation process when certain conditions are met. These conditions include the following: (1) approximate constancy, from one sampling interval to the next, of the initial isotopic composition of the water vapor in precipitation-producing air masses; (2) approximate constancy of the initial condensation temperature; (3) approximate constancy of the rate of vertical ascent of the precipitating air mass; and (4) approximate constancy of the ratio of condensed water to water vapor. Such conditions are probably rare in nature for the short collection intervals represented by existing samples. However, with the probable exception of condition 3, tropical oceanic islands may satisfy the preceding conditions on the month-to-month time scale for which precipitation samples have generally been collected for isotopic analysis. Precipitation samples from Wake and Johnston Islands that plot on the meteoric water line were used to compare monthly delta-D (a hydrogen/deuterium isotope ratio) values with corresponding precipitation intensity. In general, there appears to be a convergence of the data at high values of delta-D (low intensity) and a divergence at low values of delta-D (high intensity). Such behavior is predicted by the isotope-intensity model largely in terms of variation in the vertical rate of ascent. For Wake Island this divergence of the data appears to be bimodal in character. However, for Johnston Island, there is considerable scatter in the data. This scatter is roughly constrained by the envelope defined by two vertical ascent rates that approximately characterize the presumably bimodal Wake Island trends. Thus much of the scatter in the Johnston Island data may be explained by month-to-month variability in vertical ascent rates. The data for these two islands suggest that a simple precipitation delta-D versus intensity correlation is unlikely for monthly sample intervals. However, the issue remains unresolved for longer time scales. (Author's abstract)
W85-00517

TOTAL PRECIPITABLE WATER AND RAINFALL DETERMINATIONS FROM THE SEASAT SCANNING MULTICHANNEL MICROWAVE RADIOMETER,
National Earth Satellite Service, Washington, DC.

For primary bibliographic entry see Field 7B.
W85-00522

CASE STUDY: ESTIMATING ANTECEDENT PRECIPITATION INDEX FROM HEAT CAPACITY MAPPING MISSION DAY THERMAL INFRARED DATA,
Texas A and M Univ., College Station. Remote Sensing Center.
For primary bibliographic entry see Field 7B.
W85-00689

RAINFALL MEASUREMENT ACCURACY IN RACE: A COMPARISON OF GAGE AND RADAR RAINFALLS,
National Oceanic and Atmospheric Administration, Boulder, CO. Weather Modification Program Office.
For primary bibliographic entry see Field 7B.
W85-00915

ADJUSTING ALGORITHM FOR ESTIMATED SUB-REGIONAL MEANS OF AREAL PRECIPITATION USING A REGIONAL MEAN OF KNOWN SIZE (ANGLEICH-VERFAHREN FUR GESCHATZTE TEILGEBIETS-NIEDERSCHLAGE BEI BEKANNTEM GESAMTGEBIETS-NIEDERSCHLAG),
Muenster Univ. (Germany, F.R.). Inst. fuer Geographie.
For primary bibliographic entry see Field 7A.
W85-00970

RAIN ESTIMATION FROM SATELLITES: AN EXAMINATION OF THE GRIFFITH-WOODLEY TECHNIQUE,
National Aeronautics and Space Administration, Greenbelt, MD. Lab. for Atmospheric Sciences.
J. Negri, R. F. Adler, and P. J. Wetzel.
Journal of Climate and Applied Meteorology, Vol. 23, No. 1, p 102-116, January, 1984. 27 Fig, 1 Tab, 20 Ref.

Descriptors: *Rainfall, *Satellite technology, Griffith-Woodley Technique, Remote sensing, Infrared imagery, Clouds, Mathematical equations, Florida.

The Griffith-Woodley Technique (GWT) is an approach to estimating precipitation using infrared observations of clouds from geosynchronous satellites. It is examined in three ways: an analysis of terms in the GWT equations; a case study of infrared imagery portraying convective development over Florida; and the comparison of a simplified equation set and resultant rain maps to results using the GWT. The objective is to determine the dominant factors in the calculation of GWT rain estimates. Analysis of a single day's convection over Florida produced a number of significant weights into various terms in the GWT rainfall equations. Due to the definition of clouds by a threshold isotherm (-20 degrees C), the majority of clouds on this day did not go through an idealized growth cycle before losing their identity through merger, splitting, etc. As a result, 82% of the clouds had a defined life of 1 h (two images) or less. 64% of the defined clouds were assessed no rain because the empirically derived ratio of radar echo area to cloud area was zero for 64% of the sampled clouds. For 76% of the sample, the temperature weighting term was identically 1.0. Terms directly related to cloud area were essentially uncorrelated with GWT rain volume, but cloud area itself was highly correlated (r = 0.93). Discriminating parameters in the GWT rain apportionment algorithm were the temperatures that define the coldest 50% and coldest 10% cloud areas. Further apportionment beyond these two thresholds was found to be unnecessary. Simplifying assumptions were made to the GWT such that the resultant equations were independent of cloud history. Application of a simple algorithm incorporating these assumptions led to daily rainfall patterns on three days that were, to first order, the same as those calculated from the GWT. Daily totals in the FACE target area were actually closer to the gage determined rain depths than the GWT estimates. Correlations between half-hourly estimates from both techniques and the gage amounts were poor. The GWT is unnecessarily complicated for use in estimating daily rainfall. A method in which the relationship between clouds and rain is simple and straightforward can, to first order, duplicate the results of the GWT. (Author's abstract)
W85-01041

DETERMINING DROUGHT FREQUENCY AND INTENSITY ON THE BASIS OF PLANT RESPONSE: WILD HAY IN THE SAND HILLS OF NEBRASKA, U.S.A.,
Nebraska Univ.-Lincoln. Center for Agricultural Meteorology and Climatology.
D. A. Wilhite, and R. E. Neild.
Agricultural Meteorology, Vol. 25, No. 4, p 257-265, February, 1982. 3 Fig, 2 Tab, 6 Ref.

Descriptors: *Droughts, *Frequency analysis, *Wild hay, *Nebraska, Mathematical studies, Weather, Crop yield, Plant growth, Climate, Hay.

A district wide single year drought frequency of 0.5 and 0.15 was computed for moderate and severe drought, respectively, for wild hay in the North Crop-Reporting District of Nebraska. This analysis was based on plant response to weather conditions. However, further study at the county level revealed a great deal of disparity in severe drought frequency between counties due to local environmental factors, primarily depth to water table. Computed severe drought frequencies were as much as six times greater in counties with a low percentage of wet meadowland, in comparison to those counties with a high percentage. When computing a region's agricultural drought hazard, factors other than climate may be of local importance. Drought frequency should be computed for the smallest areal unit where yield data are available. (Baker-IVI)
W85-01064

USE OF RAINFALL MODELS IN AGRICULTURAL PLANNING,
Reading Univ. (England). Dept. of Applied Statistics.
R. D. Stern, and R. Coe.
Agricultural Meteorology, Vol. 26, No. 1, p 35-50, March, 1982. 7 Fig, 6 Tab, 20 Ref.

Descriptors: *Rainfall, *Model studies, Planning, Decision making, Agriculture, Statistical studies, Mathematical studies.

Information useful in agricutural planning may be obtained from rainfall data and the fitting of models provides a powerful method of analyzing such data. The models used are briefly described and examples are given for data from Hyderabad, India. Three methods of using rainfall data to derive results important for agricultural planning are compared. The first is a direct summary of the observed data, which may be sufficient if there is a long record of this data available. The other methods involve fitting a Markov chain model to the daily data, and then using either recurrence relations or simulation. The parameters in these models can easily and reliably be estimated even from short records. These models should each be considered an intermediate step in the analysis of the data. (Baker-IVI)
W85-01066

ECONOMICAL RECORDING TIPPING-BUCKET RAIN GAUGE,
Commonwealth Scientific and Industrial Research Organization, Armidale (Australia). Pastoral Research Lab.
K. A. Cornish, and G. C. Green.
Agricultural Meteorology, Vol. 26, No. 4, p 247-253, July, 1982. 5 Fig, 1 Tab, 8 Ref.

Descriptors: *Rain gauges, *Measuring instruments, *Tipping-bucket gages, Rainfall, Measuring, Automation.

The design and construction of a plastic tipping bucket rain gauge are described. Several of the units were made and tested in the field and the laboratory. In field tests over a two month period all gauges were accurate to within 2% in rainfalls, in the range of 1-69 mm/d. In lab tests, the rain gauge was accurate with simulated rainfalls up to 180 mm/hr, which is beyond most normal operating requirements. The rain gauge is cheap and easy to construct, taking about 8-10 man hours per unit to build and calibrate, light, durable and suitable for remote sites. Its accuracy and reliability make it suitable for a variety of field uses. When in use the only maintenance required is to check the level and the condition of the batteries. As current is only drawn from the batteries when rain is being recorded, the battery life should approach its shelf life. (Baker-IVI)
W85-01067

GEOGRAPHICAL VARIATION IN MONTHLY RAINFALL AND MILK PRODUCTION IN EASTERN NEW SOUTH WALES,
Sydney Univ. (Australia).
D. Dragovich.
Agricultural Meteorology, Vol. 26, No. 4, p 255-264, July, 1982. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Rainfall, *Livestock, *Pastures, *New South Wales, *Australia, Grasslands, Milk production, Plant growth, Vegetation.

Rainfall varied more widely on a month to month basis than did milk production, regardless of quota levels. In locations where lower quotas permitted wider fluctuations in milk production, patterns of rainfall and livestock output were more closely linked. The fact that rainfall-milk production relationships emerged at this broad level of generalization points to the importance of moisture in affecting seasonality of pasture growth, although further account needs to be taken of growth phases of individual pasture species (especially in relation to temperature) and, for livestock, seasonality of calving patterns. Rainfall-milk production relationships were weakest in locations where output patterns were most strongly geared to satisfying a nearly constant monthly level of demand. (Baker-IVI)
W85-01068

2C. Snow, Ice, and Frost

TIME-DEPENDENT ICE SHEET MODEL: PRELIMINARY RESULTS,
National Aeronautics and Space Administration, Greenbelt, MD. Lab. for Atmospheric Sciences.
R. A. Bindschadler, and R. Gore.
Journal of Geophysical Research, Vol. 87, No. C12, p 9675-9685, November, 1982. 6 Fig, 34 Ref.

Descriptors: *Ice sheets, *Model studies, *Velocity, *Shear stress, Ice thickness, Ice pressure, Glaciers, Strain, Vertical resolution, Mathematical models, Ice streams, Basal sliding.

A numerical model of ice sheet flow is developed to provide reliable predictions of regional ice sheet response characteristics. This model includes vertical resolution of temperature, stress, and strain rate which represents a considerable improvement over previous vertically averaged ice sheet models. The model follows the flow of ice along a flow line within an ice sheet drainage basin. The model results assume a flat bed and constant width. Longitudinal stresses and basal sliding are included. Preliminary studies of response behavior are completed using a simplified ice sheet geometry with a fixed terminus or grounding line. Basal sliding is dependent on the base shear stress and a specified distribution of basal water pressure. The numerical methods used to solve the coupled set of stress and velocity equations for the static and time-evolutionary cases are discussed. A steady state profile simulating an ice stream is calculated for a particular set of input parameters, and changes in the profile are examined for different choices of parameters. For time-dependent accumulation rates and boundary conditions, the model will reach a steady state configuration independent of initial geometry. The steady state configuration corresponds to the situation where the volume flux at any point is equal to the total accumulation received by the ice sheet upstream of that point, so there is no additional thickness change anywhere.

The results of these studies illustrate ice sheet thinning in response to a lowered sea level or to a reduction in the extent of ice rises (or pinning points) within ice shelves. (Collier-IVI)
W85-00518

SNOW CHEMISTRY ON JAMES ROSS ISLAND (ANTARCTIC PENINSULA),
Instituto Antartico Argentino, Buenos Aires.
A. J. Aristarain, R. J. Delmas, and M. Briat.
Journal of Geophysical Research, Vol. 87, No. C13, p 11,004-11,012, December, 1982. 7 Fig, 2 Tab, 53 Ref.

Descriptors: *Snow chemistry, *James Ross Island, *Antarctica, *Chemical properties, Chemistry of precipitation, Aerosols, Sulfuric acid, Nitric acid, Nitrates, Path of pollutants.

More than 400 firn samples were collected at an altitude of 1660 m on the small ice sheet covering James Ross Island (JRI) (northeastern coast of the Antarctic Peninsula); a better understanding was gained of the origin of the acidity of snow deposited on the Antarctic continent. Chemical analysis of these samples provides information about the marine background aerosol composition in the area. The samples cover the years 1975-1979 (pit samples) and the last 15 years (firn core samples). Major impurities (Na, K, Ca, Al, H, SO4, and NO3) were determined by using flameless atomic absorption, neutron activation, acid titration, or ion chromatography. Aerosols are contributed mainly by the surrounding ocean; however, secondary, aerosol deposition (H2SO4 and HNO3) is also important. All samples were found to be slightly acidic (pH generally in the range 5-6). Strong seasonal variations (maximum values in summer) are found in the H2SO4 deposition. A photochemical mechanism is proposed to explain the local production of H2SO4 from gaseous marine sulfur compounds. By taking a mean value of 1.5 mEqv/L (+ or - 5) as a typical Antarctic H2SO4 concentration in snow and a mean snow accumulation rate of 12 g/sq cm/yr, a yearly deposition of 0.13 (+ or - 0.06) Tg of H2SO4 was determined for the entire Antarctic continent. Sea-salt particles do not significantly contribute nitrate at JRI. Nitrate has a relatively constant background level in JRI snow with sudden increases distributed all over the year; NO3 concentrations range from 0.2 to 0.3 mEqv/L. The NO3 concentrations in JRI snow indicate that the acidity due to nitric acid would represent about 1/6 of the total acidity. (Collier-IVI)
W85-00519

USE OF SEASAT SYNTHETIC APERTURE RADAR AND LANDSAT MULTISPECTRAL SCANNER SUBSYSTEM DATA FOR ALASKAN GLACIOLOGY STUDIES,
National Aeronautics and Space Administration. Greenbelt, MD. Hydrological Sciences Branch.
For primary bibliographic entry see Field 7B.
W85-00521

SURGING OF FISHER GLACIER, EASTERN ANTARCTICA: EVIDENCE FROM GEOMORPHOLOGY,
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
P. Wellman.
Journal of Glaciology, Vol. 28, No. 98, p 23-28, 1982. 3 Fig, 10 Ref.

Descriptors: *Glacier surges, *Geomorphology, *Fisher Glacier, *Antarctic, Prince Charles Mountains, Moraines, Ice level, Climate.

A study of the geomorphology of the Prince Charles Mountains using color vertical air photographs shows well-preserved old moraines throughout much of the outcrop area. Along Fisher Glacier, lower Lambert Glacier and the Amery Ice Shelf, within the altitude range 50-2,000 m, the old moraines show that the ice level had risen 150-200 m above the present level at least three times. Old moraines elsewhere show that none of the other glaciers had risen significantly in their upper parts; the rise of their lower parts was caused by the rise of lower Lambert Glacier and the Amery Ice Shelf. The changes in ice level are unlikely to be due to climatic change because this would not repeatedly affect only one glacier draining central Antarctica. It is thought that the changes in ice level are caused by repeated surges of Fisher Glacier. (Author's abstract)
W85-00671

ICE MOVEMENT THROUGH SMITH SOUND IN NORTHERN BAFFIN BAY, CANADA, OBSERVED IN SATELLITE IMAGERY,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Geologisches Inst.
H. Ito, and F. Muller.
Journal of Glaciology, Vol. 28, No. 98, p 129-143, 1982. 9 Fig, 3 Tab, 6 Ref. NSF grant DPP-7826132, Government of Canada DSS contract OSX4-0098, NSF contract GV-40404A1, Schweizerische Nationalfonds zur Forderung der Wissenschaftlichen Forschung contract 2.383.70.

Descriptors: *Satellite technology, *Ice movement, *Baffin Bay, *Smith Sound, Remote sensing, Landsat, Ice drift, Wind.

Movement of pack ice in Smith Sound in northern Baffin Bay was observed for April 1975 using the satellite imagery obtained by Landsat. Mean velocity was found to be directed to the south with a magnitude of 4.3 km/d. The movement was strongly influenced by the wind in that location, which changes considerably from one point to another within a relatively short distance, and cannot easily be estimated from the pressure-distribution data due to the local topography. On the other hand, the ice movement through the field can be used to some extent to evaluate the wind field. Very little consideration was given to the influence of the sea current. The amount of ice transported from Smith Sound was different for different wind conditions, but the findings show that on the average 600 sq km of pack ice was carried out of the area per day. (Baker-IVI)
W85-00672

NUMERICAL MODEL OF TEMPERATE GLACIER FLOW APPLIED TO THE QUIESCENT PHASE OF A SURGE-TYPE GLACIER,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
R. Bindschadler.
Journal of Glaciology, Vol. 28, No. 99, p 239-265, 1982. 18 Fig, 24 Ref. NSF grants DES 72-01629 A01 and EAR 76-22463 A01.

Descriptors: *Glaciers, *Glacier flow, *Mathematical models, *Quiescent phase, Variegated Glacier, Alaska, Glacier surges, Shear stress, Glacier mass balance.

A time-dependent numerical model of temperate glacier flow without sliding is developed and applied to the quiescent phase of surge-type Variegated Glacier, Alaska. The model is based on a one-dimensional continuity equation but the transverse channel shape is explicitly included allowing the complex geometries of real glaciers to be modelled. Velocities and volume fluxes are calculated from the glacier geometry. Transverse stress is taken into account by shape factors which are fitted to measurements of geometry and velocity and are chosen to be insensitive to changes in geometry. Longitudinal stress gradients are taken into account by use of a large-scale surface slope. A Crank-Nicholson finite-difference approximation is used and it is unconditionally stable when a small contribution from the local slope is added to the average slope. Model parameters are fitted to extensive data collected on Variegated Glacier in 1973 and 1974. Predictions of the model over a four year interval agree well with field measurements. Predictions of the current quiescent phase (1965-84) indicate depth increases in the upper glacier of more than 75 m with a twenty-fold increase in the volume flux. During this interval the base shear stress increases 40% in the upper glacier and decreases 20% in the lower glacier. During the mid to late quiescent phase, ice motion becomes more important than mass balance in the redistribution of mass over the central region of the glacier. If normal flow were to persist, the predicted steady-state profile would be an ave
of 100 m deeper and 41% more voluminous th
1973. The predicted base shear-stress gradie
never negative enough to satisfy Robin and W
man's (J. Glaciol., 12(64):3-18, 1973) condition
blockage of subglacial water flow. The annual
of water production by dissipation of mechan
straining at the bed remains two orders of ma
tude below that produced by summer surface
The predicted fractional increase in base s
during the quiescent phase is a maximum in
region believed to be the trigger zone of
surges. (Author's abstract)
W85-00673

STABILITY OF SHEET FLOW OF WATER NEATH TEMPERATE GLACIERS AND IM CATIONS FOR GLACIER SURGING,
Stanford Univ., CA. Dept. of Geology.
J. S. Walder.
Journal of Glaciology, Vol. 28, No. 99, p 273-
1982. 3 Fig, 2 Tab, 36 Ref.

Descriptors: *Sheet flow, *Glacier surges, *Ma
matical models, Temperate glaciers, Heat diss
tion, Pressure gradients, Glacier channels.

A mathematical model is presented for the stab
of sheet flow of water beneath a temperate glac
Enhanced viscous heat dissipation in thick part
the sheet tends to make sheet flow unstable,
instability increasing as sheet thickness and p
sure gradient increase. However, incipient ch
nels may be destroyed as the glacier slides o
protuberances on its bed. Quasi-stable sheet f
may be possible for sheets up to several millime
in thickness, especially beneath glaciers that h
relatively gentle surface slopes and slide at mo
ate to high speeds. Such water sheets may so
what reduce the effective roughness of gla
beds, but probably not enough to allow su
initiation. Furthermore, the presence of numer
water-filled cavities at the glacier bed will tend
reduce the sheet thickness and lessen the degre
'lubrication' of the glacier bed by the water sh
(Author's abstract)
W85-00674

SHORT-TERM VARIATIONS IN VELOCI OF SOUTH CASCADE GLACIER, WASHIN TON, U.S.A.,
Saint Olaf Coll., Northfield, MN.
R. W. Jacobel.
Journal of Glaciology, Vol. 28, No. 99, p 325-3
1982. 4 Fig, 2 Tab, 5 Ref.

Descriptors: *Velocity, *South Cascade Glac
*Washington, *Glaciers, Variation, Monte Ca
method.

An eight element array of reflectors was p
tioned along the center line near equilibrium
South Cascade Glacier. The position of element
this array was surveyed approximately twice da
using a theodolite and a laser ranger, a distan
measuring device. The data were taken over 63
during July and August 1979. The array had ov
all dimensions comparable to the 200 m ice thi
ness in this part of the glacier. If the measu
displacement for each stake represents the mot
of the glacier, then for sufficiently small regio
having the same overall average velocity,
short-term stake motions should be compatib
The surveyed area of South Cascade Glacier
moving at an average velocity of 0.00183 m
Variations in velocity for individual stakes w
typically 100% for periods of 12 h but decrea
for longer time intervals. The constraints of req
ing compatible motion for the entire array redu
the averaged short-term fluctuations to the sa
order as the variations between stakes for a gi
12 h period. This implies that non-uniformity
individual stake motion does not represent t
velocity variation of the studied portion of
glacier. Monte Carlo simulations of the experim
tal resolution show that only 30% of the variati
can be attributed to measurement uncertainty, a
that therefore the observed effects represent re

t localized variations in surface velocity. loore-IVI)
85-00675

CULAR VARIATION OF ICE FLOW VELOCY AT LEWIS GLACIER, MOUNT KENYA, ENYA,
isconsin Univ.-Madison. Dept. of Meteorology.
Hastenrath, and P. Kruss.
urnal of Glaciology, Vol. 28, No. 99, p 333-339, 82. 2 Fig, 6 Ref. NSF grants EAR77-13130 and AR79-23897.

escriptors: *Ice flow, *Lewis Glacier, *Kenya, ount Kenya, Mathematical models, Simulation, elocity, Crevasses.

easurements at various epochs in the course of e twentieth century indicate a slowing down of rface ice flow velocity. Theoretical modeling ows this observed velocity decrease to be content with the well-documented secular glacier cession. The numerical simulation further sugsts a marked decrease in the velocity maximum ring the 1900's and a gradual upward movement the position of this maximum. Crevasse orientan is transverse above, and longitudinal below, e velocity maximum. The secular change in the ngitudinal velocity profile seems to affect the evasse pattern. The rapid retreat of Lewis Gla-r in recent times is illustrated by comparing the 78 and 1974 aerial surveys. Numerical modeling the future behavior of Lewis Glacier indicates at it is likely that the glacier will continue to treat at the present rate, or even more rapidly, o the mid 1980's. A major overall decrease in e surface velocity is also indicated, with the locity by 1985 being reduced to an ammount proaching half the 1978 value. The velocity aximum will become less sharply defined and ll move quite significantly up-glacier. An appart manifestation of such a trend is the recent velopment of a large longitudinal crevasse aching some 150 m into the region previously aracterized by transverse crevasses. (Moore-I)
85-00676

UPRAGLACIAL RE-SEDIMENTATION ROM MELT-WATER STREAMS ON TO NOW OVERLYING GLACIER ICE, SYLGJUOKULL, WEST VATNAJOKULL, ICELAND,
olorado Univ. at Boulder. Inst. of Arctic and lpine Research.
or primary bibliographic entry see Field 2J.
85-00677

ABULAR ICEBERGS: IMPLICATIONS FROM EOPHYSICAL STUDIES OF ICE SHELVES,
isconsin Univ.-Madison. Geophysical and Polar esearch Center.
Shabtaie, and C. R. Bentley.
urnal of Glaciology, Vol. 28, No. 100, p 413-430, 82. 9 Fig, 34 Ref. NSF grants DPP76-01415 and PP79-20736.

escriptors: *Icebergs, *Ice shelves, Ross Ice elf, Tabular icebergs, Iceberg calving, Rift nes, Elevation, Brine infiltration, Melting, Crasses, Radar, Iceberg transport.

ecent geophysical and glaciological investigaons of the Ross Ice Shelf have revealed many mplexities in the ice shelf that can be important ctors in iceberg structure. The presence of rift nes, surface and bottom crevasses, corrugations, dge/troughs, and other features could substantialy modify the hydraulics of iceberg towing and ad to disintegration in the course of transport. he relationships between the elevation above sea-vel and total ice thickness for three ice shelves Ross, Brunt, and McMurdo) are given; from them, xpressions for the thickness/freeboard ratios of bular icebergs calved from these ice shelves are btained. The relationships obtained from the easured values of surface elevation and ice thickess are in agreement with models derived assumg hydrostatic equilibrium. Areas of brine infiltraon into the Ross Ice Shelf have been mapped. xamples of radar profiles in these zones are shown. Absorption from the brine layers results in a poor or absent bottom echo. It is probable that little saline ice exists at the bottom of the Ross Ice Shelf front due to a rapid bottom melting near the ice front, and that the thickness of the saline ice at the bottom of icebergs calving from the Ross Ice Shelf is no more than a few meters, if there is any at all. We have observed many rift zones on the ice shelf by airborne radar techniques, and at one site the bottom and surface topographies of (buried) rift zones have been delineated. These rift zones play an obvious role in iceberg formation and may also affect the dynamics of iceberg transport. Bottom crevasses with different shapes, sizes, and spacings are abundant in ice shelves; probably some are filled with saline ice and others with unfrozen sea-water. Existence of these bottom crevasses could lead to a rapid disintegration of icebergs in the course of transport, as well as increasing the frictional drag at the ice-water boundary. Radar profiles of the ice-shelf front at four sites in flow bands of very different characteristics are shown. In some places rifting up-stream from the front shows regular spacings, suggesting a periodic calving. Differential bottom melting near the front causes the icebergs to have an uneven surface and bottom (i.e. dome shaped). Electrical resistivity soundings on the ice shelf can be applied to estimate the temperature-depth function, and from that the basal mass-balance rate. With some modifications, the technique may also be applied to estimating the basal mass-balance rates of tabular icebergs. (Author's abstract)
W85-00678

GROWTH OF ICE SHEETS,
O. V. Dement'eva.
Fluid Dynamics, Vol. 18, No. 5, p 803-805, September-October, 1983. 1 Fig, 1 Tab, 8 Ref. Translated from Izvestiyz Akademii Nauk SSSR, Mekhanika Zhidkosti i Gaza, No. 5, p 169-172, September-October, 1983.

Descriptors: *Ice sheets, *Ice formation, Fluid mechanics, Ice thickness, Freezing, Rivers, Flow rate.

The ice sheets considered are those formed by river or underground water flowing onto a surface, spreading, and freezing into layers. The outflow is due to freezing of the water carrying region through which the surface and underground water circulate. The shape and size of the sheets change during their formation and depend on the climatic, geological, and morphological conditions of the region and also on the hydrogeological conditions of freezing and the regime of the water source. When the ice sheets are formed, a process takes place that is analogous to the formation of an alluvial dam. The water that forms the ice sheet flows through a crack in the ice or in the ground with a constant flow rate. Spreading, it goes over into the solid phase. A graph is offered of a case of the growth of thickness of an ice sheet during the winter of 1965/66. Knowing the volume of ice in the sheet and its width, the flow of water per unit of width can be calculated. (Baker-IVI)
W85-00686

COMPUTER SIMULATION OF BUOYANCY AND SNOW-COVER EFFECTS IN PALSA DYNAMICS,
S. I. Outcalt, and F. Nelson.
Arctic and Alpine Research, Vol. 16, No. 2, p 259-263, May, 1984. 1 Fig, 16 Ref. NSF grant DPP-8117124.

Descriptors: *Permafrost, *Snow cover, *Buoyancy, *Palsa, Computer models, Simulation, Bogs, Model studies, Ice, Peat, Finland.

Floating palsas are permafrost bodies commonly found in bogs of the discontinuous permafrost region, although similar features may occur in taliks formed within organic terrain of the continuous permafrost zone. A simple computer model was developed to simulate the modulation effects of winter snow thickness on the development and destruction of these features. The one dimensional model tracks the annual mass budgets of ice rich peat and the overlying dry peat layer by estimating the annual accretion or thaw of ice within the peat. This is accomplished by the aid of a solution to the Stefan problem, modified to incorporate the influence of the thermal resistance of layers overlying the zone of frost or thaw. The elevation of a palsa above surrounding organic terrain is determined by the Archimedean principle. The thickness of the dry and ice rich peat layers, both lower in density than the surrounding wet peat, vary through time. The model demonstrates the sensitivity of system dynamics to both snow cover depth in a given year and the site's snow cover history. In more abstract terms, the model can be viewed as a special type of autocorrelation filter which moves through a site's history of temperature and winter snow depth, and maps mound heights and the thickness of constituent materials. (Baker-IVI)
W85-00877

FLOW, THERMAL STRUCTURE, AND SUBGLACIAL CONDITIONS OF A SURGE-TYPE GLACIER,
British Columbia Univ., Vancouver. Dept. of Geophysics and Astronomy.
G. K. C. Clarke, S. G. Collins, and D. E. Thompson.
Canadian Journal of Earth Sciences, Vol. 21, No. 2, p 232-240, February, 1984. 6 Fig, 50 Ref.

Descriptors: *Glacier surges, *Ice temperature, *Tapridge Glacier, *Yukon territory, Glaciohydrology, Glacier flow, Heat transfer, Percolation, Subglacial flow.

Surges are an incompletely explained cyclic flow instability pecular to certain glaciers. Measurements on Tapridge Glacier, Yukon Territory, show an unambiguous association of thermal structure and flow evolution in a surge-type glacier. A large bulge is forming at the boundary between warm-based (upstream) and cold-based (downstream) ice. Upstream from the bulge the glacier is progressively thickening as the next surge approaches; downstream it is nearly stagnant and thinning. For Trapridge Glacier the boundary between the reservoir and receiving areas is controlled by basal ice temperature. In the receiving area the glacier is cold based, but bottom temperature has increased as much as 0.5 degrees C between 1981 and 1982, and the basal heat flux is roughly 10 times the expected geothermal flux. Water percolation through permeable subglacial material is the probable energy source. Deformation of the substrate could destroy this drainage system and trigger a surge. (Moore-IVI)
W85-00958

1981-1982 SURGE OF HAZARD GLACIER, YUKON TERRITORY,
British Columbia Univ., Vancouver. Dept. of Geophysics and Astronomy.
G. K. C. Clarke, and S. G. Collins.
Canadian Journal of Earth Sciences, Vol. 21, No. 3, p 297-304, March, 1984. 4 Fig, 2 Tab, 25 Ref.

Descriptors: *Glacier surges, *Hazard Glacier, *Yukon Territory, Basal temperature, Thermal regime, Ice thickness.

Hazard glacier is situated in the Steele Creek Drainage basin, Yukon Territory. A minor surge, believed to have started in 1981 or earlier and ended by summer 1982, was the first to have been directly observed. The surge displaced ice as much as 0.7 km. Before the surge, ice thickness was measured by radio echo sounding and temperatures were taken in three holes to the glacier bed. The glacier is subpolar with 10 m temperatures near -5.4 C, and temperature versus depth profiles show many anomalous features, which may be due to past surges and to ablation at the upper surface. Part of the glacier is warm based: at two sites the basal temperature in 1977 was at the melting point; at the third site, upstream from the others, it was -2.70 C. If this is the true basal temperature then part of the active zone remained cold based during the 1981-1982 surge or a rapid increase in basal temperature occurred between 1977 and the surge onset in 1981. Hazard Glacier's subpolar thermal regime is consistent with a thermal mechanism but

does not eliminate equally plausible alternatives. (Moore-IVI)
W85-00959

ILLUSTRATION OF THE SPATIAL VARIABILITY OF LIGHT ENTERING A LAKE USING AN EMPIRICAL MODEL,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2H.
W85-01017

CONTROLS ON ADVECTIVE SNOWMELT IN A MARITIME ALPINE BASIN,
Canterbury Univ., Christchurch (New Zealand). Dept. of Geography.
R. D. Moore, and I. F. Owens.
Journal of Climate and Applied Meteorology, Vol. 23, No. 1, p 135-142, January, 1984. 6 Fig, 2 Tab, 24 Ref.

Descriptors: *Snowmelt, *Advection, *Alpine regions, *New Zealand, Heat transfer, Air circulation, Air temperature, Wind, Sensible heat, Latent heat, Flood forecasting.

The surface energy budget of a snowpack in an alpine basin near the Main Divide of New Zealand's South Island was calculated from meteorological observations during a spring melt period. The sensible and latent heat exchanges account for 82% of the energy used for melting snow, net radiation accounts for 16% and the sensible heat of rain for 2%. Regression analysis shows that indices of airmass characteristics and regional circulation explain most of the variances in the observed temperature and wind at the site, which are the major controls on turbulent exchange. Local advection of heat is important during periods of strong insolation. Local thermally-generated winds enhance turbulent exchange over the snowpack during calm, anticyclonic periods. The airmass and regional circulation indices account for 75% of the variance in the daily totals of sensible plus latent heat flux. These results support the utility of large-scale indices for forecasting snowmelt during flood-producing rain-on-snow events. (Author's abstract)
W85-01042

AMOUNT OF SOIL ICE PREDICTED FROM WEATHER OBSERVATIONS,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 2G.
W85-01072

2D. Evaporation and Transpiration

RESERVOIR EVAPORATION IN CENTRAL COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
N. E. Spahr, and B. C. Ruddy.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4103, 1983. 232 p, 51 Fig, 16 Tab, 17 Ref.

Descriptors: *Evaporation, *Mass-transfer, *Reservoir evaporation, Reservoirs, *Colorado, *Energy budget.

Evaporation losses from seven reservoirs operated by the Denver Water Department in central Colorado were determined during various periods from 1974 to 1980. The reservoirs studies were Ralston, Cheesman, Antero, Williams Fork, Elevenmile Canyon, Dillon, and Gross. Energy-budget and mass-transfer methods were used to determine evaporation. Class-A pan data also were collected at each reservoir. The energy-budget method was the most accurate of the methods used to determine evaporation. At Ralston, Cheesman, Antero, and Williams Fork Reservoirs the energy-budget method was used to calibrate the mass-transfer coefficients. Calibrated coefficients already were available for Elevenmile Canyon, Dillon, and Gross Reservoirs. Using the calibrated coefficients, long-term mass-transfer evaporation rates were determined. Annual evaporation values were not determined because the instrumentation was not operated for the entire open-water season. Class-A pan data were used to determine pan coefficients for each season at each reservoir. The coefficients varied from season to season and between reservoirs, and the seasonal values ranged from 0.29 to 1.05. (USGS)
W85-00613

AMOUNTS OF WATER REQUIRED BY IMPORTANT ECOSYSTEMS OF A RURAL LANDSCAPE,
Vysoka Skola Zemedelska, Brno (Czechoslovakia). Inst. of Forest Ecology.
M. Penka.
Acta Universitatis Agriculturae, Serie C, Vol. 52, No. 1-2, p 3-15, 1983. 4 Fig, 4 Tab, 33 Ref.

Descriptors: *Transpiration, *Fields, *Meadows, *Forests, Ecosystems, Evaporation, Water demand, Orchards, Vineyards, Agriculture, Irrigated crops, Vegetables, Grasslands.

The amounts of water required by a rural landscape were determined, using field, meadow, and forest ecosystems as models. The variations in transpiration or transpiration flow were determined in dominant plant species of the ecosystems and their components. The amounts of water required for transpiration (integrated transpiration, IT, or integrated transpiration flow, ITF) were estimated from the data obtained by measurement. The total amounts of water required by individual ecosystems and their components were then calculated by extrapolation. The results were used for compilation of a summary suggesting the amounts of water needed by the studied ecosystems of a rural landscape and the share taken by each in the hydraulic cycle. The meadow ecosystems require as much as 600 mm of water during the whole growing season. The same values are found for high-yield vegetable species and varieties and for irrigated agricultural crops as well as for woody seedlings. Evaporation rates exceeding this value occur from open water surfaces (600-700 mm) and soils freshly laid bare (to 700 mm). Field ecosystems and unirrigated crops require as much as 500 mm of water. Forest ecosystems require as much as 400 mm of water. As much as 350 mm of water are required by the garden ecosystems (vineyards, orchards, and cash crops) and by the grassland ecosystems managed along classical lines. (Moore-IVI)
W85-00625

EFFECT OF WIND ON THE TRANSPIRATION OF YOUNG TREES,
Toronto Univ. (Ontario). Dept. of Botany.
M. Dixon, and J. Grace.
Annals of Botany, Vol. 53, No. 6, p 811-819, June, 1984. 3 Fig, 1 Tab, 26 Ref.

Descriptors: *Transpiration, *Trees, *Wind, Pine, Oak, Fagus, Sorbus, Heat transfer, Vapor pressure, Stomatal transpiration, Leaves, Resistance.

The effects of wind on the transpiration rates of four plant species, Pinus sylvestris L., Quercus robur L., Fagus sylvatica L. and Sorbus aucuparia L., were studied in a controlled environment wind tunnel. Transpiration declined with increasing wind speed in a manner consistent with predictions of the Penman-Monteith equation. The calculations refute the more traditional view that wind increases transpiration. This view neglects the concomitant effect of wind on heat transfer, which, under high radiation loads, causes a reduction in leaf temperature and hence in water vapor pressure at the sites of evaporation. The stomatal resistance declined with increasing wind speed in two species and increased in one, but this effect was smaller than reported in other studies. In all cases the magnitude of the stomatal response was over-shadowed by the declining leaf to air vapor pressure difference. The relationship between the aerodynamic resistance and wind speed showed unexpectedly good agreement with the standard relationship used for laminar boundary layers. A definite decline in surface resistance with increasing wind speed occurred in Q. robur and S. aucuparia. There is some evidence to suggest that wind damage to the leaf surface influenced leaf surface resistance. (Moore-IVI)
W85-00626

CALCULATION OF EVAPORATION FOR INLAND LAKES USING MONTHLY MEAN VALUES OF METEOROLOGICAL PARAMETERS, BASED ON MEASURED WATER TEMPERATURES (ZUR VERDUNSTUNGSBERECHNUNG FUR BINNENSEEN AUS MONATSMITTELWERTEN METEOROLOGISCHER PARAMETER BEI GEMESSENER WASSERTEMPERATUR),
Muenster Univ. (Germany, F.R.). Inst. fuer Geographie.
J. Werner.
Deutsche Gewasserkundliche Mitteilungen, Vol. 28, No. 2, p 41-44, May, 1984. 2 Fig, 3 Tab, 5 Ref.

Descriptors: *Lakes, *Evaporation, Water temperature, Dalton's formula, Wind, Humidity.

Using measured monthly evaporation depths of three inland lakes in North Rhine-Westphalia, a simple method for calculating the evaporation is tested. The method is derived from Dalton's formula and yields satisfactory results under favorable conditions in a comparison with directly measured values from three inland lakes in North Rhine-Westphalia. If the water temperature is well known, the method gives satisfactory results. It is necessary, however, to transfer the wind velocities measured at the station in the vicinity of the lake concerned by calculation, using simultaneous wind measurements for comparison. (Baker-IVI)
W85-00899

INFLUENCE OF ATMOSPHERIC STABILITY ON POTENTIAL EVAPORATION,
Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.
L. Mahrt, and M. Ek.
Journal of Climate and Applied Meteorology, Vol. 23, No. 2, p 222-234, February, 1984. 6 Fig, 3 Tab, 27 Ref. USAF contract F19628-81-K-0046.

Descriptors: *Evaporation rate, *Atmospheric stability, Water vapor, Turbulent transport, Diurnal variation, Penman relationship.

The Penman relationship for potential evaporation is modified to simply include the influence of atmospheric stability on turbulent transport of water vapor. Explicit expressions for the stability-dependent, surface exchange coefficient developed by Louis are used. The diurnal variation of potential evaporation is computed for the stability-dependent and original Penman relationships using Wangara data. The influence of afternoon instability increases the aerodynamic term of the modified Penman relationship by 50% or more on days with moderate instability. However, the unmodified Penman relationship predicts values of daily potential evaporation close to that of the stability-dependent relationship. This agreement is partly due to compensating overestimation during nighttime hours. Errors due to use of daily-averaged variables are examined in detail by evaluating the nonlinear interactions between the diurnal variation of the variables in the Penman relationship. A simpler method for estimating the exchange coefficient is constructed from an empirical relationship between the radiation Richardson number and the Obukhov length. This method is less accurate, but it allows estimation of the stability-dependent exchange coefficient using only parameters already required for evaluation of the Penman relationship. Finally, the diurnal variation of the atmospheric resistance coefficient appearing in the Penman-Monteith relationship is presented. (Author's abstract)
W85-01044

MEASUREMENTS AND ESTIMATES OF POTENTIAL EVAPOTRANSPIRATION OVER EGYPT,

Meteorological Authority, Cario (Egypt).
M. H. Omar, and A. M. Mehanna.
Agricultural and Forest Meteorology, Vol. 31, No. 2, p 117-129, May, 1984. 1 Fig, 6 Tab, 13 Ref.

Descriptors: *Evapotranspiration, *Estimating, *Egypt, Measuring, Evapotranspirometers, Measuring instruments, Crops, Water requirements, Water needs, Irrigation.

In an earlier work (Mehanna, A. M. M., 1976. Meteorol. Res. Bull., Meteorol. Auth., Cairo 8(1): 69-83), potential evapotranspiration (PE) was estimated for a number of stations in Egypt, using Penman's method with adjustment of the constants of the radiation term and the aerodynamic term, such that they would agree with measurements of radiation in Egypt and with estimates by another investigator of PE in a large field at Giza, to the southwest of Cairo (Omar, M. H. 1971. Potential evapotranspiration at Cairo, Ph D Thesis, Cairo Univ., Egypt, and Omar, M. H. 1971, Meteorol. Res. Bull., Meteorol. Dept. Cairo, 3(1): 117-133). Measurements of PE were made in the current study at Bahtim, about 20 km to the north of Cairo, by evapotranspirometers. In the FAO Irrigation and Drainage Paper No. 24 concerning crop water requirements, four methods were given for the calculation of PE: Blaney-Criddle, radiation, Penman (adjusted) and pan evaporation. The main features of comparison of the Mehanna and FAO's estimates of PE with measurements at Bahtim were that Mehanna, and three of the FAO's estimates (Blaney-Criddle, radiation and pan evaporation) are within 10% of the measurements while the Penman estimate was 15% higher. An estimate of PE at Aswan was based on measurements of pan evaporation and estimates of evaporation from a large water surface at both Bahtim and Aswan, together with measurements of PE at Bahtim. The estimates by the methods of Mehanna, Blaney-Criddle, radiation and Penman lie in the limits of 0-5% of the estimate based on measurements while the pan evaporation estimate is markedly lower. Comparison of the estimates at eight stations over Egypt shows that the Penman estimate is higher than the other estimates in Northern Egypt. The pan evaporation estimate is lower than the other estimates except at Bahtim where it is generally higher than Mehanna's and Blaney-Criddle's estimates. The low values of the pan evaporation estimates at Assuit and Aswan are remarkable. (Baker-IVI)
W85-01059

USE OF SURFACE RESISTANCE-SOIL MOISTURE RELATIONSHIPS IN SOIL WATER BUDGET MODELS,
Instem Computer Systems, Stone (England).
D. J. Sherratt, and H. S. Wheater.
Agricultural and Forest Meteorology, Vol. 31, No. 2, p 143-157, May, 1984. 7 Fig, 2 Tab, 10 Ref.

Descriptors: *Soil water, *Evapotranspiration, *Surface resistance, Evaporation, Transpiration, Soil properties, Moisture stress, Flow resistance, Mathematical models.

A simple two layer moisture model based on a linear drying curve relating actual evapotranspiration (AE) to potential evapotranspiration (PE) ratio to a measure of soil moisture deficit (SMD) has been compared with a similar model incorporating a factor for the surface resistance of the crop (r sub s) into the SMD relationship. Results indicate that despite the theoretical attractions of specifying AE:PE reduction in terms of r sub s, for practical application on a regional scale a two-parameter linear drying curve may be at present more appropriate. The specification of soil moisture model parameters for a given soil and land use is likely to be of greater significance than the form of AE:PE reduction employed. (Baker-IVI)
W85-01060

CROP EVAPORATION AND SURFACE CONDUCTANCE CALCULATED USING SOIL MOISTURE DATA FROM CENTRAL INDIA,
Institute of Hydrology, Wallingford (England).
J. S. Wallace, C. H. Batchelor, and M. G. Hodnett.
Agricultural Meteorology, Vol. 25, No. 2, p 83-96, October, 1981. 8 Fig, 3 Tab, 37 Ref.

Descriptors: *Evaporation, *Crop yield, *India, *Soil water, *Surface conductance, Water use, Moisture stress, Soil water, Seasonal variation.

During the winter (rabi) season in central India, dryland crops rely on stored soil water and limited precipitation. Crop evaporation rates were calculated from changes in soil moisture content under wheat, dhal, lentil, linseed and mixed crops during periods of little or no rainfall. Seasonal variations in the surface conductances of these crops were then calculated using these evaporation rates in the Penman-Monteith equation. Actual evaporation from some dry land crops was much less than potential evaporation. For areas such as this, therefore, estimates of seasonal crop water use based on conventional evaporation formulae may be considerably in error, unless they are adjusted using crop coefficients or their equivalent. For the practical purpose of predicting crop water use however, the relationships between surface conductance, crop development and soil moisture stress need to be more clearly defined. (Baker-IVI)
W85-01063

AUTOMATING A CLASS A EVAPORATION PAN FOR SEMI-CONTINUOUS RECORDING,
Kansas Agricultural Experiment Station, Manhattan. Evapotranspiration Lab.
G. Asrar, R. J. Kunze, and D. E. Linvill.
Agricultural Meteorology, Vol. 25, No. 4, p 275-281, February, 1982. 3 Fig, 1 Tab, 18 Ref.

Descriptors: *Evaporation, *Measuring instruments, *Automation, Monitoring, Pan evaporation.

A linearly elastic system was developed to monitor water losses from a National Weather Service Class A evaporation pan over short time periods. A special selection of strain sensors and their unique arrangement on the strain transducer arms provided a very sensitive and temperature self-compensated system. The assembly responded linearly to small water losses over a wide working range with a sensitivity of 0.034 mm of water per 0.1 mV change in bridge output. The system was tested for six days under field conditions. Very good agreement was found between water losses measured automatically and manually. High precision in detecting water losses over short periods and low cost are the main features of this system. (Baker-IVI)
W85-01065

TRANSPIRATION, LEAF TEMPERATURE AND WATER POTENTIAL OF RICE AND BARNYARD GRASS IN FLOODED FIELDS,
International Rice Research Inst., Los Banos, Laguna (Philippines).
J. C. O'Toole, and V. S. Tomar.
Agricultural Meteorology, Vol. 26, No. 4, p 285-296, July, 1982. 8 Fig, 2 Tab, 17 Ref.

Descriptors: *Transpiration, *Rice, *Grass, *Plant water potentials, Water vapor, Temperatures, Floods, Water potential, Wind, Solar radiation, Vapor pressure deficit, Diurnal variation.

The diurnal trend of transpiration rate of both rice and barnyard grass appear to be more directly influenced by water vapor pressure deficit (VPD) and wind speed than solar radiation. An interesting loop relationship was noted between transpiration, solar radiation, and time of observation. The results suggest that a relatively low transpiration rate of both species in the morning hours, when solar radiation is low, is associated with low VPD and wind speed. High transpiration rates in the afternoon occur at the same solar radiation level but are strongly influenced by VPD and wind speed at that time. At a given value of VPD, the transpiration rate of rice was higher than that of barnyard grass. Increased transpiration decreased leaf temperature and leaf water potential in both rice and barnyard grass. Leaf water potential of -15 to -17 bar appears to be a significant degree of water deficit and is perhaps unexpected for flooded rice. This water potential was not causing stomatal closure or leaf temperature increase and was supporting the high flux rates of IR20 in these observations. These results concur with others which state that the transpiration rate of C3 plants is higher than that of C4 plants because leaf diffusive resistance of C4 plants is higher even during peak transpiration periods. (Baker-IVI)
W85-01070

2E. Streamflow and Runoff

FLOOD ROUTING IN RIVERS BY TRANSFER FUNCTION IDENTIFICATION,
Hydro-Quebec, Montreal. Service Hydraulique.
B. Cote, and P. E. Brunelle.
Journal of Hydraulic Research, Vol. 20, No. 5, p 415-426, 1982. 7 Fig, 4 Tab, 7 Ref.

Descriptors: *Flood routing, *Transfer functions, Mathematical models, Gatineau River, Quebec, Model studies, Flood forecasting.

A numerical method of obtaining the transfer function of a single input-output system in the time domain was developed which may be used as a flood routing tool. Model assumptions are that the system is time invarient and linear during identification but this restriction may be relaxed to include weakly nonlinear systems. The mathematical model reduces to a linear difference equation with constant coefficients. The model can be calibrated to yield a discharge-discharge relation or any other required combination. Two simultaneous time series of the water level and/or discharge at the upstream and downstream ends of the reach under study are sufficient for calibration. Details such as convergence and numerical particularities are discussed. The model was validated by its application (off- and on-line) to the classic problem of flood routing in a river reach, taking a hypothetical rectangular channel and a disjointed river reach, a 45 km segment of the Gatineau River (Quebec, Canada), as the testing grounds. For the latter, the model was also used online as for real-time forcasting. (Collier-IVI)
W85-00523

EXCEPTIONAL RAINFALL AROUND LEWES AND THE SOUTH DOWNS, AUTUMN 1982,
Sussex Univ., Brighton (England). Computing Centre.
T. J. Browne, and D. A. Robinson.
Weather, Vol. 39, No. 5, p 132-136, May, 1984. 4 Fig, 2 Tab, 3 Ref.

Descriptors: *Flooding, *Rainfall, *Lewes, *South Downs, *England, Erosion, Rainfall intensity, Rainfall runoff, Agricultural runoff.

Flooding occurred several times on the Sussex Downs in the vicinity of Lewes and Brighton during the last quarter of 1982. Floods were caused by excessive rainfall resulting in surface runoff from agricultural land and were usually accompanied by rill and gully erosion or sheet wash of arable soils. The incidence of short duration high intensity rainfall was particularly pronounced. It is estimated that rainfall of this nature is likely to occur only four times a century. Work is continuing to determine whether the intensity of the rainfalls are part of a trend towards an increased frequency of extreme rainfall events along the Sussex coast or whether they are random variations of rainfall to be expected over the region. (Baker-IVI)
W85-00581

HYDROLOGY OF CARBONATE TERRANE - NIANGUA, OSAGE FORK, AND GRANDGLAIZE BASINS, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-00582

TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS ON NATURAL-FLOW STREAMS IN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. C. Bridges.

Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations 82-4012, 1982. 44 p, 2 Fig, 6 Tab, 18 Ref.

Descriptors: *Flood frequency, *Frequency analysis, *Floods, *Estimating equations, *Regression analysis, Flood flow, Natural flow, Flood peak, Frequency distribution, *Florida, Flow characteristics, Basin characteristics, Recurrence interval, Flood-discharge probability.

A technique is presented for estimating floods on natural-flow streams in Florida for specific recurrence intervals of 2, 5, 10, 25, 50, 100, 200, and 500 years. Florida peaks from 159 stream-gaging stations with long-term records (10-53 years) and 23 rainfall-runoff stations with short-term records (7-17 years) were used in a multiple linear regression analysis to develop the regional equations relating peak discharge to basin characteristics. The State is divided into 3 hydrologic regions, A, B, and C. The significant independent variables in Regions A and C were drainage area, channel slope, and lake area. In Region B, the significant independent variables were drainage area and lake area. (USGS)
W85-00589

PRELIMINARY ASSESSMENT OF THE HYDROLOGIC CHARACTERISTICS OF THE JAMES RIVER IN SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-00592

LOW-FLOW CHARACTERISTICS OF INDIANA STREAMS,
Geological Survey, Indianapolis, IN. Water Resources Div.
J. A. Stewart.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 82-1007, 1983. 277 p, 8 Fig, 2 Tab, 7 Ref.

Descriptors: *Base flow, Drainage area, *Flow duration, Gaging stations, *Indiana, Low flow, Natural flow, Regulated flow, *River basins, Streamflow, Climate year, Continuous record, Partial-record station, Recurrence interval, 7-day, 10-year low flow.

Knowledge of low-flow data for Indiana streams is essential to the planners and developers of water resources for municipal, industrial, and recreational uses in the State. Low-flow data for 219 continuous-record gaging stations through the 1978 water year and for some stations since then are presented in tables and curves. Flow-duration and low-flow-frequency data were estimated or determined for continuous-record stations having more than 10 years of record. In addition, low-flow-frequency data were estimated for 248 partial-record stations. Methods for estimating these data are included in the report. (USGS)
W85-00600

ACCURACY OF DISCHARGE DETERMINED FROM A RATING CURVE,
Ministry of Works and Development, Palmerston North (New Zealand). Water and Soil Div.
J. R. Dymond, and R. Christian.
Hydrological Sciences Journal, Vol. 27, No. 4, p 493-504, December, 1982. 2 Fig, 6 Ref, 1 Append.

Descriptors: *Flow discharge, *Rating curves, *Error analysis, Water level, Mathematical equations, New Zealand, Ore Ore, Wanganui District, Flood peak.

The most common method in New Zealand for measuring discharge is to measure water level automatically then to transform to discharge with a rating function, more commonly called a rating curve. An error analysis shows that three types of errors influence the random error of a single discharge measurement determined from a rating curve. They are rating curve error, water level measurement error and an error caused by ignoring all physical parameters, other than water level, that affect discharge. Methods in the literature for evaluating the first two types of errors are reviewed and a method for evaluating the third type is given. The error of average discharge for an arbitrary period is also considered. The flow site Mangawhero at Ore Ore is used as an example. The error of peak discharge, error of daily discharge and error of monthly discharge were determined. The described methods for evaluating the rating frunction error require the rating function to be linear. This was found to be approximately true for most, but not all, of 25 well defined rating functions at uncontrolled flow sites in the Wanganui District. Three of them were obviously nonlinear with distinctly different high and low flow regimes. (Moore-IVI)
W85-00694

MIXING LAYER: DETERMINISTIC MODELS OF A TURBULENT FLOW. PART 3. THE EFFECT OF PLANE STRAIN ON THE DYNAMICS OF STREAMWISE VORTICES,
Scientific Research Associates, Inc., Glastonbury, CT.
S. J. Lin, and G. M. Corcos.
Journal of Fluid Mechanics, Vol. 141, p 139-178, April, 1984. 23 Fig, 20 Ref. ONR contract N.R. 062-665.

Descriptors: *Mixing layer, *Vortices, *Mathematical models, *Strain, Turbulent flow, Fluid mechanics, Model studies, Turbulence, Streamflow, Diffusion.

An elementary model of the dynamics of streamwise vorticity was examined in a plane mixing layer. The vorticity is assumed to be unidirectional and subjected to a two-dimensional spatially uniform strain, positive along the direction of vorticity. The equations of motion are solved numerically with initial conditions corresponding to a strain viscous diffusion balance for a layer with a sinusoidal variation of vorticity. The numerical results are interpreted physically and compared to those of an asymptotic analysis of the same problem. Strained vortex sheets were seen to be fundamentally unstable unless their local strength nowhere exceeds a constant times the square root of the product of strain and viscosity. The instability manifests itself by the spanwise redistribution of the vorticity towards the regions of maximum strength, accompanied by the local rotation of the layer and the intensification of the vorticity. The parameters upon which collapse and its timescale depend are related to those which are known to govern a mixing layer. The results suggest that the conditions for collapse of strained vortex sheets into concentrated round vortices are easily met in a mixing layer, even at low Reynolds numbers, so that these structures whose size is the Taylor microscale are far more plausibly typical than are vortex sheets on that scale. They raise significantly the diffusion rate of scalar atributes by enhancing the rate of growth of material surfaces across which diffusion takes place. Experimental methods that rely on the visualization of the gradient of scalar concentration are unable to reveal the presence of streamwise vorticity unless that vorticity has already gathered into concentrated vortex tubes. (Baker-IVI)
W85-00714

DAM-BREAK SOLUTION,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
B. Hunt.
Journal of Hydraulic Engineering, Vol. 110, No. 6, p 675-686, June, 1984. 9 Fig, 6 Ref.

Descriptors: *Dam failure, *Mathematical equations, *Floods, Reservoirs, Channels, Outflow, Flow, Model studies, Kinematic waves, Flood flow.

Floods created by dam failures almost always cause large amounts of property damage, and sometime losses of human life. A closed-form solution has been obtained from a dam-break problem in which the reservoir, dam breach, and downstream channel all have different widths. The reservoir outflow is calculated with a quasi-steady flow approximation, which results in a requirement that the ratio of breach width to reservoir width be less than 0.37. Downstream flood depths are calculated by using the kinematic-wave approximation, which leads to requirements imposed upon the solution by either of two equations. It is also assumed that the ratio of downstream flow depth to channel width is small enough to allow the approximation of the hydraulic radius with the flow depth. A numerical example shows that maximum downsteam flood depths decay relatively slowly because of storage contained within the upstream reservoir. (Baker-IVI)
W85-00724

SURFACE BUOYANT JETS IN STAGNANT WATER,
Worcester Polytechnic Inst., Holden, MA. Alden Research Labs.
D. N. Brocard.
Journal of Hydraulic Engineering, Vol. 110, No. 6, p 831-835, June, 1984. 2 Fig, 8 Ref. NSF grant CME-8012661.

Descriptors: *Buoyant jets, *Stagnant water, *Model studies, Mathematical equations, Surface flow, Jets, Dilution.

Surface buoyant jets are frequently found in nature and in man's projects. By neglecting the discharge aspect ratio and the discharge flowrate as independent parameters, the longitudinal variations of each jet characteristic can be described by a single curve for jets discharging in deep stagnant water. Longitudinal variations based on the results of a mathematical model may have biases, so the accuracy of the curves is estimated. Curves are developed for the centerline dilution. The scatter of the experimental data is non-negligible, pointing to the influence of the discharge flowrate and aspect ratio (which are neglected in this study) and of the experimental facility. (Baker-IVI)
W85-00732

SIMPLIFYING STORMWATER DETENTION BASIN DISCHARGE CONTROL DETERMINATIONS,
Rockaway Township Water Dept., NJ.
For primary bibliographic entry see Field 8A.
W85-00735

RIVERFLOW RECONSTRUCTIONS AND THEIR USE, PART 2,
University of East Anglia, Norwich (England). Climatic Research Unit.
R. D. Jones.
Water Science, Vol. 87, No. 1054, p 528-531, December, 1983. 8 Fig, 7 Tab, 10 Ref.

Descriptors: *River flow, *Catchment areas, River Wharfe, River Tyne, Addingham, Bywell, Rainfall, England, Model studies, Flow duration, Flow frequency.

Raingauge data for the River Wharfe to Addingham catchment and the River Tyne to Bywell catchment were examined over a 10 year period. Use of the CWPU catchment model with the log transformation of discharge ensures that low flows have been well reconstructed. On the River Thames to Teddington catchment the reconstruction has been shown to correlate well with those measured and to give good agreement between flow frequency curves produced from the measured and estimated riverflows. Riverflow reconstructions have been made on the two catchments. The accuracy of the reconstruction depends on the accuracy of the catchment model and the representativeness of the areal rainfall used for reconstruction. For these two catchments, the flow duration and flow frequency curves from the measured and reconstructed flows are similar, implying that the measured period gives a reasonable representation of conditions that have occurred over the last 120 years. On both catchments low flow values for high return periods would be overestimated by 10-15% of average discharge if only the shorter measured riverflows were used. Further analysis on other catchments, particularly in southern Brit-

in would allow reconstructions of riverflow to be ade back to the eighteenth century. (Baker-IVI)
V85-00758

STIMATING GENERALIZED FLOOD SKEW OEFFICIENTS FOR MICHIGAN,
Aichigan Dept. of Natural Resources, Lansing.
. M. Croskey, and D. J. Holtschlag.
vailable from OFSS, USGS, Box 25425, Fed. tr., Denver, CO 80225. USGS Water-Resources nvestigations Report 83-4194, 1983. 27 p, 4 Fig, 4 ab, 6 Ref.

Descriptors: *Data collections, Design flood, Floods, *Frequency analysis, Gaging stations, Hydrologic data, Probability, Regional analysis, Regression analysis, *Michigan, *Flood frequency nalysis, *Skew coefficients.

Current estimates of station flood frequency skew oefficients indicate that estimates of generalized kew obtained from the skew map of the United tates (U.S. Water Resources Council, 1976) have -0.27 bias for Michigan. Station skew was recom- uted using currently recommended statistical pro- edures (Water Resources Council, 1981) and vailable data through 1982. Generalized skew is ombined with station skew in order to improve stimates of flood-flow frequencies. As a result of his study, the mean station skew for each of three esignated regions is favored for estimating gener- lized skew in Michigan. The Upper Peninsula, eferred to as region 1, has a skew of 0.12. The outhwest part of the Lower Peninsula, region 2, as a skew of 0.081. The remainder of the Lower eninsula, region 3, has a skew of -0.17. The mean- quare error associated with generalized skew de- ermined on the basis of designated regions is 0.2. USGS)
W85-00849

AUTOMATIC DILUTION GAGING OF RAPIDLY VARYING FLOW,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7A.
W85-00852

SIMULATION OF THE AUGUST 1979 SUDDEN DISCHARGE OF GLACIER-DAMMED FLOOD LAKE, BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Dept. of Geophysics and Astronomy.
G. K. C. Clarke, and D. A. Waldron.
Canadian Journal of Earth Sciences, Vol. 21, No. 4, p 502-504, April, 1984. 2 Fig, 1 Tab, 13 Ref.

Descriptors: *Flood discharge, *Flood Lake, *British Columbia, *Computer models, Simulation, Model studies, Stikine River, Outburst floods, Glacial lakes, Flood prediction.

Flood Lake is a glacier-dammed lake situated in the Stikine River Basin, British Columbia. In August 1979 an outburst flood, or jokulhlaup, occurred releasing about 1,500,000,000 cu m of water beneath Flood Glacier. The resulting flood was routed through the Stikine River and yielded a maximum discharge rate of 1200 cu m/s at the USGS Stikine River gauging station near Wrangell, Alaska, 90 km downstream from the glacier dam. A computer model was used to simulate this outburst in order to test the usefulness of the model as a predictor of flood magnitude. The predicted peak discharge is 2160 cu m/s at the outlet tunnel of the ice dam and 1700 cu m/s at the gauging station. The discrepancy between predicted and observed discharge at that station is 42%. (Moore-IVI)
W85-00960

FLOODS OF THE RHINE IN APRIL AND MAY 1983 (DIE RHEIN-HOCHWASSER VOM APRIL UND MAI 1983),
Bundesanstalt fuer Gewaesserkunde, Coblenz (Germany, F.R.).
U. Schroder, and H. Engel.
Deutsche Gewasserkundliche Mitteilungen, Vol. 27, No. 5/6, p 186-194, December, 1983. 2 Fig, 6 Tab, 9 Ref.

Descriptors: *Rhine River, *Flood recurrence interval, *Storm runoff, Runoff coefficient, Moselle catchment basin, Rainfall intensity, Soil saturation, Rainfall-runoff relationships.

Flood runoff from two major events in April and May, 1983, followed a period of almost continuous rain. The long duration and high intensity of rainfalls resulted in a soil saturation reaching practically 100%. This led, even without the soil clogging typical of great floods, to runoff coefficients approaching 1.0 and to very short times of concentration of runoff in spite of the already existing vegetation. In view of the fact that no melting snow cover participated in this process, the extent of both floods may be regarded as unusual. The April flood data indicates a return interval between 11 and 31 years. The May flood data indicates a return interval of 54-350 years. Data from the lower reach of the Moselle range, within the order of magnitude of the Rhine gauge recurrence intervals, indicates for the May flood a return period of 22 years. When classified as a summer flood the May event shows a period of about 80 years. Since the May flood involved almost no alpine runoff or snowmelt, it should be considered in the class of winter floods and the interval of 22 years is statistically accurate. (Wheatley-IVI)
W85-00968

RIVER GAUGING BY ULTRASONICS/WORKSHOP REPORT KOBLENZ 1983 (BERICHT UBER DIE FACHLICHE AUSSPRACHE AM 14./15. SEPTEMBER 1983 IN KOBLENZ),
Bundesanstalt fuer Gewaesserkunde, Coblenz (Germany, F.R.).
For primary bibliographic entry see Field 7B.
W85-00969

WILLIAM RIVER: AN OUTSTANDING EXAMPLE OF CHANNEL WIDENING AND BRAIDING CAUSED BY BED-LOAD ADDITION,
Illinois Univ. at Chicago Circle. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2J.
W85-00981

EFFECTS OF ARTIFICIAL FRESHETS ON SUBSTRATUM COMPOSITION, BENTHIC INVERTEBRATE FAUNA AND INVERTEBRATE DRIFT IN TWO IMPOUNDED RIVERS IN MID-WALES,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
J. Scullion, and A. Sinton.
Hydrobiologia, Vol. 107, No. 3, p 261-269, November, 1983. 2 Fig, 2 Tab, 29 Ref.

Descriptors: *River Tywi, *River Elan, *Wales, *Benthic fauna, *Invertebrates, *River flow, Particle size, Suspended solids, Midges, Plectoptera, Organic matter, Substrates, Invertebrate drift.

Artificial discharges of water from reservoirs caused a six-fold and three-fold increase in discharge in the River Tywi and River Elan respectively but did not significantly alter particle size composition (by weight) and the porosity of the substratum or the organic matter content of fine particles (< 0.5 mm). Freshets in both rivers resulted in a consistent, though not significant, reduction in total densities of invertebrates and the densities of many major taxa and abundant species. During the freshet in the River Elan, maximum concentration and total load of suspended solids were about 11 and 35 times greater than prerelease values respectively while invertebrate drift was dominated by Chironomidae (65%) and Plecoptera (25%). Total numbers and densities of drifting chironomids increased immediately in response to the flow increase; in contrast, numbers and densities of plecopterans increased later, during the night. (Author's abstract)
W85-01002

2F. Groundwater

STUDIES ON CHEMICAL SPECIES DISSOLVED IN GROUNDWATERS FROM THE NEOGENE STRATA. A COMPARISON BETWEEN SHALLOW AND DEEP GROUNDWATERS (IN JAPANESE),
Konan Univ., Kobe (Japan). Dept. of Chemistry.
Y. Kusaka, Y. Fukui, H. Tsuji, Y. Tamari, and Y. Fujiwara.
Japanese Journal of Limnology, Vol. 43, No. 4, p 254-262, October, 1982. 9 Fig, 3 Tab.

Descriptors: *Japan, *Kobe, *Groundwater, *Chemical composition, Clay minerals, Neutron activation analysis, Ion exchange reactions, Deep wells, Shallow wells, Path of pollutants.

The Kobe Neogene strata, which have been considered to be lake sediments produced ca. 14,000,000 years ago, are widely distributed in the Sanda basin situated on the north or northwestern sides of the Rokko mountains. In the groundwaters collected from 42 shallow domestic wells and from 19 deep wells bored in golf links, the concentrations of 24 dissolved species were determined by chemical analyses and those of 9 other species by neutron activation analyses. Seasonal fluctuations of the concentration of major dissolved species in the groundwaters and the differences in the chemical compositions between the shallow and deep ones were studied. Based on the overall analytical results of the species in the groundwaters, it was concluded that ion exchange reactions by clay minerals in the strata contribute to the chemical compositions of groundwaters from the strata. This contribution is more remarkable in the deep groundwaters than the shallow ones. (Author's abstract)
W85-00537

STUDIES ON THE SEAWATER INTRUSION IN COASTAL GROUNDWATER; II. GROUNDWATER AT THE MOUTH OF THE KIKI RIVER (IN JAPANESE),
Ehime Univ., Matsuyama (Japan). Dept. of Applied Physics.
Y. Kishi, T. Kakinuma, and M. Ifuku.
Japanese Journal of Limnology, Vol. 44, No. 1, p 36-46, January, 1983. 11 Fig, 3 Tab.

Descriptors: *Kiki River, *Japan, *Saline water intrusion, *Groundwater, Hydrological models, Model studies, Chlorides, Groundwater mining, Water pollution sources.

In this study are reported for the first time the results of observations of the seawater intrusion into the coastal aquifer at the mouth of the Kiki River in Ehime Pref. This phenomenon was then analyzed with the aid of the hydrological model found by Fukuo, Kakinuma, Kishi and Ifuku. Concentrations of chloric ions were observed since 1972 in groundwater pumped up from 50-60 wells in this plain. Very high concentrations of chloric ions were observed in the fan-shaped region near the coast during the period from 1972 to 1974. It turned out, however, from data in 1976 and thereafter that concentrations of chloric ions in the above region were decreased considerably, so the phenomenon of seawater intrusion into the coastal aquifer virtually disappeared in fact. In order to determine the reason for such a sudden change in this phenomenon, the above mentioned model was applied to the groundwater in this plain. The decrease in the total amount of groundwater pumped in this plain was found to be the main cause of the shinkage of the saline region near the coast. (Author's abstract)
W85-00543

HYDROLOGY OF CARBONATE TERRANE - NIANGUA, OSAGE FORK, AND GRANDGLAIZE BASINS, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
E. J. Harvey, J. Skelton, and D. E. Miller.
Missouri Dept. of Natural Resources, Division of Geology and Land Survey, Water Resources

Report No. 35, Rolla, 1983. 136 p, 38 Fig, 35 Plates, 10 Tab, 36 Ref.

Descriptors: Surface-groundwater relationships, *Carbonate terrane, *Subsurface flow, *Basin profiles, *Groundwater movement, *Low-flow frequency, Geologic mapping, Structural geology, Runoff, Groundwater tracers, Sinks, Zone of saturation, Groundwater recharge, Discharge (water), Water level fluctuations, Aquifers, Permeability, Specific capacity, *Missouri, Gaining streams, Losing streams.

A study of hydrology in three Missouri Ozark basins (Niangua River, Osage Fork, and Grandglaize Creek) and an analysis of hydrologic methodology for carbonate terranes has shown that there are intricate relationships between ground water and surface water, and that these relationships can best be understood by using a number of methods to study them. The measurement of steamflow, in combination with geologic mapping, is one of the most important tools that can be used in a hydrologic study of carbonate terranes. Current and historic ground-water-level data are also essential. One of the most effective ways to study ground water-surface water relationships is the construction of basin profiles by using ground-water levels and streamflow data in conjunction with topographic, geologic, and structural information. Dry Auglaize Creek and Goodwin Hollow are underlain by the most extensive underground drainage system in the project area. As proved by underground dye tracing, both are hydraulically connected to the Niangua River. Field observations have shown (1) that more storm runoff is diverted to Niangua River by Goodwin Hollow than by Dry Auglaize Creek, and (2) that the stream reaches and tributaries nearest to the Niangua River basin have the largest infiltration capacities. (USGS)
W85-00582

GROUND-WATER SUPPLY POTENTIAL AND PROCEDURES FOR WELL-SITE SELECTION, UPPER CAPE FEAR RIVER BASIN,
Geological Survey, Raleigh, NC. Water Resources Div.
C. C. Daniel, III, and N. B. Sharpless.
North Carolina Department of Natural Resources and Community Development, Raleigh, October 1983. 73 p, 17 Fig, 5 Tab, 17 Ref.

Descriptors: *North Carolina, *Cape Fear River Basin, Alamance County, Caswell County, Chatham County, Forsyth County, Guilford County, Orange County, Randolph County, Rockingham County.

The regolith in the upper Cape Fear River basin, North Carolina, contains approximately 1.5 billion gallons per square mile of potentially available ground water. Storage capacity in the underlying fractured bedrock is low and decreases to nearly zero below a depth of about 400 feet. Precipitation averaging 45.9 inches per year recharges the ground-water system; about 20 percent of this amount infiltrates to the water table. A site selection procedure for locating new well sites was developed from an analysis of rock types, land forms, and drainage patterns. The mafic volcanics unit is the most productive with nearly three times as many high-yield wells as the sheared granite, porphyritic granite, felsic volcanics, mica gneiss, and diorite. High-yield wells are absent in the mica schist and argillite units. High-yield wells are most often found in draws or narrow valleys underlain by thick regolith and highly-fractured bedrock with a high water table. Drainage patterns provide clues to the presence or absence of fractured bedrock. Drilling and testing of test wells demonstrated the usefulness of site selection criteria for locating, in selected geologic units, wells with above-averaged yields penetrating zones of highly-fractured rock at sites with a high water table and thick regolith. (USGS)
W85-00584

CHLORIDE CONCENTRATIONS IN THE COASTAL MARGIN OF THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
K. W. Causseaux, and J. D. Fretwell.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 82-4070, 1983. 33 p, 18 Fig, 2 Tab, 56 Ref.

Descriptors: *Hydrologic data, *Monitoring, Groundwater, Observation well, Potentiometric surface, Saltwater intrusion, Water management, Limestone, *Coastal aquifer, *Saltwater-freshwater interface, *Chlorides, *Florida.

The Floridan aquifer is the principal source of freshwater supply in southwest Florida. The freshwater part of the aquifer is underlain by saltwater in lower formations and is bounded on the west by saltwater in the coastal parts of the aquifer. A zone of mixing lies between the saltwater and freshwater. The saltwater and freshwater boundaries are defined by chloride concentrations of 19,000 milligrams per liter on the coastward side and 250 milligrams per liter on the landward side. Lateral intrusion of saltwater can occur along the coast in areas where the hydraulic gradient declines and upconing can occur in inland areas of heavy ground-water withdrawals. Safeguards against saltwater intrusion in these areas are necessary because flushing of the aquifer is a very slow process. A network of chloride monitor wells is proposed for the zone of mixing in the upper producing zone of the floridan aquifer. Seventy wells were selected at 54 sites to monitor chloride concentrations along the 250-milligram-per-liter line of equal chloride concentration. One-fourth of the wells are located in areas of increasing chloride concentrations or heavy ground-water withdrawals and the remaining wells are intended to improve delineation of the interface and to monitor long-term changes in chloride concentrations. (USGS)
W85-00585

WATER RESOURCES OF HANSON AND DAVISON COUNTIES, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
D. S. Hansen.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4108, 1983. 55 p, 28 Fig, 11 Tab, 13 Ref.

Descriptors: *Data collection, *Hydrologic data, Water wells, *Aquifers, Hydrogeology, *Water quality, *Water use, Hanson County, Davison County, *South Dakota.

Five glacial and four bedrock aquifers were delineated in Hanson and Davison Counties. The glacial aquifers, outwash deposits confined by as much as 275 feet of glacial till, are the Floyd, Plum Creek, Ethan, Warren, and Alexandria. The bedrock aquifers are the Niobrara, Codell, Dakota, and Sioux Quartzite Wash, and may be as much as 80, 350, 700, and 500 feet below land surface, respectively. The glacial aquifers averaged 13 to 40 feet in thickness and contain about 670,000 acre-feet of water in storage. Recharge to the Floyd and Plum Creek aquifers is from the Sioux Quartzite Wash aquifer and from fractures in the Sioux Quartzite. Recharge to the Ethan and Warren aquifers is from the Niobrara aquifer. Reported yield to wells from the Floyd and Plum Creek aquifers was as much as 1,000 gallons per minute. Predominant chemical constituents in water from the glacial aquifers are sulfate, calcium, and sodium. The bedrock aquifers averaged 40 to 110 feet in the thickness and contain about 11.3 million acre-feet of water in storage. The direction of water movement in the aquifers is to the northeast. The average reported yield from wells in the bedrock aquifers ranged from 1 to 75 gallons per minute. Reported yield from wells in the Niobrara aquifer was as much as 1,000 gallons per minute. Predominant chemical constituents in water from the Niobrara and Codell aquifers were sulfate, sodium, and calcium. Predominant chemical constituents in water from the Dakota and Sioux Quartzite wash were sulfate and calcium. (USGS)
W85-00588

GEOHYDROLOGY OF THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, LOS MEDANOS AREA, SOUTHEASTERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. W. Mercer.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4016, 1983. 183 p, 21 Fig, 10 Tab, 93 Ref.

Descriptors: *Nuclear wastes, *Radioactive waste disposal, *Hydraulic conductivity, Permeability, *Geohydrologic investigations, *Regional hydrology, Disposal, Groundwater movement, Transmissivity, Bedded-salt, Test wells, Drill-stem tests, *Waste Isolation Pilot Plant, Eddy County, *New Mexico, *Salado Formation, *Rustler Formation, Magenta Dolomite Member.

Geohydrologic data have been collected in the Los Medanos area at the U.S. Department of Energy's proposed Waste Isolation Pilot Plant (WIPP) site in southeastern New Mexico since 1975 as part of an intensive study evaluating the feasibility of storing defense-associated nuclear wastes within the bedded salt of the Salado Formation of Permian age. Drilling and hydrologic testing have identified three principal water-producing zones above the salt, including the Rustler-Salado Formational contact and the Culebra and Magenta Dolomite Members of the Permian Rustler Formation. Below the bedded salt there is another water-bearing zone, the channel sandstones of the Bell Canyon formation of the Permian Delaware Mountain Group. Most data collected from 33 hydrologic test holes indicate that the water-bearing zones are characterized by low transmissivities and contain slightly saline to briny water. Data collected from drill-stem tests in the Bell Canyon Formation indicate the channel sandstones have hydraulic conductivities ranging from 0.02 to 0.36 feet per day grade vertically and laterally into siltstones and shales of very low permeability. The Rustler Formation contains the principal water-producing zones identified at the WIPP site. The Rustler-Salado formational contact has the least transmissivity, ranging from 0.00003 to 0.003 feet squared per day. The Culebra Dolomite is the most productive unit at the WIPP site with transmissivities ranging from 0.001 to 73 feet squared per day; the greater values result from fracturing in the dolomite created by dissolution of underlying halite. Minute vertical permeabilities prevent movement of water between hydrologic units. (USGS)
W85-00594

DISTRIBUTION OF CHLORIDE CONCENTRATIONS IN THE PRINCIPAL AQUIFERS OF THE NEW JERSEY COASTAL PLAIN, 1977-1981,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-00596

SOURCES AND MECHANISMS OF RECHARGE FOR GROUND WATER IN THE WEST-CENTRAL AMARGOSA DESERT, NEVADA--A GEOCHEMICAL INTERPRETATION,
Geological Survey, Denver, CO. Water Resources Div.
H. C. Claassen.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 83-542, 1983. 61 p, 15 Fig, 6 Tab, 42 Ref.

Descriptors: Chemical reactions, *Groundwater recharge, *Paleoclimatology, Stable isotopes, Water chemistry, *Nevada, Amargosa Desert, *Aqueous geochemistry, Desert recharge, *Groundwater chemistry.

Ground water in the west-central Amargosa Desert, Nevada, was recharged primarily by overland flow of snowmelt in or near the present-day stream channels, rather than by subsurface flow from highland recharge areas to the north. Geo-

chemical arguments, including reaction mechanisms, are used to support these findings. Carbon-, hydrogen-, and oxygen-isotope data show that much of the recharge in the area occurred during late Wisconsin time. Absence of ground-water recharge prior to late Pleistocene is considered to indicate that either climatic conditions were unfavorable for recharge or that ground-water velocities were such that they transported this earlier recharge away from the study aea. (USGS)
W85-00598

TRANSIENT TWO-DIMENSIONAL GROUNDWATER FLOW,
Auckland Univ. (New Zealand). School of Engineering.
V. U. Nguyen, and A. J. Raudkivi.
Hydrological Sciences Journal, Vol. 27, No. 4, p 427-438, 1982. 2 Fig, 21 Ref.

Descriptors: *Flow rates, *Groundwater movement, Confined aquifers, Unconfined aquifers, Mathematical equations, Leakage, Laplace equation, Piezometric head, Transmissivity, Storage coefficient, Aquifer characteristics.

Large open cuts are a feature of many engineering projects. An important aspect of such operations is the analysis of slope stability for which an estimate of the groundwater discharge from the seams is required. Simple analytical solutions have been obtained for two-dimensional confined, leaky and unconfined groundwater flows. The confined and leaky aquifer solutions obtained by the Laplace transformation of the unsteady flow equation are in terms of the error function and its complementary part. The input parameters required for the solution are the piezometric head, the transmissivity and storage coefficient of the aquifer. The solutions provide a simple method for computing the phreatic surface at any time and from its slope, the flow rate. The flow rate over a time interval is the difference of the areal integrals of the water table curves divided by the time interval. (Baker-IVI)
W85-00690

SUBSURFACE STORMFLOW: AN ANALYSIS OF RESPONSE TIMES,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
K. Beven.
Hydrological Sciences Journal, Vol. 27, No. 4, p 505-521, December, 1982. 5 Fig, 4 Tab, 35 Ref.

Descriptors: *Storm seepage, *Slopes, Permeability coefficient, Saturated flow, Unsaturated flow, Response time, Kinematic wave theory, Mathematical equations, Model studies, Soil moisture.

On hillslopes where the soils are sufficiently permeable to make the occurrence of surface flow extremely unlikely, hillslope response will be dominated by subsurface stormflows involving both saturated and unsaturated flows. A simple theory for predicting the response times of unsaturated and saturated flows on hillslopes, based on kinematic wave equations, is presented. The sensitivity of unsaturated zone lag and time of concentration of the saturated zone to hillslope and soil parameters, antecedent moisture and input rates is examined. For many hillslopes subsurface flows will be too highly delayed to be considered as a part of the stormflow response. Only where effective hydraulic conductivities are very high, the soil is wet and the water table or an impeding layer is close to the ground surface can rapid responses be expected. Even then, the effective slope length contributing to stormflow may be small. Under these conditions a kinematic model may be an appropriate one for modelling the fast subsurface response at the hillslope or catchment scale. (Moore-IVI)
W85-00695

HYDROGEOLOGICAL STUDY WITH ENVIRONMENTAL ISOTOPES OF KARST WATERS OF THE EASTERN SWABIAN ALB AND THE DANUBE RIED (HYDROGEOLOGISCHE STUDIE MIT UMWELTISOTOPEN AN KARSTWASSERN DER OSTLICHEN SCHWABISCHEN ALB UND DES DONAURIEDS (BADEN-WURTTEMBERG UND ANGRENZENDES BAYERN)),
Niedersaechsisches Landesamt fuer Bodenforschung, Hanover (Germany, F.R.)
M. A. Geyh, P. Groschopf, and W. Schloz.
Archiv fur Hydrobiologie, Vol. 95, No. 1/4, p 81-91, 1982. 4 Fig, 1 Tab, 14 Ref.

Descriptors: *Swabian Alb, *Danube Ried, *Karst hydrology, *Isotope studies, *Geohydrology, Residence time, Groundwater movement, Carbon isotopes, Tritium, Catchment areas.

Determinations of C-14, H-3, and delta C-13 have been made of some representatively selected karst waters of the eastern Swabian-Alb (open and covered regions) and of the Danube-Ried as well. Following the exponential model the results from young karst waters were explained as mean residence time (MVZ), but conventional ages were determined for the older and old karst waters. The MVZ is valid only for the long-term part of the karst water (dominating at low water level) being specific for each spring. Between the open region of the Swabian-Alb and the Danube, the MVZ values increase from 10 to 50 years. In the border zone of the covered region, MVZ values increase up to 150 years. In the covered region south of the Danube, the age of the ground water suddenly jumps up to values of more than 20,000 years. These groundwaters must have settled before the last glaciation. The sealing of the drainage area by permafrost during the glacial period interrupted the inflow of groundwater for several thousand years. By means of geological parameters the values of MVZ are used for estimating the catchment area of each karst spring. In the gathering ground of the 'Zweckverband Landeswasserversorgung' in the Danube-Ried at Langenau, the authors succeeded in grouping the karst waters according to origin and age by using the C-14, H-3, and delta C-13 values. (Author's abstract)
W85-00765

HYDROGEOLOGIC EVALUATION OF SELECTED STRATIFIED-DRIFT DEPOSITS IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
S. J. Grady, and E. H. Handman.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigation Report 83-4010, 1983. 51 p, 11 Fig, 3 Tab, 34 Ref.

Descriptors: *Groundwater, *Aquifer characteristics, Water Supply, Water quality, Evaluation, Glacial aquifers, Data collection, Test holes, Test wells, *Connecticut, *Stratified drift, Potential well yields, Seismic refraction profiles.

Test borings at 28 sites and seismic-refraction profiles at 16 sites provide data on the saturated thickness and grain-size characteristics of stratified-drift deposits in five areas of Connecticut. These data, together with information on the areal extent of the deposits and their proximity to sources of induced recharge, can be used to estimate the water-yielding potential of the stratified-drift deposits. Individual wells could potentially yield moderate to possibly very large quantities of water (50 to 2000 gallons per minute) at some locations in all five areas where saturated, dominantly coarse-grained stratified drift is 40 feet thick or greater and hydraulically connected to nearby surface-water bodies. Coarse-grained stratified drift is most extensive in the Glastonbury, Haddam, and Simsbury, Connecticut areas. Saturated thickness exceeds 150 feet in parts of the Glastonbury and Haddam areas, but is less than 100 feet in most places. The best sites for developing large quantities of water are in the Glastonbury and Haddam areas where thick, saturated, coarse-grained stratified drift is hydraulically connected to the Connecticut River. Water in the stratified drift is generally of good chemical quality except for excessive iron (0.64 to 20 mg/L) and manganese (0.1 to 10 mg/L) in some samples. (USGS)
W85-00842

ESTIMATES OF VERTICAL HYDRAULIC CONDUCTIVITY AND REGIONAL GROUNDWATER FLOW RATES IN ROCKS OF JURASSIC AND CRETACEOUS AGE, SAN JUAN BASIN, NEW MEXICO AND COLORADO,
Geological Survey, Albuquerque, NM. Water Resources Div.
P. F. Frenzel, and F. P. Lyford.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 82-4015, 1982. 59 p, 22 Fig, 2 Tab, 42 Ref.

Descriptors: *Groundwater flow, *Hydraulic conductivity, Steady-state model, Vertical hydraulic conductivity, San Juan Basin, Chaco Canyon National Monument, *New Mexico, *Colorado.

The San Juan structural basin northwestern New Mexico was modeled in three dimensions using a finite-difference, steady-state model. The modeled space was divided into seven layers of square prisms that were 6 miles on a side in the horizontal directions. In the vertical direction, the layers of prisms ranged in thickness from 300 to 1,500 feet. The model included the geologic section between the base of the Entrada Sandstone and the top of Mesaverde Group. Principal aquifers in this section are mostly confined and include the Entrada Sandstone, the Westwater Canyon Member of the Morrison Formation, and the Gallup Sandstone. Values for vertical hydraulic conductivities from 10 to the minus 12th power to 10 to the minus 11th power feet per second for the confining layers gave a good simulation of head differences between layers, but a sensitivity analysis indicated that these values could be between 10 and 100 times greater. The model-derived steady-state flow was about 30 cubic feet per second. About one-half of the flow was in the San Juan River drainage basin about one-third in the Rio Grande drainage basin, and one-sixth in the Puerco River drainage basin. (USGS)
W85-00844

MODIFICATION OF THE FINITE-DIFFERENCE MODEL FOR SIMULATION OF TWO-DIMENSIONAL GROUND-WATER FLOW TO INCLUDE SURFACE-GROUND WATER RELATIONSHIPS,
Geological Survey, Providence, RI. Water Resources Div.
M. M. Ozbilgin, and D. C. Dickerman.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4251, 1984. 98 p, 12 Fig, 5 Tab, 6 Ref.

Descriptors: *Digital model, Aquifer, *Aquifer simulations, *Recharge, Evapotranspiration, Wells, Pumping rate, Pumping duration, Groundwater, Surface water, Leakage, Mass balance, *Baseflow, Stream stage, *Model studies, *Finite element difference.

The two-dimensional finite-difference model for simulation of groundwater flow was modified to enable simulation of surface-water/groundwater interactions during periods of low streamflow. Changes were made to the program code in order to calculate surface-water heads for, and flow either to or from, contiguous surface-water bodies; and to allow for more convenient data input. Methods of data input and output were modified and entries (RSORT and HDRIVER) were added to the COEF and CHECKI subroutines to calculate surface-water heads. A new subroutine CALC was added to the program which initiates surface-water calculations. If CALC is not specified as a simulation option, the program runs the original version. The subroutines which solve the groundwater flow equations were not changed. Recharge, evapotranspiration, surface-water inflow, number of wells, pumping rate, and pumping duration can be varied for any time period. The Manning formula was used to relate stream depth and discharge in surface-water streams. Interactions between surface water and ground water are represented by the leakage term in the ground-water flow and surface-water mass balance equations. Documentation includes a flow chart, data deck instructions, input data, output summary, and program listing. Numerical results from the modified

program are in good agreement with published analytical results. (USGS)
W85-00845

SOUTHERN HILLS REGIONAL AQUIFER SYSTEM OF SOUTHEASTERN LOUISIANA AND SOUTHWESTERN MISSISSIPPI,
Geological Survey, Baton Rouge, LA. Water Resources Div.
A. Bouno.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4189, 1983. 38 p, 13 Fig, 6 Tab, 42 Ref.

Descriptors: *Groundwater, *Water supply, *Aquifers, *Recharge, Aquifer characteristics, Hydrogeology, Water quality, Geology, Water utilization, Population, Water sources, *Louisiana, *Mississippi.

The Southern Hills regional aquifer system, named in a petition to the Environmental Protection Agency for designation as a sole or principal source of drinking water, is the primary source of public and domestic supplies in the northern 10 parishes of southeastern Louisiana. The gulfward dipping and thickening, complexly interbedded aquifer system extends from the northern limit of the recharge area near Vicksburg, Mississippi, as far as the Baton Rouge area in southeastern Louisiana. As many as 13 interdependent aquifer units compose the system in the southern part of the area and are known to coalesce or pinch out northward (updip) into fewer units. Aquifer water is almost exclusively a soft, sodium bicarbonate type with an average dissolved-solids concentration of about 220 milligrams per liter in southeastern Louisiana. Although several streams are available as alternatives for supply, they have not been accepted by local officials because of the additional water treatment that would be necessary and the extensive distribution system needed to deliver water to areas not near a source stream. Groundwater use in 1980 for public and domestic supply averaged 121 Mgal/d (million gallons per day), serving 744,000 people in southeastern Louisiana. In southwestern Mississippi, where the aquifer system is also the primary source for public and domestic supply, water use for these categories in 1980 totaled 25 Mgal/d, serving about 273,000 people. (USGS)
W85-00848

GROUND WATER IN NORTH MONTEREY COUNTY, CALIFORNIA, 1980,
Geological Survey, Sacramento, CA. Water Resources Div.
M. J. Johnson.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4023, July 1983. 32 p, 9 Fig, 5 Tab, 21 Ref.

Descriptors: *Aquifers, Groundwater, *Groundwater recharge, Pumpage, Overdraft, Groundwater movement, *Groundwater availability, Water demand, *California, Monterey County, Salinas Valley, Prunedale, Aromas, Saltwater intrusion, Freshwater storage, Yield to wells, Paiaro Valley.

Present ground-water demands exceed long-term recharge throughout much of North Monterey County in the shallow Quaternary deposits--principally the upper part of the Aromas Sand--and the overlying alluvium. Recharge occurs largely from local precipitation, although small quantities of potable ground water from outside areas also recharge these aquifers. Water levels in the Pajaro and Salinas River valleys north and south of the study area are lower than most of the intervening area, and recharge from the east is blocked by faults and impervious rock. Ocean water moves in from the west to replace depleted freshwater storage in the upper part of the Aromas Sand, alluvium, and terrace deposits. The North County area was divided into subareas to estimate pumpage demands and to evaluate ground-water yields. Pumpage near the granitic ridge, an area of limited storage, nearly matches local recharge. West of the granitic ridge, pumpage exceeds available recharge but draws upon a large storage potential. Deeper units than those now tapped by wells in the Aromas Sand and the underlying Purisima Formation may have substantial water-bearing potential for additional ground-water development. Extensive development of water from these formations might be limited, however, by the remoteness of the recharge source and by the proximity to the ocean. (USGS)
W85-00851

EVALUATION OF WATER LEVELS IN MAJOR AQUIFERS OF THE NEW JERSEY COASTAL PLAIN, 1978,
Geological Survey, Trenton, NJ. Water Resources Div.
R. L. Walker.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, Colo. 80225. USGS Water-Resources Investigations Report 82-4077, 1983. 56 p, 15 Fig, 8 Tab, 25 Ref, 5 Maps.

Descriptors: Water level, *Water-level fluctuations, *Groundwater, Water, *Artesian head, Potentiometric level, Aquifers, *New Jersey Coastal Plain.

Increased withdrawals from the major artesian aquifers that underlie the New Jersey Coastal Plain have caused water-level declines and large regional cones of depression. These cones of depression are delineated on detailed potentiometric surface maps produced from water-level data collected in the field in 1978. Water levels for 1978 are compared with those from 1970 or 1973, and water-level changes are evaluated and compared with hydrographs from observation wells. The Potomac-Raritan-Magothy aquifer system is divided into regionally extensive lower and upper aquifers. These aquifers have large cones of depression centered in Camden, Middlesex, and Monmouth Counties. Water levels declined 5 to 20 feet in these areas between 1973 and 1978. Deep cones of depression in coastal Monmouth and Ocean Counties in the Englishtown and Wenonah-Mount Laurel aquifers are similar in location and shape, due to a good hydraulic connection between these aquifers. Water levels declined 2 to 31 feet in the Englishtown aquifer and 12 to 26 feet in the Wenonah-Mount Laurel aquifer between 1973 and 1978. Water levels in the Atlantic City 800-foot sand of the Kirkwood Formation define an extensive elongated cone of depression centered near Margate, Atlantic County. Head changes ranged from a decline of 4 feet to a recovery of 9 feet during 1970-78. The lowest heads in the Cohansey Sand were about 26 feet below sea level at Cape May, Cape May County, and less than 0.5 miles from salty ground water. (USGS)
W85-00854

GROUND WATER IN THE GREATER ATLANTA REGION, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
C. W. Cressler, C. J. Thurmond, and W. G. Hester.
Georgia Department of Natural Resources, Atlanta, Information Circular 63, 1983. 144 p, 37 Fig, 9 Tab, 59 Ref, 1 Map.

Descriptors: Wells, *Fractures, *Crystalline rocks, Borehole geophysics, Groundwater, *Fracture permeability, Pumping tests, Safe yield, Water quality data, *Stress relief fractures, High-yielding wells, Emergency supplies, Sustained yields, Sonic televiewer logs, Declining well yields, Contact zones, Fault zones, *Georgia, Atlanta.

Water supplies in the Greater Atlanta Region, Georgia, are obtained mainly from surface-water sources, but there is concern that these sources may be unable to meet rising demands. This study indicates that large quantities of good-quality ground water are obtainable from selected sites in the crystalline rocks of the area. Hydrogeologic investigations of 1,051 wells that produce 20 to nearly 500 gallons per minute revealed that large supplies can be developed where favorable structural, stratigraphic, and topographic features result in localized increases in bedrock permeability. These features are described in detail and methods are presented for using them in selecting sites for locating high-producing wells. Most of the site-selection methods are applicable to the north half of the report area, which has rectangular and trellis drainage systems, but their use is restricted in the south half where a dendritic drainage system predominates. Borehole geophysical logs and core drilling revealed that some of the highest production wells derive water from 1- to 8-inch wide horizontal fractures. These fractures occur in a variety of topographic settings and are believed to be stress-relief fractures. (USGS)
W85-00866

ORIGIN OF HIGH FLUORINE CONTENTS IN GROUNDWATERS FROM PALEOCENE AQUIFER OF MBOUR AREA (SENEGAL). ROLE OF THE MAGNESIUM ION (ORIGINE DES FORTES TENEURS EN FLUOR DES EAUX SOUTERRAINES DE L'AQUIFERE PALEOCENE DE LA REGION DE MBOUR (SENEGAL). ROLE DE L'ION MAGNESIUM),
Dakar Univ. (Senegal). Dept. de Geologie.
For primary bibliographic entry see Field 2H.
W85-00947

USE OF DISSOLVED OXYGEN AS INDICATOR OF HYDROLOGICAL STRUCTURES: APPLICATION TO KARSTIC AQUIFERS (UTILISATION DE L'OXYGENE DISSOUS COMME INDICATEUR DE STRUCTURES HYDROGEOLOGIQUES: EXEMPLE D'APPLICATION AUX AQUIFERES KARSTIQUES),
Montpellier-2 Univ. (France). Lab. d'Hydrogeologie.
J. P. Faillat, and J. Wyart.
Comptes Rendus De L'Academie des Sciences Paris, Series II, Vol. 298, No. 9, p 419-422, 1984. 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Dissolved oxygen, *Karst hydrology, *Aquifers, Physicochemical properties, Water temperature, Velocity, Confined aquifers.

Physicochemical parameters, the ions in solution and the dissolved gas of subterrainean waters were used to obtain information on the organization and function of hydrogeologic systems, notably karsts. There is a good relationship between the concentration of dissolved oxygen in water and the structure of some karstic aquifers, as well as with temperature of springs, based on differentials in discharge velocity, the distance traveled, the degree of confinement, the quantity of oxidizers, mean annual air temperature, and other parameters. Four types of aquifer structures were defined. (Collier-IVI)
W85-00948

MOVEMENT OF WATER FROM PEATLAND INTO SURROUNDING GROUNDWATER,
Western Michigan Univ., Kalamazoo. Dept. of Biology.
For primary bibliographic entry see Field 2L.
W85-00953

HYDROGEOCHEMISTRY OF CONTINENTAL BRACKISH WATERS IN THE SOUTHERN COASTAL PLAIN, ISRAEL,
Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotope Research.
For primary bibliographic entry see Field 2K.
W85-01095

2G. Water In Soils

OPTIMAL PREDICTION OF SATURATION AND WETTING FRONTS DURING TRICKLE IRRIGATION,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
D. Lockington, J.-Y. Parlange, and A. Surin.
Soil Science Society of America Journal, Vol. 48, No. 3, p 488-494, May-June, 1984. 4 Fig, 1 Tab, 29 Ref.

Descriptors: *Wetting fronts, *Soil saturation, *Trickle irrigation, Soil water, Mathematical equations, Diffusion, Saturated flow, Similarity solution.

The nonlinear diffusion equation in spherical geometry describes water movement from a point source into a porous medium. This situation occurs, for example, in the early stages of trickle irrigation. Prediction of the saturation and wetting front positions during irrigation is of obvious practical importance. In the present paper, a general formula which predicts the positions of the two fronts is found by optimization. For particular soil properties the exact numerical solution of the diffusion equation can be easily found and is used to check the accuracy of the optimization formula. This formula proves to be extremely accurate. A simple asymptotic solution is also obtained which compares favorably with the above results in the long-time limit. The maximum error associated with neglecting gravity is quantified using this solution and proves to be quite acceptable for most practical applications. In those few cases when this error is too large to be neglected and gravity needs to be included in the theory, other effects, e.g., instability, should also be considered. (Author's abstract)
W85-00751

SHALLOW-LAYER SOIL WATER POTENTIAL CHANGES DUE TO WATERDROP IMPACT,
Iowa State Univ., Ames. Dept. of Agronomy.
R. M. Cruse, and P. B. Francis.
Soil Society of America Journal, Vol. 48, No. 3, p 498-500, May-June, 1984. 4 Fig, 4 Tab, 10 Ref.

Descriptors: *Soil water potential, *Rain impact, *Soil erosion, Soil shear strength, Matric potential, Soil surface.

Soil shear strength is inversely related to soil water matric potential (psi sub m), which changes in the soil during a rainstorm. An understanding of surface soil psi sub m changes due to rainfall may give an insight in soil erosion dynamics. Changes in soil water matric potential (psi sub m) under 1- and 3-mm simulated soil surface seals were monitored following single waterdrop impacts on the soil surface. Selected psi sub m's were applied to the base of the seals with a hanging water column during the tests. After waterdrop impact, changes in psi sub m were detected within 2 to 3 s under 1-mm surface seals and within 6 to 10 s under 3-mm surface seals. The time required for psi sub m to equilibrate with the preimpact psi sub m (that psi sub m applied continuously with the hanging water column) ranged from 160 to 280 s. Equilibration time decreased slightly with increasing preimpact psi sub m's and was significantly affected by the type of soil material used to make the seal, the applied psi sub m, and the thickness of the seal. Increases in psi sub m under the 1-mm surface seal due to waterdrop impact ranged from 0.3 to 0.5 kPa depending on psi sub m applied via the hanging water column. Smaller psi sub m changes were observed under the 3-mm surface seal. (Author's abstract)
W85-00752

ANISOTROPY OF UNSATURATED SOILS,
Hebrew Univ., Jerusalem (Israel).
Y. Mualem.
Soil Science Society of America Journal, Vol. 48, No. 3, p 505-509, May-June, 1984. 6 Fig, 10 Ref.

Descriptors: *Anisotropy, *Unsaturated soils, *Mathematical models, Permeability coefficient, Saturated soils, Capillary head, Soil hydraulics.

A conceptual model is applied for quantitative evaluation of the anisotropy factor during desaturation. The soil is assumed to consist of many thin parallel layers having different hydraulic properties. A uniform density distribution function is used to represent the saturated hydraulic conductivity probability of the various layers. A power function relationship is assumed between the hydraulic conductivity and the capillary head. The exponent in the hydraulic conductivity-capillary head relationship and the air entry value are allowed to be variables. The model indicates that the degree of anisotropy of unsaturated soil may vary considerably from its value at saturation. Reducing the capillary head gradually from zero, the anisotropy factor first decreases to a minimum and then increases rapidly as the soil dries. In some cases, the anisotropy factor can reach values several orders of magnitude higher than at saturation. Soil layers with very low permeability tend to diminish anisotropy on desaturation. Conversely, large variation of the hydraulic properties of the layers would enhance anisotropy in the unsaturated state. (Author's abstract)
W85-00753

DRAINAGE OF A TROPAQUALF BEFORE AND AFTER WATER EXTRACTION BY A CROP,
Philippines Univ. at Los Banos.
T. Klodpeng, and R. A. Morris.
Soil Science Society of America Journal, Vol. 48, No. 3, p 632-635, May-June, 1984. 5 Fig, 2 Tab, 12 Ref.

Descriptors: *Drainage, *Tropaqualf, *Soil water extraction, *Monsoon transition, Crop production, Perched water table, Rice, Cowpea, Sorghum, Root development, Wet season, Dry season.

To improve production of crops planted after lowland rice (Oryza sativa L.) in monsoonal Asia, there is a need to understand more clearly the drainage pattern during the transition from the wet to the dry season. For crops of 75 to 80 d maturity, the top 750 mm of soil contains the bulk of the root system. This study determined the flux of water across the 750-mm plane and the water table recession patterns during the transition from wet to dry season and again after a crop had removed water from the soil. The study was conducted in three phases on a 9-m by 9-m plot of an Aeric Tropaqualfs. In the first phase, the soil was field saturated, covered with plastic sheeting, and drained for 30 d. In the second phase, a cowpea (Vigna unguiculata L. Walp) - sorghum (Sorghum bicolor L. L. Moench) intercrop was grown for 42 d. In the third phase, 22 mm of water was applied and soil was again covered and drained for 15 d. Volumetric water changes were determined by neutron scattering at 150-, 300-, 600-, 900- and 1200-mm depths. Tensionmeters were placed at the same depths. The plot was surrounded by flow barriers to a 750-mm depth. Drainage through the 750-mm plane during the first phase amounted to only 11 mm. A perched water table formed in and above the B horizon at 600 mm. The ground water table receded at 30 mm/d after it appeared below the perched water table on day 10. During the second phase roots penetrated at about 25 mm/d suggesting that the initial high water content was not a major impediment to root development. After a 22-mm irrigation, the drainage rate during the third phase was 1.2 mm/d, with drainage apparently coming both from applied water and water remaining in the profile prior to irrigation. The results suggest both opportunities and problems for using soil water remaining after rice harvest during the transition from wet to dry season. (Author's abstract)
W85-00754

ESTIMATION OF WATER POTENTIAL COMPONENTS OF SALINE SOILS OF GREAT BASIN RANGELANDS,
Arizona Univ., Tucson. School of Natural Resources.
B. A. Roundy.
Soil Science Society of America Journal, Vol. 48, No. 3, p 645-650, May-June, 1984. 6 Fig, 2 Tab, 31 Ref.

Descriptors: *Soil water potential, *Saline soils, *Rangelands, *Great Basin, *Nevada, Electrical conductivity, Matric potential, Solute potential, Semiarid lands.

A rapid method is described to assess the solute and matric components of the total soil water potential at field water contents of a saline soil in central Nevada. The solute potential is estimated from saturated paste conductivity (ECp) measurements easily made on the conductivity cell of an instant salinity meter and assumes that the salt concentration varies inversely with water content. The method requires determination of the relationship between ECp and the electrical conductivity of the saturated paste extract, ECe. The total water potential is measured with a Peltier psychrometer. Subtraction of the solute potential from the total water potential results in an estimate of matric potential. Matric potentials estimated in this way were similar to those determined by a pressure plate at volumetric water contents greater than 0.09 cu m/cu m soil and soil ECe's < 15/dSm. The method tends to underestimate solute potentials and overestimate matric potentials of soil with lower soil water contents and higher salinity. These measurements are useful in determining plant adaptability on saline, semiarid rangeland soils. (Author's abstract)
W85-00756

SOIL WATER VARIATION IN SPOIL AND UNDISTURBED SITES IN NORTH DAKOTA,
North Dakota State Univ., Mandan. Land Reclamation Research Center.
S. A. Schroeder, and A. Bauer.
Soil Science Society of America Journal, Vol. 48, No. 3, May-June, 1984. 1 Fig, 4 Tab, 7 Ref.

Descriptors: *Soil water, *Mine spoil, *North Dakota, Semiarid lands, Percolation, Groundwater recharge, Rooting zone, Saline soils, Land reclamation, Evapotranspiration, Unsaturated flow.

The capacity of a soil to store water during the nongrowing season to a large extent determines crop yields in a semiarid climate. Percolation below the rooting zone may lead to degradation of groundwater supplies by salts present in many North Dakota soils. The amounts of total soil water in reshaped, vegetated spoils disturbed during mining were compared with nearby undisturbed grassland sites at four coal mine sites in central North Dakota. Analyses of total soil water monitored over a 7-yr period (1974-1981) indicate that little, if any, water percolated beyond the rooting zone (0-122 cm) at either the spoil or undisturbed grassland sites. Total soil water below the rooting zone decreased over time, presumably due to upward movement by unsaturated flow in response to gradients created in the rooting zone by evapotranspiration. The spoil sites contained more total soil water in 1974 than the undisturbed sites but greater evapotranspiration losses at the spoil sites had presumably decreased soil water to a level nearly equal to that of the undisturbed sites by 1981. Any contribution of precipitation to groundwater recharge likely results from landscape position where ponding occurs from runoff or from fissures that extend into the material to allow water to penetrate deeper than the reach of growing vegetation. (Moore-IVI)
W85-00757

STUDIES ON THE DRAINAGE BEHAVIOR OF QUARTERNARY GRAVEL AND SAND MIXTURES (UNTERSUCHUNGEN ZUM ENTWASSERUNGSVERHALTEN VON QUARTAREN KIES- UND SANDGEMISCHEN),
Technische Univ., Munich (Germany, F.R.). Lehrstuhl fuer Hydrogeologie and Hydrochemie.
H. Blasig, B. Merkel, and P. Udluft.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17, No. 1, p 1-6, February, 1984. 7 Fig, 2 Tab, 12 Ref.

Descriptors: *Sand, *Gravel, *Lysimeters, Aeration zone, Drainage, Soil saturation, Permeability coefficient, Capillary tension.

For research on the zone of aeration, an apparatus was developed for the determination of drainage and saturation behavior, as well as the dependence of conductivity upon the water content. It consists of a weighable suction-lysimeter which can be operated with either vacuum or pressure. First results from quarternary model gravel-sand mixtures are described together with error calculations for the methods used. With the help of weighable lysimeters, it is possible to study the drainage be-

havior of gravel and sand. Using the tensiometers, the distribution and variability of the capillary tension can be studied. (Moore-IVI)
W85-01055

EFFECT OF SOIL MOISTURE UPON SOIL ALBEDO,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
E. A. Graser, and C. H. M. Van Bavel.
Agricultural Meteorology, Vol. 27, No. 1-2, p 17-26, November, 1982. 4 Fig, 3 Tab, 13 Ref.

Descriptors: *Albedo, *Soil water potential, Soil texture, Soil water, Remote sensing.

A general relation between soil water and albedo would be useful for field situations where soil types are mixed, on unknown such as in remote sensing studies. The relation between albedo and water potential was determined for three soils (Arenosa fine sand, Lufkin fine sandy loam, Norwood silty clay) and compared to the corresponding relation between albedo and water content. Homogeneous disks of soil were equilibrated at different water potentials, and their albedo measured outdoors, using a pyranometer with a 28 degree view angle. The albedo varied with water potential over a small range, different for each soil, but apparently related to texture. The potential at which this occurs appears lower for fine-textured soils than for coarse-textured ones. Outside that range, the albedo was essentially constant. This abrupt change in albedo with water potential does not accord with the proposed mechanism that the change in albedo results from the change in conformation of the soil water body, as the amount of water in the soil varies. It does support the mechanism of total internal reflectance. The findings suggest that the relation between albedo and water potential can be established with fewer measurements than the relation between albedo and water content. (Moore-IVI)
W85-01071

AMOUNT OF SOIL ICE PREDICTED FROM WEATHER OBSERVATIONS,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
J. W. Cary.
Agricultural Meteorology, Vol. 27, No. 1-2, p 35-43, November, 1982. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Ice, *Soil ice, Air temperature, Heat transfer, Solar radiation, Snow depth, Prediction, Freezing.

Frozen soil reduces the infiltration of water; this is an important factor in the hydrology of watersheds that experience low temperatures. An equation has been developed that gives the net daily heat flux across the soil surface in the winter. The equation is based on the Fourier heat flow relation using the thermal gradients and conductivity at the soil surface. Input requires the daily maximum/minimum air temperatures, solar radiation and snow depth. The cumulative daily soil heat flux was used to estimate the amount of ice in the soil. Given a site constant that accounts for soil type and cover conditions, the presence of absence of soil ice can generally be correctly predicted at least 70% of the time over a period of years that includes both warm and cold extremes. The ability to predict the occurrence of frozen soil from this type of information would be quite useful in hydrologic modeling of water storage and runoff. (Moore-IVI)
W85-01072

ERROR ANALYSIS OF AIRBORNE GAMMA RADIATION SOIL MOISTURE MEASUREMENTS,
National Weather Service, South Minneapolis, MN. Airborne Snow Survey Program.
W. K. Jones, and T. R. Carroll.
Agricultural Meteorology, Vol. 28, No. 1, p 19-30, January, 1983. 2 Fig, 3 Tab, 20 Ref.

Descriptors: *Error analysis, *Soil water, *Gamma radiation attenuation, Remote sensing, Calibration, Aerial sensing.

The gamma radiation attenuation technique is capable of measuring the soil moisture flux in the upper 20 cm of the soil surface with the accuracy necessary for operational applications. Ground-based soil moisture data collected along 155 calibration flight lines in the upper Midwest indicate mean areal soil moisture values can be calculated with a root mean square (RMS) error of 3.9% soil moisture. Approximately 80% of the error is due to airborne instrumentation sensitivity, while only 20% results from the flight line calibration using ground-based soil moisture data. To obtain airborne soil moisture measurements on a specific flight line with an error at 4% soil moisture, approximately two typical airborne calibration flights are required. Alternatively, twice as many ground soil moisture samples collected during a one-time calibration flight would provide data sufficient for similar ariborne measurement accuracy. The airborne gamma radiation technique is capable of measuring reliable, real-time, mean areal soil moisture values over large areas, with the accuracy required for operational hydrologic and agricultural applications. (Moore-IVI)
W85-01075

2H. Lakes

PARTITIONING OF HEAVY METALS (MN, FE, AS, CD, PB, CU, ZN, CO AND NI) INTO SELECTIVE CHEMICAL FRACTIONS IN SEDIMENT CORES FROM LAKE BIWA (IN JAPANESE),
Okayama Univ., Kurashiki (Japan). Inst. for Agricultural and Biological Sciences.
For primary bibliographic entry see Field 5B.
W85-00527

EFFECTS OF BOTTOM DREDGING ON SOME ENVIRONMENTAL FACTORS AND BENTHIC ANIMALS IN THE SOUTH BASIN OF LAKE BIWA (IN JAPANESE),
Kyoto Univ., Otsu (Japan). Otsu Hydrobiological Station.
A. Terashima, and T. Ueda.
Japanese Journal of Limnology, Vol. 43, No. 2, p 81-87, April, 1982. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Dredging, *Lake Biwa, *Japan, *Environmental effects, *Benthic fauna, Midges, Light penetration, Water temperature, Dissolved oxygen, Hydrogen ion concentration, Ammonium, Nitrates, Nitrites, Phosphates, Organic carbon, Lake sediments, Stratification, Anaerobic conditions.

The bottom area (ca. 4 m deep) of 25 ha in the south basin of Lake Biwa was intensively dredged. As a result of dredging, water depth became deep to ca. 15 m. Physico-chemical factors (light attenuation, water temperature, dissolved oxygen, pH, NH4-N, NO2-N, NO3-N, PO4-P, particulate organic carbon, particulate organic nitrogen, ignition loss of bottom sediment) and the number of benthic animals were surveyed almost biweekly from March 1980 to April 1981, both in the dredged area (Sta. 1) and an adjacent one (Sta. 2, ca. 4 m deep). Annual average compensation depth at Sta. 1 was about 5.5 m, and the aphotic layer was found throughout the year. Stratification of water temperature continued from April to the middle of September. Dissolved oxygen was not detected in the bottom layer during June-August, but NH4-N and PO4-P were observed in noticeably high concentrations. These nutrients must be produced under anoxic conditions. There were no differences in the ignition loss and the organic carbon and nitrogen contents between surface sediments of the bottom at Stas. 1 and 2. This finding suggests that the organic matter content of the bottom sediment at Sta. 1 was not reduced by dredging. Chironomidae were very few at Sta. 1 for the four months from the middle of June to the middle of October. This phenomenon might be related to the anaerobic condition of the bottom sediment during summer. (Author's abstract)
W85-00528

BACTERIAL MINERALIZATION OF ORGANIC MATTER IN LAKE SAGAMI (IN JAPANESE),
Samukawa Purification Plant (Japan).
S. Maeda.
Japanese Journal of Limnology, Vol. 43, No. 2, 88-95, April, 1982. 4 Fig, 3 Tab, 29 Ref.

Descriptors: *Lake Sagami, *Japan, *Mineraliz tion, *Organic matter, *Bacterial physiology, Re piration, Lake sediments, Biochemical oxyge demand, Decomposition, Plankton, Nitrates, Tu bidity, Chlorophyll a.

Community respiration and bacterial respiratio together with some environmental factors wer measured in Lake Sagami, Kanagawa Prefectur The annual mean of community respiration (3.77 O2/sq m/day) was 9.7% of that of BOD in th water column of Lake Sagami. Also communit respirations of 0 and 1 meter in depth (1.06 an 1.07 g O2/cu m/day) were 29.4 and 27.2% of th annual means of BOD, respectively. Therefore, th high activity of planktonic organisms was suggest ed to affect the quality of the lake water in th epilimnion. Since the annual mean of bacterial res piration (1.63 g O2/sq m/day) was 43% of commu nity respiration, bacteria were considered to pla an important role in the decomposition of organi matter. But bacteria in the hypolimnion were muc more inactive than those in the epilimnion. Bacte rial respiration had a strong correlation with tur bidity, BOD, NO3, chlorophylla and total numbe of bacteria. Among other factors, bacterial respira tion was assumed to depend on BOD. (Author' abstract)
W85-00529

ESTIMATION OF ALLOCHTHONOUS AN AUTOCHTHONOUS ORGANIC MATTER O THE FRESH SEDIMENTS ON THE BASIS O TI CONTENT,
Nagoya Univ. (Japan). Water Research Inst.
K. Matsunaga.
Japanese Journal of Limnology, Vol. 43, No. 1, p 113-120, April, 1982. 3 Fig, 3 Tab, 34 Ref.

Descriptors: *Organic matter, *Titanium, *Sediments, *Lake Kizaki, *Japan, Organic carbon, Nitrogen, Phytoplankton, River Naka-Nogu, Particulate matter, Lake sediments, Mesotrophic lakes.

Sediment traps were deployed at the depths of 10, 20 and 25 m in the profundal area of Lake Kizaki (a Japanese mesotrophic lake) from April to June in 1969 to collect fresh sediment, which were then analyzed for organic carbon and nitrogen, and Ti. Only trace amounts of Ti have been found in phytoplankton. Since particulate matter of the surface water mainly consisted of phytoplankton, Ti can be a useful tool for the separation of the organic carbon of the fresh sediments into allochthonous (from outside the lake) and autochthonous materials on the basis of Ti, assuming that allochthonous organic matter was refractory. Autochthonous materials accounted for 61% and 41% of the fresh sediment at the depths of 10 m and 25 m, respectively. Allochthonous materials increased from 39% to 59% of the fresh sediment at 10 m and 25 m, respectively. The values of 217, 173 and 88 mg C/sq m/day at the depths of 10, 20 and 25 m, respectively, were obtained for the fluxes of autochthonous organic carbon corrected by microbial attack of autochthonous organic matter during the sediment trap mooring. About 129 mg C of autochthonous organic carbon would be degraded in the water column with 1 sq m of the cross section and depth from 10 to 25 m, for one day, which corresponded to about 60% of the flux of autochthonous organic carbon sinking through the 10 m depth. The fluxes of allochthonous organic carbon increased from 137 to 198 mg C/sq m/day at 10 and 25 m respectively, due to the supply of allochthonous materials from the River Naka-Nogu. (Collier-IVI)
W85-00532

RELATIONSHIP BETWEEN MORPHOMETRIC FEATURES AND ORGANIC MATTER CONTENTS OF BOTTOM SEDIMENTS AT THE DEEPEST POINTS OF LAKES (IN JAPANESE),

Hokkaido Fish Hatchery, Sapporo (Japan).
T. Ito.
Japanese Journal of Limnology, Vol. 43, No. 4, p 230-236, October, 1982. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Hokkaido, *Japan, *Bottom sediments, *Lake sediments, *Organic matter, *Lake morphology, Sediments, Nitrogen, Organic carbon, Ignition loss, Water depth, Path of pollutants.

Based on the analysis of the surface layer (0-3 cm) of bottom sediments at the deepest points of 10 lakes in Hokkaido and on the data by other investigators on the organic matter of 10 other Japanese lakes, the relationship between morphometric features and organic matter contents of bottom sediments of lakes was investigated. Concentrations of total nitrogen, organic carbon and ignition loss of the bottom sediments were reversely correlated with the common logarithms of maximum depths in deep (over 30 m in maximum depth) natural lakes. The concentration of organic matter was also related with the ratio of the length of shore line to area except for artificially polluted lakes, man-made lakes, and very large or small lakes. Hence, organic matter of bottom sediments was suggested to be primarily influenced by the morphometric features of lakes. Organic matter of bottom sediments at the deepest points of 20 Japanese lakes consisted of total nitrogen 0.07-0.81%, organic carbon 0.21-7.05%, and ignition loss 6-24%. (Author's abstract)
W85-00534

LIMNOLOGICAL STUDIES ON FUKUJI RESERVOIR AT HIGASHI-SON, OKINAWA ISLAND; PART 1. PHYSICOCHEMICAL FACTORS AND PLANKTON,
Okinawa Inst. of Physicachemical Research, Okinawa City.
E. Toyama.
Japanese Journal of Limnology, Vol. 43, No. 4, p 246-253, October, 1982. 3 Fig, 2 Tab, 13 Ref.

Descriptors: *Fukuji Reservoir, *Okinawa Island, *Japan, *Plankton, Physicochemical properties, Zooplankton, Thermal stratification, Chlorophyta, Diatoms, Ammonium, Phosphates, Limnology, Dissolved oxygen.

Fukuji Reservoir is multipurpose, but serves mainly as a drinking water source. The reservoir has a total storage capacity of 51,000,000 cu m. The physicochemical conditions and the species composition of plankton in Fukuji Reservoir were investigated during the main seasons from June 1980 to February 1981. In the summer, thermal stratification was markedly developed, but was not observed in winter. The difference between temperatures at the surface and at the bottom for August was approximately 17 C. The water temperature was considered to form the various limnological characteristics in the reservoir. With respect to plankton, 17 genera and 38 taxa were recorded at the sampling station. Green algae were the most abundant plankton in the summer, and diatoms developed profusely in the winter. The zooplankton were surprisingly few in both number and species during the winter. The development of plankton in the summer was associated with the abundance of inorganic nutrients such as NH4(+) and PO4(3-). The reservoir was stratified so markedly during the summer that the plankton population was extremely reduced in August as a result of the dissolved oxygen deficiency. (Moore-IVI)
W85-00536

COMPLEXING CAPACITY OF RIVER WATER (IN JAPANESE),
Hirosaki Univ. (Japan). Dept. of Earth Sciences.
S. Nakaya, and A. Goto.
Japanese Journal of Limnology, Vol. 43, No. 4, p 272-274, October, 1982. 1 Fig, 1 Tab.

Descriptors: *Iwaki River, *Aomori Prefect, *Japan, *Complexing capacity, Chelating agents, Particulate matter, Suspended sediments, Wastewater pollution, Water pollution sources.

Complexing capacity of waters of Iwaki River, Aomori Pref. was determined using Sasaki's method. This method consists of the dissolution of equivalent copper (II) oxide with chelating agents to be determined and the subsequent spectrophotometry of dissolved copper (II) with sodium diethyl-dithiocarbamate (Na-DDTC). Complexing capacity of river waters increased from the upper to the lower reaches of Iwaki River, and concentrations from 0.3 x 10 to the minus 7th to 7.1 x 10 to the minus 7th M for non-filtered samples were observed. But the concentrations for filtered samples by nucleopore filter (pore size: 0.4 micro m) were comparatively constant. These findings suggested that complexing capacity of river waters resulted from the wastewater pollutants, especially the suspended or particulate matters larger than 0.4 micro m. However, whether these matters are the origin must be studied in detail in the future. (Author's abstract)
W85-00538

LITTORAL SURVEY OF THE CHIRONOMIDAE IN RESERVOIRS OF NAGOYA CITY AND SUBURBS,
Aichi Medical Univ. Association, Nagakute (Japan). Dept. of Parasitology
For primary bibliographic entry see Field 5C.
W85-00539

CORRELATION OF THE FLORA OF AQUATIC MACROPHYTES WITH THE CHEMICAL CONTENTS OF WATER IN THE IRRIGATION RESERVOIRS OF TOKAI DISTRICT (IN JAPANESE),
Ichimuragakuen Takakura High School, Nagoya (Japan).
S. Hamashima.
Japanese Journal of Limnology, Vol. 44, No. 1, p 1-5, January, 1983. 1 Fig, 3 Tab, 18 Ref.

Descriptors: *Tokai District, *Japan, *Macrophytes, *Chemical composition, Reservoirs, Altitude, Hydrogen ion concentration, Calcium, Potassium, Magnesium, Aquatic plants, Species composition, Water pollution effects.

To clarify the relationship between the occurrence of aquatic macrophytes and the chemical nature of the water, the flora of aquatic macrophytes grown in 122 irrigation reservoirs in Tokai District was investigated along with some major elements (pH and concentrations of Ca, K and Mg) in the water of 65 randomly selected reservoirs. By dividing the irrigation reservoirs into three altitudinal locations (plain, lower hillside, and higher hillside), it was revealed that 23 species of the aquatic macrophytes (exclusive of two omnipresent species, Phragmites communis and Zizania latifolia) inhabiting these reservoirs could be classified into six groups. Since both pH and the concentrations of the three elements in the water gradually lowered with the higher altitude of reservoirs, it was supposed that the flora of each reservoir was considerably influenced by some elements of its water, and the latter must in turn have been affected by the geographical feature of the basin in which the reservoirs were located. (Author's abstract)
W85-00540

STUDIES ON A FRESHWATER RED TIDE IN LAKE BIWA - I. CHANGES IN THE DISTRIBUTION OF PHYTOPLANKTON AND NUTRIENTS (IN JAPANESE),
Kyoto Univ. (Japan). Div. of Tropical Agriculture.
For primary bibliographic entry see Field 5C.
W85-00541

STUDIES ON A FRESHWATER RED TIDE IN LAKE BIWA - II. RELATION BETWEEN OCCURRENCE OF RED TIDE AND ENVIRONMENTAL FACTORS (IN JAPANESE),
Kyoto Univ. (Japan). Div. of Tropical Agriculture.
Y. Yoshida, T. Matsumoto, and H. Kadota.
Japanese Journal of Limnology, Vol. 44, No. 1, p 28-35, January, 1983. 8 Fig, 13 Ref.

Descriptors: *Lake Biwa, *Japan, *Red tide, *Phytoplankton, *Uroglena, Weather patterns, Chlorophyll, Water temperature, Eutrophication, Dinoflagellates.

A freshwater red tide of Uroglena americana usually occurred after the continuation of windless weather for several days and disappeared after stormy weather. Three typical distribution patterns were obtained as the results of observation of the distribution of temperature and chlorophyll. In Type I, the vertical distribution of both chlorophyll and temperature were uniform from the water surface to the bottom. In Type II, the peak of chlorophyll concentration was found at the depth of 2-3 m. In Type III, the maximum concentration of chlorophyll in the vertical distribution was found at the surface of lake water where water temperature was remarkably high compared with that of the deeper water. A dense accumulation in the horizontal pattern of colonies of U. americana was found in the area where the temperature of surface water was relatively low, in the case of Type II. On the contrary, with Type III, the population maximum was found in the area where the water temperature was relatively high. (Author's abstract)
W85-00542

DIURNAL VARIATIONS OF PHYSICO-CHEMICAL FACTORS AND PLANKTONIC ORGANISMS IN JOS PLATEAU (WEST AFRICA) WATER RESERVOIR,
Jos Univ. (Nigeria). Dept. of Botany.
M. A. Khan, T. Fagbemi, and C. Ejike.
Japanese Journal of Limnology, Vol. 44, No. 1, p 65-71, January, 1983. 3 Fig, 16 Ref.

Descriptors: *Lamingo Reservoir, *Jos Plateau, *Nigeria, *Plankton, *Physicochemical properties, *Diurnal distribution, Dissolved oxygen, Hydrogen ion concentration, Water temperature, Alkalinity, Chlorides, Copepods.

The diurnal rhythm of planktonic organisms in relation to various physico-chemical variables was monitored during the dry, hot and rainy seasons of 1981 in the Lamingo reservoir in Jos Plateau, Nigeria. The period of high dissolved oxygen (DO) concentration coincided with the relatively high pH values observed at noon, although pH was circum-neutral throughout with relatively narrow diel variations. Maximum and minimum temperatures were recorded at 12 noon and 4 am, respectively, on all sampling days. Bicarbonate alkalinity decreased during daytime when photosythesis was taking place, compared with increased values of alkalinity recorded during night hours. Chloride content exhibited little fluctuation. Phytoplankters and zooplankters were classed into three groups each based on their seasonal occurence and their diel variations. Phytoplankton showed typical diel variations, characterized by their abundance during early hours of the day followed by a decline in the number at night. The phytoplankton density was directly related to DO concentration. The zooplankton increased at night in the surface layer and decreased during the daytime. Different reproductive stages of organisms responded differently to the diel nature of the physico-chemical environment: adult copepods exhibited nocturnal movements and the immature nauplii stages did not. (Collier-IVI)
W85-00544

ONONDAGA LAKE AND THE DYNAMICS OF CHLORIDE IN THE OSWEGO RIVER,
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
S. W. Effler, M. G. Perkins, and S. D. Field.
Water, Air, and Soil Pollution, Vol. 23, No. 1, p 69-80, July, 1984. 5 Fig, 1 Tab, 30 Ref.

Descriptors: *Onondaga Lake, *Oswego River, *Seneca River, *Oneida River, *New York, *Chlorides, Dynamics, Mass balance, Path of pollutants, Dissolved oxygen, Organic matter, Phytoplankton, Tracers.

The dynamic character of chloride concentration in the Oswego River, New York, during a three month summer period in 1982, downstream of Onondaga Lake and the dynamics of mixing that occurred between the lake and the two rivers (the Seneca and Oneida Rivers) that combine to form

the Oswego were analyzed through a simple mass balance approach on chloride. Onondaga Lake is polluted with chloride and enriched in organics in the form of phytoplankton; the lake releases through a single 4.5 m deep outlet into the Seneca 10.9 km upstream of the Three Rivers junction. The chloride concentration and load in the Oswego River were highly variable with time, largely due to the dynamics of flow release from Onondaga Lake. Dramatic chloride gradients exist among the three sources of the Oswego: Onondaga Lake > Seneca River (above the lake) > Oneida River. The chloride distribution in the Oswego River, with its unique dynamics and chemically conservative nature, make it a valuable hydraulic tracer for the system. The tracking of chloride through the system has allowed the delineation of the nature of various physical processes which greatly influence the behavior of more critical parameters, such as dissolved oxygen, and has enhanced the ability to simulate that behavior. (Collier-IVI)
W85-00549

WATER QUALITY OF BELTON LAKE, CENTRAL TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 5A.
W85-00622

RIVER HULL, A NORTHERN ENGLISH CHALK STREAM: THE ZONATION OF THE MACRO-INVERTEBRATE FAUNA WITH REFERENCE TO PHYSICAL AND CHEMICAL FEATURES,
Universitaet des Saarlandes, Saarbrucken (Germany, F.R.). Fachrichtung Mikrobiologie.
R. G. Pearson, and N. V. Jones.
Archiv fur Hydrobiologie, Vol. 100, No. 2, p 137-157, 1984. 2 Fig, 5 Tab, 37 Ref.

Descriptors: *River Hull, *England, *Invertebrates, *Chalk streams, Stream biota, Species composition, Stream classification, Salinity, Water pollution effects, Stream gradient, Velocity, Substrates, Water temperature, Macrophytes, Calcareous streams.

The River Hull has low gradient and high conductivity. Three zones are recognized: the upper, which is a typical chalk stream; the middle, which is an embanked channel crossing the boulder clay plain; and the lower, which is tidal, polluted and frequently saline in its lower reaches. Three major biotic zones are recognized which concur with the three physical zones. The upper zone was characterized by running water species and by the predominance of Gammarus pulex; the middle by a relatively high number of species, including many that are typical of still water; and the lower by pollution-tolerant species. There was overlap between zones and gradation within them. The major influences on the distribution of species in the River Hull are several interrelated physical factors: the stream size, gradient, current velocity and substratum. Temperature, the distribution of macrophytes and the effects of organic pollution and salinity partly govern the distribution of some species. The Hull was very different biologically from other types of stream, mainly because of its low gradient, moderate to low current velocities, calcareous nature and the relatively mobile substratum. (Moore-IVI)
W85-00627

ECOLOGICAL CHARACTERIZATION OF DIFFERENT TYPES OF WATERCOURSES BY THE MULTIVARIATE ANALYSIS OF CILIATED PROTOZOA POPULATIONS,
Hull Univ. (England). Dept. of Zoology.
P. Madoni.
Archiv fur Hydrobiologie, Vol. 100, No. 2, p 171-188, 1984. 8 Fig, 2 Tab, 21 Ref.

Descriptors: *Protozoa, *Italy, *Species composition, *Ecological distribution, Physicochemical properties, Biotopes, Geomorphology, Water pollution effects, Multivariate analysis, Cluster analysis, Ecotopes, Biocenotypes.

Factorial analysis of the correspondences and minimum variance clustering was used to define the ecological structure of a watercourse network situated on the northern slope of the Northern Appenines (Italy) according to the ciliated Protozoa populations. Samples representing the diverse biotopes were collected from 42 stations. An initial series of analyses conducted between physio-chemical parameters and stations was used to determine similarities between stations both in geomorphological factors (zonations) and pollution by organic matter. A second series of analyses was carried out between stations and species; the results were very near those previously obtained. The species are arranged on factorial plane F1-F2 according to a gradient corresponding to their saprobic valence. In order to obtain a deeper knowledge of the ties and affinities between the species, the data was subjected to a cluster analysis which made it possible to identify eight groups. When related to factorial plane F1-F2 of the correspondences, these groupings made it possible (in a typological context) to identify those groups of species (biocenotypes) which are representative of groups of stations (ecotopes). (Moore-IVI)
W85-00628

NUTRIENT BUDGET OF LAKE BOSTALSEE (SAARLAND) WITH PARTICULAR REFERENCE TO PHOSPHORUS AND NITROGEN (DER NAHRSTOFFHAUSHALT DES BOSTALSEES (SAARLAND) UNTER BESONDERER BERUCKSICHTIGUNG DES PHOSPHORS UND STICKSTOFFS),
Parma Univ. (Italy). Ist. di Ecologia.
For primary bibliographic entry see Field 5G.
W85-00629

EVOLUTION OF ALGAL AND DETRITAL COMPONENTS IN THE PARTICULATE ORGANIC CARBON OF THREE RIVERS FROM THE BASSIN PARISIEN (EVOLUTION DU CARBONE ORGANIQUE PARTICULAIRE 'ALGAL' ET 'DETRITIQUE' DANS TROIS RIVIERES DU BASSIN PARISIEN),
Ecole Normale Superieure, Paris (France). Lab. de Geologie.
S. Dessery, C. Dulac, J. M. Laurenceau, and M. Meybeck.
Archiv fur Hydrobiologie, Vol. 100, No. 2, p 235-260, 1984. 13 Fig, 3 Tab, 42 Ref.

Descriptors: *Vire, *Oise, *Seine, *France, *Organic carbon, *Detritus, *Algae, *Particulates, Chlorophyll, Seasonal variation, Phytoplankton, River flow, Bottom sediments, Eutrophication.

Seasonal chlorophyll variations have been set up on 20 stations of the Vire, Oise, and Seine rivers in the French Bassin Parisien. For the Vire and Oise these variations have been compared to those of particulate organic carbon (POC). Despite the similarity of the three rivers (regime, high nutrients levels), the chlorophyll levels and variations, and the algae counts are somewhat different. Chlorophyll behavior, which can be homogeneous along river stretches from 50 to 100 km, is linked to hydrodynamic and climatic conditions. Two major types of POC have been defined: first the 'algal POC', which is linked to pigments and comprises both living and dead phytoplankton, then the 'detrital POC', essentially allochthonous. These forms have been separated for each sample on the basis of POC/chlor.-a (SCOR-Unesco) ratio in river algal biomass estimated to 30. This value is the lower limit of the ratio, which reaches 500 in winter. As the high-water periods, occuring in winter in the three studied rivers, and the algal production periods are shifted, the seasonal variation of detrital and algal POC are opposite. Detrital POC is dominating during the winter time at any station and is up to 3 mg C/l; it increases with water discharge. During the summer time POC levels are very variable from one station to another. In the downstream section of the Vire river where reaches are numerous the algal POC (0.5 to 0.8 mg C/l) exceeds the detrital POC (<0.2 mg C/l) during 3 months. In the Oise river detrital POC is relatively high (1 to 3 mg C/l) all through the year due to bottom sediment stirring caused by navigation, but is still exceeded by algal POC (2 mg C/l) during the algae blooms (chlor.-a > 60 micro g/l). In t yearly POC budget the algal form represents 9 of the total riverborne POC in the upstream s tion of the Vire river, where slopes exceed 10 and 17% in the downstream section. In the ri Oise this proportion rises to 32% due to the high plankton production. (Author's abstract)
W85-00630

COMPARISON OF PHOSPHORUS TURNOVER TIMES IN NORTHERN MANITOBA RESERVOIRS WITH LAKES OF THE EXPERIMENTAL LAKES AREA,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. Planas, and R. E. Hecky.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 4, p 605-612, April, 1984. 4 Fig, Tab, 31 Ref.

Descriptors: *Turnover time, *Phosphorus, *Reservoirs, *Lakes, *Manitoba, *Ontario, Experimental Lakes Area, Seasonal variation, Chlorophyll, Limiting nutrients, Algae, Postimpoundment.

The turnover time, tau, of (P-32) PO4 was measured during July and September in a natural lak and two lakes in northern Manitoba that we undergoing impoundment in 1976. The tau valu were 10-1000 times longer than those observed the epilimnia and hypolimnia of two lakes beir experimentally enriched in northwestern Ontari (Experimental Lakes Area) in the same summe Algal populations in the Experimental Lakes Are exhibited short tau values over a large range temperature and light values, which exceeded th ranges of temperatures and light intensities mea ured in northern Manitoba. In northern Manitob the shortest tau values occurred in July when a independent indicator of sestonic P deficiency, th particulate alkaline phosphatase activity per un weight ATP, measured moderate to severe P def ciency. In September in northern Manitoba, ta values were at least 10 times greater than in Jul and were among the highest reported in the litera ture. The 2-yr-old Notigi Reservoir had the high est tau values in both July and September, and deviated strongly from the expected chlorophyll phosphorus relation for north temperature lakes These new reservoirs in northern Manitoba are no P limited and even the natural lakes may be onl moderately P limited. (Author's abstract)
W85-00636

BREAKDOWN OF CONIFER NEEDLE DEBRIS IN A NEW NORTHERN RESERVOIR, SOUTHERN INDIAN LAKE, MANITOBA,
Manitoba Univ., Winnipeg. DEpt. of Entomology
P. J. Crawford, and D. M. Rosenberg.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 4, p 649-658, April, 1984. 3 Fig, Tab, 44 Ref.

Descriptors: *Southern Indian Lake, *Manitoba *Conifers, *Needles, Decomposition, Waves, Erosion, Invertebrates, Chironomids, Leaching, Microorganisms, Aquatic habitats, Postimpoundment.

Formation of the Southern Indian Lake reservoir, northern Manitoba, added an estimated 540,000 of Picea mariana (black spruce) needles to the lake. The breakdown of needles in the lake was measured by stringing needles on monofilament lines, placing the strings into 3-mm mesh bags, and situating the bags along four shorelines representing high and low shoreline erosion rates (clay vs. bedrock) and wave exposures (highly exposed vs. protected). Sampling was done in phases of 0-41 and 328-384 d. Effects of excluding macroinvertebrates were tested by using needle strings placed in 5-micro m mesh bags at the clay low exposure shoreline. Needle breakdown apparently occurred in two stages. Initially, weight losses were due primarily to leaching and microbial conditioning. Subsequently, weight losses were due primarily to feeding by macrinvertebrates. Processing coefficients (k) ranged from 0.0011/d for the 50-micro m mesh bags to 0.0097/d for the 3-mm mesh bags at the bedrock high exposure shoreline. The presence

f macroinvertebrates and exposure to waves enanced needle breakdown. Macroinvertebrate colnization of needle strings occurred rapidly (> or = 3 d) and was mainly by chironomid larvae. haenopsectra punctipes (Wied.) and Brillia flavions (Joh.) larvae fed directly on needle tissue. lacroinvertebrates accounted for about 40% of otal weight losses and, apparently, were active ver the winter. Leaching and microbial conditionng each accounted for about 30% of total weight sses. Values of k for Southern Indian Lake most esembled those for conifer needle breakdown reorded in streams, indicating the significance of ave action in the lake. The breakdown of P. ariana needles in Southern Indian Lake appeared be a significant source of carbon during the year llowing impoundment, and needles may have een an important habitat for macroinvertebrates ithin localized areas. (Author's abstract)
V85-00639

HARACTERIZATION OF STREAM TEMERATURES IN PAKISTAN USING HARMONC ANALYSIS,
Voodward-Clyde Consultants, Englewood, CO.
. D. Steele.
Iydrological Sciences Journal, Vol. 27, No. 4, p 51-467, December, 1982. 9 Fig, 2 Tab, 22 Ref.

Descriptors: *Pakistan, *Stream temperature, Harmonic analysis, Variability, Water temperature, Temporal distribution, Arid lands, Altitude.

ntermittent water temperature measurements at 60 ites in Pakistan during the period 1961-1972 were nalyzed for annual variability and regional patrns. The basic data were taken from annual reorts published by the Pakistan Water and Power Development Authority. The period of record at ach site varied from 1 to 12 years. Harmonic nalysis functions were derived for data sets in ingle-year increments as well as for entire periods f record. For the majority of sites (44 of 60), 64% r more of the observed stream temperature variaility could be explained by a multiyear simple armonic function. Use of higher order harmonic unctions may have increased the variance exlained in some instances. In some cases, especially or streams in the more arid, western part of Pakitan, this procedure does not appear to explain dequately the observed annual variability of tream temperature. Diel variations and the interittent nature of flows in several other cases disracts from the extensive application of this proceure to all possible cases. Regional patterns howed a negative correlation of 0.84 between the armonic mean coefficient and measurement site ltitude. (Moore-IVI)
W85-00692

UANTITATIVE ANALYSIS OF PHOSPHORUS CYCLE IN THE SHALLOW BRACKISH AKE NAKANOUMI, JAPAN,
Shimane Univ., Matsue (Japan). Dept. of Agricultural Chemistry.
H. Ohtake, Y. Seike, A. Takeda, K. Kondo, and Y. Date.
Archiv fur Hydrobiologie, Vol. 94, No. 3, p 286-301, 1982. 7 Fig, 3 Tab, 23 Ref.

Descriptors: *Lake Nakanoumi, *Japan, *Phosphorus, *Brackish water, *Haloclines, Phosphates, Vertical distribution, Sedimentation rates, Nitrogen, Dissolved oxygen, Lake sediments, Cycling nutrients.

The rates of vertical transfer of phosphate through he halocline and release of phosphate from lake ediment were determined from phosphorus profile lata obtained for Lake Nakanoumi (Japan), a shalow brackish coastal body of water connected to he sea by the Sakai Channel. The lake surface-toottom salinity difference was usually greater than 5 0/00, averaging 8.2 0/00. Strong gradients in the oxygen saturation vertical profiles were observed directly below the halocline. High phosphate concentrations, up to 129 mg P/cu m, were observed n the bottom water layer below the halocline in summer. The mean rate of vertical transfer of phosphate through the halocline was 5-10 mg P/sq m/day. The halocline served as an effective barrier for the vertical transport of dissolved materials. Total-P and PO4-P concentrations showed distinct seasonal cycles with high values in the bottom waters below the halocline during the summer months; strong increases in PO4-P concentration below the halocline caused the total-P maximum concentration. Sedimentation rates averaged 6-10 g/sq m/day; this rate is similar to those reported for coastal water systems. The sedimentation rates of nitrogen and P were 80.8-168.2 mg N/sq m/day and 8.11-14.9 mg P/sq m/day. In comparison with the vertical P gradient, the horizontal gradient of P is very small. Vertical eddy diffusivity was 0.06-0.12 sq cm/sec. The mean rate of release of phosphate from lake sediment was 10-20 mg P/sq m/day. (Collier-IVI)
W85-00761

HYPOTHESIS RELATING TROPHIC STATUS AND SUBSURFACE CHLOROPHYLL MAXIMA OF LAKES,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
R. A. Moll, and E. F. Stoermer.
Archiv fur Hydrobiologie, Vol. 94, No. 4, p 425-440, 1982. 5 Fig, 65 Ref. NSF grant 0CE76-11355.

Descriptors: *Lake Michigan, *Lake Superior, *Trophic level, *Chlorophyll maxima, *Phytoplankton, Succession, Thermocline, Metalimnion, Epilimnion, Lake stages, Eutrophic lakes, Thermal stratification, Distribution patterns, Ecological distribution.

A small but rapidly growing body of information concerning the development of a deep-living phytoplankton layer is used to form an alternate hypothesis to the currently accepted theory of phytoplankton seasonal succession. This hypothesis shows how plankton in the late spring and throughout the summer occupy a low light, temperature, and turbulence niche in order to remain in a nutrient-rich environment. Species which occupy this niche form a distinct layer, generally in or below the thermocline. This deep phytoplankton layer contains up to ten times the concentration of chlorophyll in the surface water of Lake Michigan, and more than ten times in smaller lakes. The phytoplankton in the subsurface chlorophyll maximum have high levels of photosynthesis despite the low levels of light observed in the metalimnion. Implications of the deep chlorophyll maximum to general phytoplankton ecology have been considered especially in relation to the summer standing crop in thermally stratified lakes. The formation and persistence of the deep chlorophyll maximum is directly tied to trophic status of lakes. Experimental evidence from the Great Lakes is used to verify the hypothesis relating the deep chlorophyll maximum to trophic status. As lakes move toward increasing eutrophy, the environment available for subsurface phytoplankton growth is restricted by shading from epilimnetic algae growth. Eventually, a subsurface chlorophyll maximum cannot develop in highly eutrophic lakes. The subsurface maximum was maintained primarily by in situ growth in Lakes Michigan and Superior rather than by sinking cells. The subsurface chlorophyll maximum was observed to have an important effect on the vertical distribution of nutrients in Lake Michigan. (Author's abstract)
W85-00763

SEASONAL VARIATION OF WATER CHEMISTRY OF THE MIDDLE AMAZON VARZEA-LAKE LAGO CALADO (JAHRESZEITLICHE CHEMISCHE VERANDERUNGEN IN EINEM VARZEA-SEE DES MITTLEREN AMAZONAS (LAGO CALADO, BRASILIEN)),
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
K. Furch.
Archiv fur Hydrobiologie, Vol. 95, No. 1/4, p 47-67, 1982. 4 Fig, 54 Ref.

Descriptors: *Lago Calado, *Amazon varzea, *Seasonal variation, *Chemical composition, *Amazon River, Electrolytes, Cations, Anions, Silicon, Hydrogen ion concentration, Dissolved solids, Lake sediments, Macrophytes, Rain, Water level fluctuations.

The Lago Calado is situated in the inundation area of the Amazon, the so-called varzea, between the Amazon River itself, to which it is connected by a channel, and the adjacent, not inundated so-called terra firme. Due to the location of the lake it is influenced by inflowing water from the Amazon, from the terra firme and from rainwater falling directly into the lake basin. Since the Amazon water is relatively rich in electrolytes, whereas both rainwater and terra firme water are extremely poor in them, it is obvious that the chemistry of the lake water will vary according to the varying mixture of the three waters. Monthly samples of surface waters from the Amazon and two localities in the lake were studied from 1974 to 1977 over a period of 31 months. Concentrations of major cations, major anions, Si, H and dissolved solids (as specific conductance) were determined. The Amazon River shows a regular change of its water level with maxima in July and August and minima in November and December. The variation of its chemical quality is less regular. The lake however varies regularly with regard to both its water level and the chemical quality of its water. Lowest concentrations in the lake water were observed in December/January when water level is lowest. While at that time no river water flows into the lake, it receives rainwater and water flowing from the terra firme, both being extremely low in electrolytes. The concentrations in the lake water increase with rising water level, when Amazon water, relatively rich in electrolytes, flows into the basin. They decrease with falling water level, when rainwater and water from the terra firme, both poor in electrolytes, again dilute the lake water. However, it can be shown that not all changes of chemical composition and ion concentration observed in the lake water are due to mixing of the above three waters. The chemical impact of lake sediments and of decomposition processes of aquatic macrophytes on the lake water quality is also discussed. (Author's abstract)
W85-00764

DEVELOPMENT OF AQUATIC MACROPHYTES IN CURUA-UNA, THE FIRST MAN-MADE LAKE IN CENTRAL AMAZONIA (ZUR ENTWICKLUNG AQUATISCHER MAKROPHYTEN IN CURUA-UNA, DEM ERSTEN STAUSEE IN ZENTRALAMAZONIEN),
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
W. J. Junk.
Archiv fur Hydrobiologie, Vol. 95, No. 1/4, p 169-180, 1982. 2 Fig, 3 Tab, 15 Ref.

Descriptors: *Macrophytes, *Curua-Una River, *Amazonia, Effluents, Electrolytes, Hydrogen ion concentration, Water level fluctuations, Chemical properties, Lakes, Artificial lakes.

In May 1978 and September 1979 studies were made of the aquatic macrophytes in Curua-Una, the first man-made lake in Central Amazonia. The vegetation there is rich in species and individuals; their distribution and frequency show great differences in the various parts of the lake. In the part influenced by the Curua-Una River, the most important species are Eichhornia crassipes, Scirpus cubensis, Pistia stratiotes, Paspalum repens, Ceratopteris pteridoides and Salvinia auriculata. The almost complete absence of these species from the parts influenced by effluents of the Curua-Una River is explained by extremely low concentrations of electrolytes and low pH values of the water; in those areas Syngonanthus anomalus and Tonina fluviatilis are frequent. A mass development of Eichhornia crassipes, Scirpus cubensis and Pistia stratiotes can be observed. In 1978 the plants covered a total area of 13.45 sq km and in 1979 a total area of 15.39 sq km. The quantity of plants increased near the dam, because this area is influenced for the longest period by the increase of water level. The importance of regulating factors which inhibit the mass development of these plants in Amazonia under natural conditions is discussed. Beside hydrochemical conditions, the high periodical water-level fluctuations have to be considered as very effective regulating mechanisms. (Author's abstract)
W85-00766

SOLAR ENERGY AND QUANTA IN BALTIC LAKES,
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
H.-J. Krambeck.
Archiv fur Hydrobiologie, Vol. 95, No. 1/4, p 197-206, October, 1982. 3 Fig, 3 Tab, 6 Ref.

Descriptors: *Solar radiation, *Baltic, *Lakes, Quanta, Spectral analysis, Light penetration, Mathematical models.

While the spectral distribution of light in a water column depends mostly on prevailing conditions in the lake, the light impinging on lakes is ruled by comparatively few physical effects, which can easily be formulated as a mathematical model. The first part of the study emphasizes an exact derivation of the physical facts in dealing with the light above the water surface. Since the mathematical model of the impinging radiation contains the latitude, it can be applied to any lake on earth, although the results with respect to the existing field data are given for lakes of a latitude of about 55 degrees north. The second part of the study deals with underwater samples of the spectral radiation as a function of depth. The readings of a spectroradiometer allow the exact computation of energy and quanta of the actual spectral radiation, which changes significantly with increasing depth. (Baker-IVI)
W85-00767

METHANOGENESIS IN SEDIMENTS OF INLAND WATERS; 1. METHANOL AS THE DOMINANT METHANE- 'PRECURSOR' IN THE SEDIMENTS OF AN EUTROPHIC LAKE (METHANOGENESE IM SEDIMENT DER BINNENGEWASSER 1. METHANOL ALS DOMINANTER METHAN- PRECURSOR IM SEDIMENT EINES EUTROPHEN SEES),
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
M. Naguib.
Archiv fur Hydrobiologie, Vol. 95, No. 1/4, p 317-329, 1982. 2 Fig, 2 Tab, 50 Ref.

Descriptors: *Pluss-See, *Methane, *Methanol, *Lake sediments, *Eutrophic lakes, Sediments, Nitrogen, Acetate, Ammonium, Carbon dioxide, Pepton.

Methanol was found, for the first time, to be the dominant methane-precursor in in vitro experiments with sediments of the eutrophic lake Pluss-See. Methanol, in an end-concentration of 60 m-molar proved to be non-toxic and produced 13.3 micro moles CH4/g Wet Wt. sediments, corresponding to a 22% degradation of methanol. In comparison, the methane production of 0.2 micro moles from acetate and 0.8 micro moles from CO2 was negligible. The influence of the N2-sources, inorganic as NH4(+) and organic-bound as pepton, was followed in combination with the methane-precursors. The results indicate that the organic-bound-N2 with methanol and the inorganic NH4(+) in lower concentrations (in these experiments 88 micro molar) with acetate and CO2 were the most favorable N2-sources. The possible ecological significance of these findings is discussed. (Author's abstract)
W85-00769

NUTRIENT SUPPLY OF LAKE GREBINER SEE BY ATMOSPHERIC PRECIPITATION AND SURFACE RUN-OFF FROM THE WATERSHED AREA (NAHRSTOFFZUFUHREN DES GREBINER SEES DURCH ATMOSPHARISCHE NIEDERSCHLAGE UND OBERFLACHENABSCHWEMMUNG DES EINZUGSGEBIETES),
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
W. Ohle.
Archiv fur Hydrobiologie, Vol. 95, No. 1/4, p 331-363, 1982. 9 Fig, 18 Tab, 22 Ref.

Descriptors: *Nutrients, *Lake Grebiner See, *Precipitation, *Surface runoff, *Holstein, *West Germany, Hypolimnion, Dissolved oxygen, Hydrogen sulfide, Phosphates, Agricultural runoff, Nitrogen, Eutrophication, Source of pollutants.

Lake Grebiner See is one of the typical smaller Holstein water bodies situated in an intensively used agricultural district. It has a surface area of 26.89 ha and a mean depth of 9.54 m. The hypolimnion is free of dissolved oxygen and contains hydrogen sulfide in summer time because the lake is overloaded by phosphate and other nutrients deriving by aquatic and eolic erosion from agricultural fields and meadows which have been fertilized strongly. Areal loading of the lake reaches 1.69 g P/sq m/a and high amounts of nitrogen compounds. This means a real overfertilization because an aerobic metabolism of the lake would be possible only at a level of 0.30 g P/sq m/a, i.e. there would be oxygen left in the profundal contact water layer even in autumn. The phosphorus supply of Lake Grebiner See derived by 4% from atmospheric precipitation and only a rate of 0.1% came from the drainage water, but more than 95% from run-off reach in nutrients. This is the decisive factor of 'racing eutrophication' produced by aquatic and eolic erosion and not at all by sewage water. Lake Grebiner See is one of the typical examples of this development which unfortunately cannot be avoided but can be diminished, however, by distinct agricultural procedures. (Author's abstract)
W85-00770

LIMNOLOGICAL SURVEY OF THREE GREEK LAKES: TRICHONIS, LYSSIMACHIA AND AMVRAKIA (EIN LIMNOLOGISCHER UBERBLICK VON DREI GRIECHISCHEN SEEN: TRICHONIS, LYSSIMACHIA UND AMVRAKIA),
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
J. Overbeck, K. Anagnostidis, and A. Economou-Amilli.
Archiv fur Hydrobiologie, Vol. 95, No. 1/4, p 365-394, 1982. 9 Fig, 24 Tab, 41 Ref.

Descriptors: *Greece, *Lake Trichonis, *Lake Lyssimachia, *Lake Amvrakia, *Limnology, *Lake morphology, Monomictic lakes, Light penetration, Turbidity, Oligotrophic lakes, Mesotrophic lakes, Karst hydrology, Dissolved oxygen, Photosynthesis, Carbonates, Sulfates, Gypsum, Phytoplankton, Cyanophyta, Sediment-water interfaces.

Three lakes in the western part of central Greece were studied four times: March and August 1978, October 1979, and September 1981. They belong to the group of warm monomictic lakes with surface temperatures in summer of about 25 degrees C and a homogeneous temperature after winter turnover of 12 to 15 degrees C. The thermocline lies in about 15 m depth. Two of them are deep (Lake Trichonis; 97 sq km, about 50 m depth, and Lake Ambrakia; 14 sq km, about 40 m depth). The shallow Lake Lyssimachia (max. depth 6 m, area 13.5 sq km), belonging to the drainage area of L. Trichonis, differs considerably from the deep lakes: because of distinct turbidity, the underwater light is often highly attenuated; on the other hand, the mud-water exchange probably is rather high resulting in a much higher nutrient content than in the clear deep lakes. Also, the primary production of this lake is considerable. Basically, the deep lakes are oligotrophic but are now characterized by a nutrient accumulation in the hypolimnion and show rates of daily areal photosynthesis in the range of mesotrophic lakes. Light is not a limiting factor, going down to 20 m depth. Chemically, the lakes form two groups: L. Trichonis and Lyssimachia belong to lakes of the Carbonate type; L. Amvrakia belongs to the Sulfate type, caused apparently by outcrops of gypsum in the karstic environment of this lake. The oxygen content is higher with decreasing temperature, as is typical for oligotrophic lakes. The oxygen consumption in the hypolimnion is not complete; still, at the end of the stratification period we find some milligrams of O2 just above the sediment. Blue green algae can be of some importance only in Lake Amvrakia. The phytoplankton of the lakes is mostly characterized by Dinophyceae and Diatoms. (Author's abstract)
W85-00771

PRIMARY PRODUCTION OF VARIOUS SIZE FRACTIONS OF NATURAL PHYTOPLANKTON COMMUNITIES IN A NORTH GERMAN LAKE (PRIMARPRODUKTION VERSCHIEDENER GROSSENFRAKTIONEN DER NATURLICHEN PHYTOPLANKTONGEMEINSCHAFTEN IN EINEM NORDDEUTSCHEN SEE),
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
H. Rai.
Archiv fur Hydrobiologie, Vol. 95, No. 1/4, p 395-412, 1982. 6 Fig, 3 Tab, 68 Ref.

Descriptors: *Phytoplankton, *Schohsee, *Holstein, *West Germany, *Primary productivity, Nanoplankton, Biomass, Assimilation, Particulate carbon, Metabolism.

In situ primary production of Schohsee (Holstein, West Germany) natural phytoplankton communities and their subsequent size fractionation (< 250 to > 106, < 106 to > 35, < 35 to > 10, and < 10 micro m) was studied to determine the relative photosynthetic rates of different size fractions of natural phytoplankton. Nanoplankton (< 35 micro m fraction) contributed 40-90% of the total community assimilation and this fraction accounted for about 75% of the total phytoplankton community biomass (particulate carbon). The trend of total primary production fluctuations followed closely that of < 10 micro m fraction throughout the period of study. This study emphasizes the importance of adopting this differential fractionation technique for studying the complex phytoplankton metabolism and the importance of nanoplankton in the community dynamics. (Author's abstract)
W85-00772

WATER TEMPERATURES OF THE THYMALLUS-ZONE OF MIDDLE EUROPEAN RUNNING WATERS IN SUMMER (DIE SOMMERLICHEN WASSERTEMPERATUREN DER ASCHENZONE MITTELEUROPAISCHER FLIESSGEWASSER),
W. Schmitz, and G. O. Schuman.
Archiv fur Hydrobiologie, Vol. 95, No. 1/4, p 435-443, 1982. 2 Fig, 3 Ref.

Descriptors: *Europe, *Water temperature, *Running waters, *Thymallus, Denmark, Germany, Austria, Italy, Aquatic habitats, Salmonids.

Mean temperatures of running waters in Central Europe ranging from Denmark through Germany and Austria to Northern Italy were determined over a period from July to September 1957 by using sucrose-solution-tubes as thermometrical detectors. The rivers were investigated throughout their zones of grayling (Thymallus thymallus Gairdn.) or salmonid habitats and correlations between the occurrence of grayling and temperature were established. (Author's abstract)
W85-00773

ANOMALOUS STRATIFICATION BEHAVIOUR OF LAKE GORDON, HEADWATER RESERVOIR OF THE LOWER GORDON RIVER, TASMANIA,
Tasmania Univ., Hobart (Australia). Dept. of Botany.
M. S. Steane, and P. A. Tyler.
Australian Journal of Marine and Freshwater Research, Vol. 33, No. 5, p 739-760, 1982. 18 Fig, 1 Tab, 36 Ref.

Descriptors: *Thermal stratification, *Lake Gordon, *Lower Gordon River, *Tasmania, Reservoirs, Seasonal variation, Stratification, Thermoclines, Mixing, Hypolimnion, Meromixis.

The thermal pattern of Lake Gordon in spring and summer shows the reservoir to be of the oceanic type with a long, gradual change of temperature rather than an abrupt thermocline, and for most of the year there is no definite epilimnion. Oceanic profiles are common in the deeper lakes of southwestern Tasmania. Towards the end of summer, wind-induced mixing leads to a deepening and sharpening of the temperature gradient resulting in a more typical profile, with an isothermic epilimnion and an almost horizontal thermocline, at

bout 50 m, corresponding with an equally abrupt ycline. One unusual feature of the reservoir is e cold, oxygenated inflow and the upward dis-acement of the previous season's anoxic water to mixed subsequently into the underlying and verlying strata. For several months of the year, very horizontal strata of different lineage remains discrete body of water. The inflow introduces a mperature gradient in the bottom strata, but as is is only of about 1 degree C, it is doubtful hether, in its own right, it would be sufficient to event holomixis. The behavior pattern of Lake ordon appears to be rare in the temperate zone it more common in the tropics. When Lake ordon was formed, large areas of rainforest and dgeland were flooded, both yielding large nounts of organic material. This and the mor-nometry of the western parts of the reservoir are e conditions likely to produce prolonged anoxia d even biogenic meromixis of a special kind in hich a monimolimnetic pool of dense water accu-ulates at the base of the dam while much of the st of the reservoir remains holomictic. The hypo-nnion of Lake Gordon is now the effective head-ater of, and greatest contributor to, the lower ordon River. Because of the stratification pat-rn, the discharge stratum may be oxygenated or oxic and laden with hydrogen sulfide, iron, and anganese. Any undesirable effects of the latter e rapidly dissipated in a short stretch below the m, but the relatively invariable nature of the mperature and major ion chemistry of this stra-m impose an unwonted uniformity on the river, its mouth. (Baker-IVI)
85-00779

IOLOGICAL AND PHYSICOCHEMICAL HARACTERISTICS OF THE ROSS RIVER AM, TOWNSVILLE,
ommonwealth Scientific and Industrial Research rganization, Griffith (Australia). Centre for Irri-tion Research.
M. Finlayson, and J. C. Gillies.
ustralian Journal of Marine and Freshwater Re-arch, Vol. 33, No. 5, p 811-827, 1982. 8 Fig, 7 ab, 37 Ref.

escriptors: *Dams, *Ecosystems, *Physicochem-l properties, *Ross River Dam, *Townsville, ustralia, Aquatic vegetation, Phytoplankton, sh, Nutrients, Dissolved oxygen, Chlorophyll a.

ecific parameters of the Ross River Dam, which an artificial lake, investigated included aquatic getation, phytoplankton measurements, fish na, ionic characteristics, nutrient characteristics, ermal and dissolved oxygen characteristics, and ht penetration. The lake was characterized by a dium and chloride ionic dominance, may be po-mictic, and contains a relatively low ratio of total osphorus to total nitrogen due to the low nitro-n concentrations. The aquatic vegetation is despread and dominated by the submerged Hy-illa verticillata and Potamogeton javanicus. Both ecies are plentiful but are not major weeds. The ytoplankton were not in bloom in spite of chlo-phyll a concentrations near 10 mg/cu m. Of 11 ajor fish species recorded, Glossamia gilli was e most common. (Baker-IVI)
85-00783

PECIATION OF IRON, COPPER AND ZINC N THE HAWKESBURY RIVER,
dney Univ. (Australia). Dept. of Inorganic emistry.
or primary bibliographic entry see Field 5A.
85-00786

IMICTIC THERMAL REGIME AND MOR-HOLOGY OF BLUE LAKE IN THE SNOWY OUNTAINS OF NEW SOUTH WALES,
ustralian National Univ., Canberra. Dept. of Bio-ography and Geomorphology.
I. Raine.
ustralian Journal of Marine and Freshwater Re-arch, Vol. 33, No. 6, p 1119-1122, 1982. 1 Fig, 2 ab, 8 Ref.

escriptors: *Glacial lakes, *Temperature, *Lake orphology, *Blue Lake, *New South Wales, Thermoclines, Mountain lakes, Moraines, Maps, Ice cover.

Temperature measurements of Blue Lake, a glacial cirque lake 28 m deep, were taken in 1971 and 1972 and indicate a dimictic thermal regime. A new bathymetric map, showing moraine features, is presented. A previously unobserved feature is the small basin in the northern corner of the lake, which is barred by a submerged ridge, about 3 m high, composed of large blocks. Except where influent streams have built small non-lobate deltas at the north, west, and south-west corners of the lake, shore line development is minimal. The present surface area of the lake is 144000 sq m and the volume is approximately 1900000 cu m. Water level in the lake varies through the year by less than 1 m. Temperature profiles indicate a dimictic thermal regime. In Blue Lake, epilimnetic temperature appears to peak in late February and early March. Complete mixing began in April 1971 during the current study and continued until permanent ice formation in June, when lake temperature had dropped to one degree C except close to the sediment-water interface. In a region of predominantly monomictic lakes, its dimictic behavior is presumably due to its relatively great depth, cover of ice in winter and low ratio of inflow to volume. The depth of the summer thermocline and the period of holomixis to well below the temperature of maximum density attest to the importance of wind induced circulation in the alpine lakes. Only Blue Lake is deep enough to attain a stable summer hypolimnion. (Baker-IVI)
W85-00790

CHEMICAL AND BIOLOGICAL FEATURES OF TASMANIAN SALT LAKES,
Australian National Univ., Canberra. Research School of Pacific Studies.
P. De Deckker, and W. D. Williams.
Australian Journal of Marine and Freshwater Research, Vol. 33, No. 6, p 1127-1132, 1982. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Saline lakes, *Aquatic biota, *Chemical properties, *Tasmania, Fauna, Lakes, Sodium, Chloride, Crustaceans, Mollusks.

The chemistry and biota of 10 saline lakes in Tasmania were investigated. Only two of the lakes are highly saline and sodium and chloride dominate the ions. In ionic composition therefore, the lakes are similar to almost all mainland lakes, though the relatively large concentrations of magnesium are noteworthy. The taxa of greatest interest are the crustaceans and the mollusk, other fauna being both less diverse and less abundant. The salt lakes are dominated by crustaceans, almost all of which are endemic to Australia and involve in particular many different species of ostracod. The Tasmanian fauna is different in makeup from the South Australian fauna. The affinities of the Tasmanian salt-lake fauna lie with the fauna of the Victorian lakes; the Tasmanian salt lake fauna seems essentially an impoverished Victorian one. Most of the Tasmanian salt lakes dry out each summer. The persistence of Halomiscus searlei and Coxiella striata in the area indicates that at least some of the lakes regularly contain water for considerable periods, if not all year. (Baker-IVI)
W85-00791

STUDIES ON SOME LOTIC SYSTEMS IN THE NORTH-EASTERN HILL REGIONS OF INDIA,
Kohima Science Coll. (India). Dept. of Zoology.
M. Ao, J. R. B. Alfred, and A. Gupta.
Limnologica (Berlin), Vol. 15, No. 1, p 135-141, March, 1984. 1 Fig, 4 Tab, 21 Ref.

Descriptors: *Streams, *Lotic environment, *India, Algae, Physicochemical properties, Invertebrates, Benthic environment, Dissolved oxygen, Chemical properties, Physical properties.

Ecological investigations were carried out on a number of hill streams in and around Shillong, North-eastern region of India with the measurements of physical and chemical properties of the water and analysis of planktonic and periphytonic algae and benthic macroinvertebrates. Dissolved oxygen values were fairly high in all streams where low carbon dioxide and conductivities values prevailed. Under these conditions the pH readings were slightly acidic, while alkalinity and nutrients were in moderate concentrations. The most dominant group of algae in all the streams were the bacillariophyceae and these also exhibited the most diversification in form. Ephemeropteran nymphs were the most abundant of the benthic macroinvertebrates in all streams except two where simuliid larvae were dominant. The level of eutrophication in these streams is well within the limits of the natural regeneration capacity. (Baker-IVI)
W85-00799

INVERTEBRATE RECOLONISATION OF PREVIOUSLY DRY CHANNELS IN THE RAKAIA RIVER,
Ministry of Agriculture and Fisheries, Wellington (New Zealand). Fisheries Research Div.
P. M. Sagar.
New Zealand Journal of Marine and Freshwater Research, Vol. 17, No. 4, p 377-386, 1983. 5 Fig, 2 Tab, 19 Ref.

Descriptors: *New Zealand, *Rakaia River, *Invertebrates, Midges, Mayflys, Oligochaetes, Deleatidium, Colonization rates, Braided streams.

Recolonization of previously dry channels by stream invertebrates was studied in the Rakaia River (New Zealand) during winter 1981 and summer 1982. The winter experiment continued for 42 days, with stable low flows, whereas the summer experiment was characterized by fluctuating large flows which caused it to be abandoned after 27 days. The fauna was dominated numerically by Chironomidae, a leptophlebiid mayfly (Deleatidium), and oligochaetes during the winter, and by Deleatidium alone during the summer. Recolonization was considered complete after 33 days in winter and 15 days in summer. Flow fluctuations were the main factor affecting colonization rates, and it was assumed that drift was the main source of colonizing animals. Small freshes during low-flow periods in winter resulted in a rapid increase in total density of invertebrates and number of taxa present and also affected the population structure of Deleatidium larvae in colonization baskets. Before these freshes, numbers had increased steadily over a 27 day period. In summer, large floods during high flow periods initially decreased benthic invertebrate numbers in samples but numbers increased rapidly once the flood had passed. This appears to be the first study of its kind on a large unstable river system. (Author's abstract)
W85-00804

EFFECT OF VERTICAL MIXING ON THE PHYTOPLANKTON OF LAKE ROTONGAIO (JULY 1979 JANUARY 1981),
Department of Scientific and Industrial Research, Taupo (New Zealand). Div. of Marine and Freshwater Sciences.
A. B. Viner, and L. Kemp.
New Zealand Journal of Marine and Freshwater Research, Vol. 17, No. 4, p 407-422, 1983. 8 Fig, 3 Tab, 37 Ref.

Descriptors: *Lake Rotongaio, *New Zealand, *Phytoplankton, *Mixing, Growth rates, Stratification, Biomass, Diatoms, Chlorella, Anabaena, Synedra, Cyclotella, Seasonal variation.

The seasonal succession of the major phytoplankton species is described for Lake Rotongaio, a small New Zealand crater lake which flows into Lake Taupo via a short channel. The dynamics of only the 4 most abundant species are described. Expressed as cell numbers, Anabaena oscillarioides dominated in the warmer and stratified periods from November 1979 to April 1980 and again from September 1980 to the end of the observation period in January 1981. During destratification the diatoms Synedra ulna and Cyclotella menenghiniana attained maximum numbers. The green alga Chlorella vulgaris peaked immediately before the September 1980 stratification. When expressed as

cell volumes, however, the diatoms were always greater than Anabaena. It is proposed that these seasonal changes can largely be explained as being long-term versions of short-term population fluctuations seen during thermal stratification. These are interpreted to have been responses to vertical mixing with resulting changes in the availability of light for photosynthesis in the epilimnion. During thermal stratification, Anabaena is buoyed upwards, whereas the diatoms sink to the hypolimnion. To compensate for such losses, the growth rates of the diatoms must have been of an approximately similar magnitude to the growth rates leading to their winter maxima. The Synedra population decline may have been influenced by low temperature in mid-winter. Nutrient recirculation did not appear to be an important factor for phytoplankton biomass. There is little evidence for any important direct competition between the species for resources; the phytoplankton dynamics and biomass appear to be mediated directly by external events and not, in any important way, by internally generated conditions. (Author's abstract)
W85-00805

LAKE EUTROPHICATION IN NEW ZEALAND - A COMPARISON WITH OTHER COUNTRIES OF THE ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT,
Department of Scientific and Industrial Research, Taupo (New Zealand). Div. of Marine and Freshwater Sciences.
E. White.
New Zealand Journal of Marine and Freshwater Research, Vol. 17, No. 4, p 437-444, 1983. 3 Fig, 5 Tab, 13 Ref.

Descriptors: *New Zealand, *Organisation for Economic Co-operation and Development, *Eutrophication, Nitrogen, Phosphorus, Algal growth, Lake classification, Limiting nutrients.

The findings of the Organisation for Economic Co-operation and Development Co-operative Programme on Eutrophication are largely inapplicable to lakes in New Zealand. This is because the relative distributions of nutrient nitrogen and phosphorus in New Zealand lakes and those of the OECD study are very different. The limnological feature central to the OECD findings is that phosphorus is the nutrient limiting algal growth, nutrient nitrogen usually being massively in excess of algal requirements. Based on information from several sources, this is not true in New Zealand, where nitrogenous material in fresh waters is very much less abundant. Total nitrogen concentrations of less than 300 mg/cu m were not found in the OECD program, whereas concentrations in excess of this were found in only 7 out of 27 New Zealand lakes. For a total phosphorus concentration of 10 mg/cu m, the expected average concentration of total nitrogen in OECD data is 605 mg/cu m, but in New Zealand lakes it is only 177 mg/cu m. At a total phosphorus concentration of 100 mg/cu m the expected concentration of total nitrogen in OECD lakes is 1793 mg/cu m, whereas in New Zealand lakes it is only 513 mg/cu m. In many New Zealand lakes the relative availability of nitrogen to phosphorus approximates that required for balanced algal growth, and in some, shortage of nitrogen limits growth. Water managers aiming to control eutrophication in New Zealand lakes are advised to use the OECD predictive equations with the utmost caution. (Collier-IVI)
W85-00806

ASPECTS OF THE LIMNOLOGY OF LAKE ROTONGAIO,
Department of Scientific and Industrial Research, Taupo (New Zealand). Div. of Marine and Freshwater Sciences.
D. J. Forsyth, M. T. Downes, M. M. Gibbs, L. Kemp, and I. McCallum.
New Zealand Journal of Marine and Freshwater Research, Vol. 17, No. 4, p 423-435, 1983. 11 Fig, 4 Tab, 27 Ref.

Descriptors: *Lake Rotongaio, *New Zealand, *Limnology, *Monomictic lakes, Water temperature, Transparency, Zooplankton, Invertebrates, Benthos, Phytoplankton, Chlorophyll a, Phosphorus, Nitrogen.

Lake Rotongaio, a warm monomictic lake in New Zealand, was sampled at monthly intervals from October 1974 to September 1975 to investigate water temperature, transparency, chemistry, zooplankton, and benthic macroinvertebrates. Phytoplankton composition and standing crop represented by concentration of chlorophyll a, were measured for 6 months. Secchi disc values were always less than 2 m because of the large standing crops of algae dominated throughout the year by Anabaena oscillarioides. The major ion composition of the lake water indicated a source typical of a pumice aquifer. The average concentration of dissolved reactive phosphorus during the circulation period was 275 mg/cu m and the average reactive N:P ratio was 0.55. The decline in concentration of inorganic N during the breakdown of thermal stratification could not be accounted for by mixing, and 606 kg or 6.71 mg/cu m/d of inorganic N was lost from the lake. The zooplankton comprised rotifers (57%), crustaceans (34%), and ciliates (9%). There was 1 species of calanoid copepod, 2 species of cladocera, and 6 species of rotifer. Ninetyone percent of the benthic macroinvertebrates were chironomids; the rest were other insects, oligochaete worms, and molluscs. (Author's abstract)
W85-00807

OPTICAL PROPERTIES AND REFLECTANCE SPECTRA OF 3 SHALLOW LAKES OBTAINED FROM A SPECTROPHOTOMETRIC STUDY,
Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Science Centre.
For primary bibliographic entry see Field 5A.
W85-00808

RECONNAISSANCE SURVEY OF THE MINERALOGY AND GEOCHEMISTRY OF SOME NEW ZEALAND LAKE AND NEARSHORE SEDIMENTS,
Heidelberg Univ. (Germany, F.R.). Inst. fuer Sedimentforschung.
P. Stoffers, G. P. Glasby, W. L. Pluger, and P. Walter.
New Zealand Journal of Marine and Freshwater Research, Vol. 17, No. 4, p 461-480, 1983. 7 Fig, 7 Tab, 34 Ref.

Descriptors: *New Zealand, *Sedimentology, *Geochemistry, *Mineralogy, Lake sediments, Trace metals, Trophic level, Chemical analysis, X-ray spectroscopy, X-ray diffraction.

Previously collected sediment samples representing 4 different environments (lakes, sounds, harbors, and fiords) in New Zealand have been studied and characteristic differences in chemical composition and mineralogy noted. Samples were studied by standard X-ray diffraction methods, dry combustion, X-ray spectrometry, and optical examination. Most of the lake samples can be classified as silty clays to clayey silts. The fiord samples are characterized by a high sand content, which in some is greater than 30%. The differences in mineralogy observed in the samples primarily reflect the various source lithologies. Trace metal content in most of samples is very low. Some evidence of pollution effects is seen in the sediments of some of the North Island harbors and estuaries. New Zealand lakes are, in general, unpolluted by industrial compounds and are therefore useful in baseline studies of lake systems. Their trophic status has, however, been influenced by the effect of agricultural developments and fertilizer use. (Collier-IVI)
W85-00809

GEOCHEMICAL STUDY OF LAKE ERIE WATER NEAR CLEVELAND, OHIO,
Cleveland State Univ., OH. Dept. of Geological Sciences.
H. H. Lo.
Ohio Journal of Science, Vol. 84, No. 3, p 94-98, 1984. 2 Fig, 1 Tab, 6 Ref.

Descriptors: *Lake Erie, *Cuyahoga River, *Rocky River, *Geochemistry, Chemical analysis, Potassium, Sodium, Calcium, Magnesium.

In August 1981, 88 surface, intermediate-depth, and near-bottom water samples from 30 locations near Cleveland, Ohio, were collected from Lake Erie. The distribution of K, Na, Ca, and Mg with respect to water depth and location was investigated. Surface water generally had higher K, Na, Ca and Mg contents than near-bottom water. Elemental concentrations increased sharply near the mouths of the Cuyahoga and Rocky Rivers, and these higher levels are probably the result of cultural inputs from residential and industrial wastes. In Lake Erie water far from the river mouths, the average concentrations of K, Na, Ca, and Mg were 1.5, 12.0, 38.2, and 9.6 ppm, respectively. These values are comparable with those reported for mid-lake water of Lake Erie but are considerably lower than values found for water near the mouths of the Cuyahoga and Rocky Rivers. (Author's abstract)
W85-00810

SUMMER PLANKTON DYNAMICS IN ACTON LAKE, OHIO,
Procter and Gamble Co., Cincinnati, OH. Environmental Safety Dept.
M. A. Lewis.
Ohio Journal of Science, Vol. 84, No. 3, p 103-112, 1984. 3 Fig, 4 Tab, 35 Ref.

Descriptors: *Acton Lake, *Ohio, *Zooplankton, *Phytoplankton, *Population dynamics, Physicochemical properties, Lotic environment, Cyanophyta, Chlorophyta, Chrysophyta, Diatoms, Species diversity, Rotifers.

Acton Lake is a 250-ha impoundment of Four Mile Creek 60 km northwest of Cincinnati, Ohio. Contaminants are primarily eroded soils, septic tank seepage, sewage effluent, and agricultural runoff. A physicochemical profile of the lake was determined during May-October 1982. Anoxic conditions at lake bottom (6.2 m) were observed on only two occasions; this is attributable to the lotic nature of the lake. The photic zone typically extended to 3.9 m. Water temperature ranged from 13-29 degrees C while alkalinity and hardness varied from 110-141 mg/L as CaCO3 and 108-202 mg/L as CaCO3, respectively. The pH range was 6.8-8.0. Midday photosynthesis (carbon assimilation) ranged from an average of 20.7 mg C/cu m/h in October to 100.4 mg C/cu m/h during June. Plankton was quantitatively sampled from Acton Lake during July-September 1982. Eighty-two species of phytoplankton and 18 species of zooplankton were identified. Species of Cyanophyta dominated the phytoplankton, with species of Cyanophyta, Chlorophyta, and Chrysophyta comprising an average of 99% of the total cell volume. Overall the most abundant species during the study was the blue-green alga Schizothrix calcicola. Species of Cyclotella were the most numerous of the centric diatoms which dominated the Chrysophyta. More species of pennate diatoms were identified than centric species, however they were less abundant. The phytoplankton community is indicative of an organically enriched water. Rotifers dominated the zooplankton, averaging 87% of the species. Copepods and cladocerans were minor constituents of the zooplankton. The diversity index, species number and density of phytoplankton progressively increased whereas the same parameters for zooplankton were highest in August. (Collier-IVI)
W85-00811

WETLANDS OF THE WINNEBAGO POOL: A DETAILED FIELD SURVEY AND MANAGEMENT RECOMMENDATIONS,
Fox Valley Water Quality Planning Agency, Neenah, WI.
For primary bibliographic entry see Field 5G.
W85-00828

MARSH AND WETLAND STUDY, (FOX RIVER VALLEY, WISC.),
Fox Valley Water Quality Planning Agency, Neenah, WI.
J. Laumer, and B. J. Zellmer.
Report, November 1979. 78 p, 11 Fig, 2 Tab, 30 Ref, 1 Append.

Descriptors: *Marshes, *Wetlands, *Management planning, *Shore protection, *Water quality, Slopes, Bank erosion, Lakes, Groundwater, Flood plains, Groundwater runoff, Vegetation, Fish, Waterfowl, Wildlife habitats, Zoning, Land use, Political constraints, Legal aspects, *Wisconsin, Fox River Valley.

Before this 1979 study, Fox Valley marsh and wetland resources and their management needs had not been reviewed comprehensively. This study begins with a survey of these resources in the Fox Valley. Marshes of each basin are unique in value and in their need for protection. The conclusions, presented as policies and actions that could be developed into a regional strategy for better protection, are based on field surveys, interviews, newspaper accounts, Wisconsin Department of Natural Resources files research, U.S. Army Corps of Engineers studies, and other scientific literature. The study focused on lake contiguous areas. Most remaining marsh and wetland acreage in the Valley is of this type; it is important for maintaining water quality because vegetation in or adjacent to a surface water body intercepts sediment and nutrients from runoff, controls flooding, and competes for nutrients with undesirable algae. These areas also provide a habitat for game fish, waterfowl, and non-game wildlife. Regardless, the destruction of remaining lake contiguous areas goes on, evidence that the need to protect is exceeded by lack of enforcement and by exploitation for private profit. Better management is needed to prevent further loss of marshes and wetlands. In some cases it will suffice to stringently enforce existing ordinances and zoning requirements, especially those controlling development in or near marshes. Some political and legal questions to be considered are raised. (Fazio-Omniplan)
W85-00831

INVESTIGATION OF PHYSICAL AND BIOLOGICAL PROCESSING OF TWO SPECIES OF LEAF LITTER IN TAI PO KAU FOREST STREAM, NEW TERRITORIES, HONG KONG,
Hong Kong Univ. Dept. of Zoology.
D. Dudgeon.
Archiv fur Hydrobiologie, Vol. 96, No. 1, p 1-32, December, 1982. 12 Fig, 4 Tab, 56 Ref.

Descriptors: *Streams, *Litter, *Tai Po Kau Forest Stream, *Hong Kong, Temperature effects, Tropical regions, Forests, Metabolism, Organic matter, Decomposition.

The investigation was conducted during the winter and early spring of 1978, so that it would coincide with the period following abscision of the test species, Aleurites montana and Liquidambar formosana. Complete breakdown occurred by the 13th week of the study, the decomposition of L. formosana proceeding slightly faster than that of A. montana. The pattern of weight loss due to leaching was markedly different in these species as were the patterns of succession shown by bacteria and fungi on the leaf tissue. Microorganisms were generally more abundant on decaying L. formosana leaves and there was a general trend for the numbers and diversity of the associated macroinvertebrates to increase as breakdown progressed. No such trends were evident for macroinvertebrates associated with A. montana. The breakdown rates of litter in Tai Po Kau Forest Stream were among the most rapid recorded in any freshwater habitat. This was attributed to the temperature of the stream and the exposure technique used in the study. Tai Po Kau Forest Stream appears to be a predominantly heterotrophic system dependent on the surrounding terrestrial environment for a large proportion of its metabolic requirements. (Baker-IVI)
W85-00867

RELATIVE CONTRIBUTIONS OF NET AND NANNO PHYTOPLANKTON TO PRIMARY PRODUCTION IN LAKE KINNERET (ISRAEL),
Israel Oceanographic and Limnological Research Ltd., Haifa.
U. Pollingher, and T. Berman.
Archiv fur Hydrobiologie, Vol. 96, No. 1, p 33-46, December, 1982. 2 Fig, 8 Tab, 39 Ref.

Descriptors: *Water level, *Phytoplankton, *Lake Kinneret, *Israel, *Primary productivity, Chlorophyll, Nannoplankton, Dinoflagellates, Biomass, Succession, Algae.

The decrease of the water level in Lake Kinneret in the period of 1973 to 1978 affected the composition, succession and biomass of the phytoplankton. The Pyrrhophyta biomass decreased, and an increase of other algal groups occurred. In spite of the drastic decrease of the phytoplankton biomass in the first half of the year (when Peridinium is the dominant form), the chlorophyll levels and photosynthetic activities remained relatively high and only declined in 1977. The chlorophyll content and carbon fixation of Peridinium cells were higher at the beginning of the growth period than at the end of the bloom. The measurements of chlorophyll and specific productivity of Peridinium in situ and under experimental conditions gave very similar values: a mean chlorophyll content of 60-290 pg per cell and 90-400 pg C ass./cell/hr. Peridinium located at the deeper layers had higher cellular chlorophyll content than cells at the surface but adapted rapidly to higher irradiance. Measurements of carbon assimilation at different depths showed a strong self-shading effect by Peridinium in situ. The absolute amount of carbon assimilated per cell by nannoplankton was less than that of Peridinium, but the amount of carbon assimilated per carbon biomass was ten-fold higher. During the Peridinium bloom, despite an extremely low biomass, the nannoplankton had a disproportionately higher contribution to the chlorophyll and primary production. Due to the increase of this fraction of the algal population, the phytoplankton photosynthetic activity in Lake Kinneret remained relatively high until 1977. (Baker-IVI)
W85-00868

PRELIMINARY CHARACTERIZATION OF THE TROPICAL LAKES OF THE CENTRAL AMAZON BY COMPARISON WITH POLAR AND TEMPERATE SYSTEMS,
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
G. Hill, and H. Rai.
Archiv fur Hydrobiologie, Vol. 96, No. 1, p 97-111, December, 1982. 3 Fig, 2 Tab, 49 Ref.

Descriptors: *Lakes, *Primary productivity, *Tropical regions, *Amazon, Thermal stratification, Temperatures, Dissolved oxygen, Bacteria, Nutrients, Morphological dynamism.

While the comparisons are incomplete, they do point out some significant physical and microbiological distinctions found among these three types of aquatic systems. The Central Amazonian lakes are created by fluvial action, are subject to heavy rains (2,371 mm/year) and small temperature variations. They are moderately stratified during the day at the low water period, stratification being both seasonal and diurnal. Nitrogen and phosphorus are the major limiting nutrients to primary production which is quite high although biomass is comparatively low. Bacterial populations are characterized by both low and high densities, large range of Vmax (0.045 tp 9.644 micrograms glucose/l/hr), slow turnover times for the substrate studied, and extraordinarily high natural substrate concentrations. The most characteristic and unique feature of the Central Amazon lakes is the consummate relationship with the rivers which is so all embracing that even in the most elementary study of a single lake there is mention of the entire system. This grand, annual exchange of energy for biomass encountered in the rise and fall of the Central Amazonian lakes might be termed morphological dynamism. (Baker-IVI)
W85-00869

LEVELS OF PHOSPHATE, CALCIUM, MAGNESIUM AND ORGANIC MATTER IN THE SEDIMENTS OF SOME BRAZILIAN RESERVOIRS AND IMPLICATIONS FOR THE METABOLISM OF THE ECOSYSTEMS,
Universidade Federal de Sao Carlos (Brazil). Lab. of Limnology.
F. A. Esteves.
Archiv fur Hydrobiologie, Vol. 96, No. 2, p 129-138, January, 1983. 1 Fig, 1 Tab, 43 Ref.

Descriptors: *Reservoirs, *Sediments, *Brazil, *Phosphates, *Calcium, *Magnesium, *Organic matter, Eutrophication, Mineralization, Water temperature, Cycling nutrients.

Concentrations of P, Ca, Mg, and organic matter were measured in the sediments from 13 reservoirs in the State of Sao Paulo, Brazil. These concentrations were very low when compared to concentrations of the same substances in temperate lakes. High P levels were positively correlated with high levels of organic matter. In the reservoirs of Bariri and Ibitinga, organic matter and phosphorus increased considerably in the surface fractions, suggesting that these ecosystems may be undergoing intensive eutrophication. Under the classification proposed by Ungemach (Ungemach, H., 1960, Sedimentchemismus und seine Beziehungen zum Stoffhaushalt in 40 Europaischen Seen. - Diss. Kiel. 1-420), 50% of the reservoirs studied showed a mineral sediment and 50% showed an organic sediment type. The low observed levels of P, Ca, Mg and organic matter are most likely accounted for by ambient high temperatures which may accelerate mineralization of the organic matter. Nutrients may also be concentrated in the organic compartment. The mechanism of short-circuit metabolism may be of fundamental importance for the cycling of materials in these reservoirs. (Baker-IVI)
W85-00870

SULPHIDE POOL AND LAKE MORRISON, MEROMICTIC LAKES OF SOUTH-WEST TASMANIA,
Tasmania Univ., Hobart (Australia). Dept. of Botany.
R. D. King, and P. A. Tyler.
Archiv fur Hydrobiologie, Vol. 96, No. 2, p 139-163, January, 1983. 19 Fig, 3 Tab, 7 Ref.

Descriptors: *Meromictic lakes, *Chemocline, *Tasmania, *Lake Morrison, *Sulphide Pool, Water temperature, Light penetration, Ionic composition, Water analysis, Bacteria, Turbidity, Chlorophyll, Redox potential, Environmental effects, Reservoir releases.

Sulphide Pool and Lake Morrison are two shallow meromictic lakes behind levees of the Gordon River in southwest Tasmania. In many ways they resemble neighboring Lake Fidler with which they are compared. Both lakes have a sharp chemocline at a depth of 1-1.8 m from the surface, marked by abrupt changes in redox potential, by the disappearance of oxygen and the appearance of hydrogen sulfide. The halocline is more gradual, as indicated by the change in electrical conductivity. Temperature profiles vary with season and only in winter do they indicate meromixis. Seasonal heating and cooling of the monimolimnia occurs. Both lakes are dystrophic and light penetration is severely limited and restricted to red wavelengths. The ionic composition of both mixolimnia and monimolimnia is that of seawater. In each lake a dense population of photosynthetic bacteria, evidenced by peaks of turbidity and chlorophyll lies immediately beneath the redoxcline, about 1.2 to 1.8 m beneath the surface. At this level, light is red and of low intensity. The meromictic condition of the lakes is attributed to an estuarine salt wedge which, before construction of a power station, penetrated up the river. Elimination of the salt wedge during this study had no effect on Sulphide Pool, but Lake Morrison became holomictic, returned briefly to meromixis after a brief shut-down of the power station, and then again became holomictic. (Baker-IVI)
W85-00871

AUTOMATIC SYSTEM FOR MEASUREMENTS IN SHALLOW LAKES,
Odense Univ. (Denmark). Biological Inst.
E. Lastein.
Archiv fur Hydrobiologie, Vol. 96, No. 2, p 245-260, January, 1983. 6 Fig, 10 Tab, 5 Ref.

Descriptors: *Lakes, *Measuring instruments, *Automation, Insolation, Water currents, Wind,

Temperature, Acidity, Turbidity, Dissolved oxygen, Hydrogen ion concentration, Computers.

A mobile, low powered measuring system is presented for measurements in shallow waters. Possible measurements include the insolation in the air and 80 cm below the surface, wind and water speed and directions, temperatures at five sites, pH, oxygen and turbidity. The system consists of a microprocessor made programmable by a diode-matrix, timed by clock pulses. Water is pumped by a peristaltic pump, and a multivalve shifts water between five different depths and a container in which water is aerated and used as an oxygen reference. Data is stored on magnetic tape in ANSI-ECMA 34 format. The power source consists of two 12 volt lead batteries, and the overall stand by current is about 10 mA increasing to 1.2 A when water is sampled. Results from a selected period indicate a fast response to a strong wind stress in water movement at the bottom, coupled with an increase in turbidity and a decrease in oxygen concentration. Among the results from half a year of study, a period is taken from the middle of August 1980 in which a storm is coming up. The relations between the forcing functions insolation and wind and the affected variables, water movement and particle concentrations are shown. (Baker-IVI)
W85-00874

DRAINAGE OF A MARGINAL ICE-DAMMED LAKE AT NORDBOGLETSCHER, JOHAN DAHL LAND, SOUTH GREENLAND,
Woodhouse (Robert P.), Slidell, LA.
P. Clement.
Arctic and Alpine Research, Vol. 16, No. 2, p 209-216, May, 1984. 6 Fig, 2 Tab, 18 Ref.

Descriptors: *Glacial lakes, *Iced lakes, *Drainage, *Nordbogletscher, *Base Camp Lake, *Greenland, Streamflow, Powerplants, Base Camp Lake, Seasonal variation, Water storage, Tapping.

Ice-dammed lakes are widespread phenomena of most glacier-covered areas, and outbursts from such lakes have been reported from such lakes. The location of ice-dammed lakes within basins proposed for hydropower may involve problems because they can be tapped in a catastrophic way, which could damage installations. The tapping of Base Camp Lake to Nordboso takes place beneath the margin of Nordbogletscher every year. The tapping depends on the outlet stream which undercuts the margin inside Nordbogletscher. On a yearly basis the amount of outflow differs only slightly from the amount of inflow, that is, the year to year storage is small. Base Camp Lake acts as a seasonal reservoir inside the Nordboso basin, storing water in the beginning of the summer, reaching a maximum level in early July, and then slowly releasing the stored amount during July and August into the lower-lying large lake, Nordboso, by a submarginal stream. Since 1980 the daily inflow of water to the lake has been recorded, and from knowledge of the relationship between water level and volume in the lake, the daily outflow is calculated. The outflow depends on the amount of inflow and the depth of the outlet stream beneath the margin of Nordbogletscher. The amount of water involved in year to year storage is of minor importance compared to the annual throughflow. (Baker-IVI)
W85-00875

CHEMICAL AND RADIOTRACER MEASUREMENTS OF PHOSPHORUS UPTAKE BY LAKE PLANKTON,
National Water Research Inst., Burlington (Ontario).
D. R. S. Lean, and E. White.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 40, No. 2, p 147-155, February, 1983. 7 Fig, 1 Tab, 20 Ref.

Descriptors: *Phosphorus, *Absorption, *Plankton, *Radioactive tracers, Kinetics, Algae, Bacteria, Nutrients, Orthophosphates, Lakes.

Either chemical or radioisotope methods can be used to measure the maximum uptake velocity for phosphorus in lake water but neither can measure uptake at ambient concentrations. Measurement of phosphate uptake by organisms in lake water is complicated by the uncertainty in the measurement of orthophosphate, by the difficulty in arriving at an appropriate rate constant for a mixed species community, and by the exchange of phosphate which occurs between organisms and their environment. Rates of net uptake and phosphate release are quantified. The problems relevant to the estimation of orthophosphate in lake water and complications which occur when working with a mixed community are discussed. Chemical estimates at ambient concentrations are insensitive and the isotope method provides the uptake rate constant only. By multiplying the uptake rate constant by ambient phosphate concentration one obtains an estimate for phosphorus influx, but reliable estimates for ambient phosphate concentrations are still unattainable. The isotope method overestimates net phosphate uptake even at added phosphate levels up to 10 microg P/L, because of release of phosphate from the plankton. Influx and efflux are practically equal under steady state conditions, and during periods of phosphate limitation a net uptake of phosphorus occurs only when there is an increase in the phosphorus supply. Phosphorus uptake is predominantly by small cells at low concentrations of added phosphate and by larger cells at the higher enrichments. This makes the use of the radiobioassay for estimating ambient phosphate concentrations difficult to interpret. The half saturation coefficients measured for whole lake water are a mean for the entire population and consist of small values for small algae and bacteria and larger values for larger algae. (Baker-IVI)
W85-00887

FACTORS AFFECTING THE RELATION BETWEEN PHOSPHORUS AND CHLOROPHYLL A IN MIDWESTERN RESERVOIRS,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
M. V. Hoyer, and J. R. Jones.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 40, No. 2, p 192-199, February, 1983. 6 Fig, 7 Tab, 41 Ref. Missouri Agriculture Experiment Station project 176, Missouri Water Resouces Research Center project A095MO.

Descriptors: *Reservoirs, *Phosphorus, *Chlorophyll a, Lakes, Trophic level, Nitrogen, Zooplankton, Flushing rate, Suspended solids.

The following multivariate relation describes how concentrations of inorganic suspended solids in a lake affect the chlorophyll a yield per unit of phosphorus. Log chlorophyll a = -0.47 + 1.13 log total phosphorus - 1.03.I:TP. Because the relation among phosphorus, inorganic suspended solids, and chlorophyll a is a continuum, the multivariate model should be especially useful for predicting chlorophyll in lakes with high inorganic turbidities. This relation should also be useful when phosphorus management is associated with reducing the total sediment load to a lake. In such situations, phosphorus concentration may decrease but algal biomass may increase because the concentration of inorganic suspended solids is reduced, as exemplified by data from Lake of the Ozarks. For a wide range of midwest reservoirs, a significant part of the variance in the P-C relation could not be attributed to the concentration of nitrogen, zooplankton abundance, or flushing rate. Other investigators, however, have shown that these factors can significantly affect the chlorophyll concentration in individual lakes. Therefore, the future of P-C relations may be in developing relations for homogeneous groups of lakes that are affected by unique factors. This systematic improvement in empirical P-C relations should eventually lead to the development of accurate predictive capabilities for lake managers. (Baker-IVI)
W85-00889

SEASONAL DYNAMICS OF THE DEEP-CHLOROPHYLL MAXIMUM IN CASTLE LAKE, CALIFORNIA,
California Univ., Davis. Div. of Environmental Studies.
J. C. Priscu, and C. R. Goldman.
Canadian Journal of Fisheries and Aquatic Science, Vol. 40, No. 2, p 208-214, February, 1983. 5 Fig, 30 Ref. NSF grants DEB80-19918 and DEB76-19524.

Descriptors: *Chlorophyll, *Seasonal variation, *Castle Lake, *California, Primary productivity, Aphotic zone, Thermal stratification, Turbidity, Phytoplankton.

Castle Lake lies in a granitic cirque basin at an elevation of 1706 m in the Klamath Mountains in northern California. The southwest portion of the Castle Lake basin is bowl-shaped with a maximum depth of 35 m, whereas the northeastern one-third of the lake forms a shallow plain averaging 4 m. The lake is typically dimictic with well-developed thermal stratification usually extending from late May to late October. During thermal stratification, the maximum depth:mixing depth ratio is about 6 with an average thermocline depth of about 6 m. Vertical profiles of chlorophyll concentration measured during 1980 showed a deep maximum developed immediately after ice thaw and persisted in the deep basin of the lake until autumn overturn. In the early portion of the ice-free season, low epilimnetic turbidity allows enough light to reach this deep chlorophyll layer to produce a deep primary productivity maximum. Photoautotrophic growth appears to maintain the deep chlorophyll maximum early in the season whereas the accumulation of sinking organisms appears to do so later in the season. Although the deep water phytoplankton have reduced rates of photosynthesis late in the season, they maintain their ability to photosynthesize immediately on exposure to light. Consequently, the redistribution of deepwater chlorophyll at fall overturn can increase the chlorophyll concentration of the euphotic zone by 58% which can potentially increase primary productivity in this zone by 81%. (Baker-IVI)
W85-00890

BIOLOGICAL AVAILABILITY OF SOLUBLE REACTIVE PHOSPHORUS IN ANOXIC AND OXIC FRESHWATERS,
McGill Univ., Montreal (Quebec). Dept. of Biology.
G. Nurnberg, and R. H. Peters.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 5, p 757-765, May, 1984. 3 Fig, 5 Tab, 32 Ref.

Descriptors: *Phosphorus, *Hypolimnion, *Bioavailability, Phosphates, Lakes, Sediment, Chemical reactions, Anoxic conditions, Aeration, Hypolimnion.

The equivalence of soluble reactive phosphorus (SRP) and biologically available phosphorus (BAP) was investigated. The experimental work is largely confined to anoxic lake water from hypolimnia and cores containing phosphorus released from the sediment. The short-term radiological bioassays used measured BAP and were specific for phosphate and kinetically similar substances. To cover a large range of phosphorus concentrations, water bodies, and techniques, a comparison was also made of published concentrations of SRP with BAP or phosphate. In the anoxic hypolimnia of 8 lakes and in anoxic model systems (core tubes) at least 80% of soluble reactive phosphorus is biologically available. Biologically available phosphorus is only a small fraction of soluble reactive phosphorus in iron-rich, previously anoxic waters after aeration and in lake water from the anoxic-oxic interface. This result is supported by published data for oxic waters from epilimnia of lakes, rivers, sewage effluent, and precipitation. (Baker-IVI)
W85-00892

MOLLUSCA OF SIX LOW-ALKALINITY LAKES IN ONTARIO,
Guelph Univ. (Ontario). Dept. of Zoology.
J. B. Rooke, and G. L. Mackie.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 5, p 777-782, May, 1984. 3 Fig, 2 Tab, 24 Ref. National Research Council of Canada contract 0754-31048-0-3931.

escriptors: *Lakes, *Mollusks, *Ontario, *Alkaity, Clams, Acid rain, Population dynamics.

he mollusk populations were examined in a small mber of low-alkalinity lakes sampled at six difrent depths during three seasons. By taking many mples at each visit and returning many times roughout the year it was hoped that a better derstanding would be gained of molluscan ocrrence in low-alkalinity lakes that are currently perienced acidic precipitation. There appeared be no consistent difference in the number of ecies present in these lakes, across a limited nge of alkalinity (0.24-3.17 mg/L). It is possible at mollusks are more dense in lower alkalinity kes, due primarily to large numbers of Pisidium sertanum and P. ferrugineum found there. Signifant differences between mollusk densities in two termediate alkalinity lakes indicate that factors her than alkalinity may have affected mollusk stributions. The unionid clam, Elliptio comanta, was found in two lakes with mean alkalines of 0.41 mg/L. (Baker-IVI)
'85-00894

FFECTS OF WIND ON THE TEMPERATURE TRATIFICATION IN THE LAKE OF KOCHEL FIRST EVALUATION OF DATA AND REULTS (DER GESCHICHTETE KOCHELSEE NTER WINDLAST - ERSTE DATENAUSWERUNG UND ERGEBNISSE),
echnische Univ., Munich (Germany, F.R.). Inst. er Hydraulik und Gewasserkunke.
. Lammel.
eutsche Gewasserkundliche Mitteilungen, Vol. , No. 2, p 44-49, May, 1984. 11 Fig, 9 Tab.

escriptors: *Thermal stratification, *Lakes, Wind, *Lake Kochel, Inflow, Seasonal variation, hermocline, Water circulation, Seiches, Model udies.

ased on data measured in autumn 1982, the effects wind on the temperature stratification in the ake Kochel are discussed. Although currents in e Lake are essentially determined by its inflow, e study shows wind effects to also be of great portance, particularly in autumn when the nuerous southern winds cause a faster depression of e thermocline. The internal seiches with amplides of a few meters are of great importance in gard to the vertical exchange of temperature, mpounds and organisms. A comparison between e observed oscillation periods and those calculat by the one-dimensional two-layer Defant-Morner model shows a very satisfactory agreement. he applicability of this model to Lake Kochel is so examined by comparison with observation relts. (Baker-IVI)
'85-00900

IOTIC STRUCTURE AND PROCESSES IN HE LAKE SYSTEM OF R. JORKA WATERHED (MASURIAN LAKELAND, POLAND), I. AND IMPACT, LOADING AND DYNAMICS F NUTRIENTS,
olish Academy of Sciences, Lomianki. Inst. of cology.
. Hillbricht-Ilkowska, and W. Lawacz.
kologia Polska, Vol. 31, No. 3, p 539-585, 1983. 3 g, 13 Tab, 39 Ref.

escriptors: *Nutrients, *Lakes, *Poland, Nitroen, Phosphorus, Watersheds, Surface runoff, Preipitation, Tributaries, Water pollution sources, easonal variation, Thermoclines, Oxygen deficit, ooplankton, Cycling nutrients.

nnual nutrient loading was assessed for 5 lakes of e Jorka River Watershed. The annual loading timated on the basis of different data and assumpons for the lakes is 10.2-148.2 g organic carbon, 8-53.6 g total nitrogen, and 0.08-1.1 g total P/sq of lake area. Surface runoff from direct waterheds introduced only 10-30% of the annual load hereas the input from precipitation is about 50-5% of the annual load, but only in two lakes with rge surface areas. The insignificant contribution surface runoff to the annual loading results from ery low rates of surface runoff from watersheds to lakes. The main tributary, Jorka River, introduced 15-85% of the annual loading, especially for lakes situated in its lower course. The largest amounts of nutrients are introduced from farm and domestic waste polluted watercourse opening into Lake Jorzec, and Salmo gairdneri aquaculture, representing 80% of the annual nutrient input to these lakes. The critical P loading ranges from 0.04 - 0.5 g P/sq m lake area. In two polluted lakes the measured loading is several times greater than this critical value. The existence of a significant internal loading in the shallow eutrophic Lake Inules, indicated by a higher content of total P in the water bulk in summer than in the early spring period, and a permanently high percentage of inorganic P in total P is favored by high vertical water movements with a simultaneous mobile thermocline, a long lasting oxygen deficit involving a considerable part of the bottom, and very low sorption rates characterizing the bottom sediments of the lake. In Lake Jorzac a high content of Fe in the sediments should have an influence on phosphorus cycling and cause particularly high release and sorption rates in sediments in summer periods. In summer, in all the lakes with very low inorganic P concentrations, the N:P ratio is 10-30, which seems to confirm the decisive role of zooplankton excretion in the supply of nutrient proportions stabilizing the optimum N:P ratio. The nutrient concentration in the lakes found in the watershed is generally lower than in a number of other lakes. (Baker-IVI)
W85-00902

BIOTIC STRUCTURE AND PROCESSES IN THE LAKE SYSTEM OF R. JORKA WATERSHED (MASURIAN LAKELAND, POLAND), II. PHYSICAL AND CHEMICAL PROPERTIES OF WATER AND SEDIMENTS,
Polish Academy of Sciences, Lomianki. Inst. of Ecology.
M. Planter, W. Lawacz, and A. Tatur.
Ekologia Polska, Vol. 31, No. 3, p 587-611, 1983. 12 Fig, 3 Tab, 17 Ref.

Descriptors: *Lakes, *Chemical composition, *Thermal stratification, *Poland, Watersheds, Trophic level, Glebokie Lake, Lake Inulec, Lake Majcz Wielki, Lake Jorzecis, Nutrients, Silicates, Hypolimnion, Oxygen deficit, Stagnation, Thermocline, Seasonal variation, Transparency, Nitrogen, Phosphorus.

The size and character of the watershed, the inflows to the lakes, the activities of man directly in water bodies, and morphometric characters of lakes are responsible for the fact that the lakes of this watershed differ distinctly in trophic state. Lake Majcz Wielki, relatively big and deep, with a limited input of nutrients and silicates is the purest of all lakes studied. Slow rates of hypolimnion deoxygenation and oxygen deficit occur only at the end of the summer stagnation. At the beginning of summer stagnation an oxygen stratification of positive heterograde type was observed, which is characteristic of lakes having high water transparency during the period of maximal photosynthetic production. The level of nitrogen and phosphorus concentration in lake water was low, and seston abundance was not great. Sedimentation rate of tripton and the rate of accumulation of bottom sediments were slow and the real rate of accumulation of silicates, originating from soil erosion within the watershed, was several times lower than in remaining lakes. The lake has distinct characteristics of mesotrophy. Glebokie Lake, the deepest of those studied, has a surface area four times smaller than Lake Majcz Wielki and Lake Inulec, and has distinct and very stable summer stratification. Despite a heavy nutrient load from aquaculture and high primary production, the deep hypolimnion slowly deoxygenates. Characteristics of a moderate trophic state are present in the lake. Lake Jorzec is located in an agricultural area. The lake has high primary production, low water transparency, great seston abundance and the highest accumulation rate of bottom sediments. The lake is stratified in summer but the thermocline was mobile and blurred. Oxygen deficit in the hypolimnion appears early, at the end of May. Water in this lake is abundant in mineral forms of nitrogen. Lake Inulec is one of the most eutrophic water bodies in this watershed. Water here has low transparency and great seston abundance, being also the most abundant in phosphorus. Sedimentation rate of tripton and the rate of accumulation of bottom sediments were almost as high as in Lake Jorzec. Lake Zelwazek is a shallow, small water body which appears to be a eutrophic lake of pond type. (Baker-IVI)
W85-00903

BIOTIC STRUCTURE AND PROCESSES IN THE LAKE SYSTEM OF R. JORKA WATERSHED (MASURIAN LAKELAND, POLAND). XII. PRODUCTIVITY, STRUCTURE AND DYNAMICS OF LAKE BIOTA (A SYNTHESIS OF RESEARCH),
Polish Academy of Sciences, Lomianki. Inst. of Ecology.
A. Hillbricht-Ilkowska.
Ekologia Polska, Vol. 31, No. 3, p 801-834, 1983. 2 Fig, 8 Tab, 36 Ref.

Descriptors: *Lakes, *Poland, *Productivity, *Aquatic life, Lake Majck Wielki, Lake Inulec, Lake Glebokie, Lake Zelwazek, Phytoplankton, Nutrients, Trophic level, Water pollution effects, Bacteria, Euglenophyta.

The lake located at the highest level in the watershed under study, Lake Majcz Wielki, represents a system where the nature and impact of the watershed, very low external loads of nutrients and absence of points of pollution determine a low productivity of the lake and its mesotrophic status. The richest of the lakes discussed is the large, shallow L. Inulec whose contemporary eutrophic status seems to be the result of internal loading, the calculated value of which appears to be several times as high as the external input of nutrients. The remaining lakes are considered, relative to L. Majcz Wielki, to be more or less eutrophic, and markedly more fertile, representing a system of quantitative and qualitative trophic indices that is clearly inconsistent. This includes Lakes Glebokie and Zelwazek, which are exposed to the heaviest external load of nutrients derived from sources of pollution and show distinct signs of organic pollution in the form of a higher percentage and biomass of Euglenophyta in the phytoplankton, larger numbers of polysaprobic ciliates, and also a very high abundance of bacterioplankton, particularly in Glebokie. A comparison of the phytoplankton biomass indicates that the Jorka lakes can in general be included among low fertile or medium fertile water bodies. (Baker-IVI)
W85-00904

WORLD'S GREAT LAKES,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
A. M. Beeton.
Journal of Great Lakes Research, Vol. 10, No. 2, p 106-113, 1984. 3 Fig, 2 Tab, 24 Ref.

Descriptors: *Lake morphometry, *Limnology, *Water quality, Geography, Lakes, Glacial lakes, Scour basins, Physicochemical properties, Climatology.

Most of the large lakes lie in glacial scour basins in the nothern hemisphere. These lakes are closely similar in physicochemical characteristics and in their biota. On the basis of geologic origin the glacial scour lakes make a cohesive group, while lakes formed by other processes do not. This situation is, however, not merely a consequence of their origin, but of the climactic conditions at latitudes above 40 degrees N which resulted in the glaciers. Glaciation in the northern hemisphere resulted in closely similar conditions in northern North America, Europe, and Asia. Tectonic lakes have been subjected to a broad range of climatic conditions and a diversity of terrestrial environments. Consequently, they do not have much in common. The large lakes offer a great diversity of habitats and as a consequence the really ancient lakes have a great number of species, many endemic. The horizontal differences in physicochemical conditions in large lakes contribute to the diversity of habitats. The importance of horizontal limnology has largely been overlooked because of the emphasis on the

vertical limnology of small temperate lakes. Yet pronounced horizontal differences are recognized in a number of large lakes in Africa, Asia, Europe, and North America, including the St. Lawrence Great Lakes. The results of studies on Lake Skadar demonstrate that aquatic macrophytes can be a major factor in causing horizontal differences to the extent that the horizontal gradients in dissolved materials are closely similar to the vertical gradients observed in small stratified eutrophic lakes. (Baker-IVI)
W85-00917

MILESTONES OF RESEARCH ON THE PHYSICAL LIMNOLOGY OF THE GREAT LAKES,
Woods Hole Oceanographic Institution, MA.
G. T. Csanady.
Journal of Great Lakes Research, Vol. 10, No. 2, p 114-125, 1984. 12 Fig, 53 Ref.

Descriptors: *Limnology, *Great Lakes, Circulation, Wind, Waves, Boundary layers, Upwelling, Topography, Model studies.

The growth in understanding of Great Lakes physics has advanced significantly over the past 25 years. From a general scientific standpoint an important aspect of these advances was that relatively simple theoretical models could be connected to observation in quantitative detail, partially verified, and their limitations defined. There are only a limited number of oceanographic problems where such definite connection between theory and observation can be demonstrated. One reason why use can be made of this connection in the Great Lakes is that their size makes them more manageable than the oceans. A consequence is that the physics of the Great Lakes has acquired much greater visibility in the oceanographic community than it had before. Two important themes of research on the physical immunology of the region during the past 20 years have been: the controlling influence of bottom topography on circulation, and the boundary layer character of circulation. The first idea is highlighted by the generation of topographic gyres by wind and by the propagation of vortex wave modes. The second is highlighted by the distinct current climatology of the coastal boundary layer and the spectacular upwelling and downwelling events occurring there. Both themes developed as advances in theoretical insight could be quantitatively coupled to the observational evidence. (Baker-IVI)
W85-00918

GREAT LAKES LEVELS AND FLOWS: PAST AND FUTURE,
Atmospheric Environment Service, Downsview (Ontario).
J. P. Bruce.
Journal of Great Lakes Research, Vol. 10, No. 1, p 126-134, 1984. 6 Fig, 17 Ref.

Descriptors: *Water level, *Great Lakes, *Flow, Lakes, Prediction, Climatology, Precipitation, Evaporation, Consumptive use, Water use, Carbon dioxide, Temperature effects, St. Lawrence River.

In reviewing the more than 100 years worth of records of Great Lakes water levels and of precipitation in the basin, a reasonable basis is achieved for predicting, statistically, future lake levels. Whether this is possible, or even useful, has been questioned due to the continued and increased consumptive use of the water from the Great Lakes as well as probable climatic changes over the next century. The most likely scenario of annual growth in consumptive use has been put forth by the International Joint Commission in their 1981 report as 2.7%. By the year 2035, this would reduce Great Lakes outflows by about 708 cu m with an estimated loss of $200 million per year in hydropower production. Inexorable increases in atmospheric carbon dioxide due mainly to burning of fossil fuels and the resulting effects on the climate are still hard to predict. It is estimated that in the next 70 or so years, the mean air temperature in the Great Lakes basin will rise by about 3 degrees C and may well be accompanied by slightly less precipitation. Evaporation increases from the Great Lakes would be equivalent to 7-8% of the mean annual flow of the St. Lawrence. These two factors suggest that significantly lower lake levels and flows of interconnecting channels and the St. Lawrence River are likely to be noted in the next century. (Baker-IVI)
W85-00919

RESEARCH ON GREAT LAKES ALGAL COMMUNITIES: PROBLEMS FROM THE PAST, LESSONS FOR THE FUTURE,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
E. F. Stoermer.
Journal of Great Lakes Research, Vol. 10, No. 2, p 143-155, 1984. 4 Fig, 100 Ref. EPA grants R803086 and R807450.

Descriptors: *Reviews, *Algal growth, *Great Lakes, Management, Water quality control, Phytoplankton, Benthic flora, Physical properties, Eutrophication.

Research on algal communities in the Laurentian Great Lakes is reviewed. The research shows significant progress has been made in delineating this component of the biota and understanding the factors which regulate its composition and distribution. There are still, even in some fundamental research areas, a few questions which remain ill defined or delineated. Future progress will depend largely on how quickly and how thoroughly these particular problems are reduced. No useful distinction between basic and applied research can be made in this area and the best steps forward will be taken in a balanced approach. (Baker-IVI)
W85-00921

PRESENT STATUS OF RESEARCH ON THE ZOOPLANKTON AND ZOOBENTHOS OF THE GREAT LAKES,
National Marine Pollution Program Office, Rockville, MD.
A. Robertson.
Journal of Great Lakes Research, Vol. 10, No. 2, p 156-163, 1984. 3 Tab, 43 Ref.

Descriptors: *Great Lakes, *Zooplankton, Benthos, Aquatic animals, Ecosystems, Water pollution effects, Invertebrates, Spatial distribution, Temporal distribution, Lakes.

Present knowledge concerning the basic ecology of the zooplankton and zoobenthos of the Great Lakes is reviewed. The species of invertebrates that occur in the Great Lakes is described including information regarding the species temporal and spatial distributions as well as factors that cause these distributions. While much knowledge has been gained in this area of study, there are still major gaps. A good data base now exists for describing the distributions of a number of the most important species. In most cases the results from separate surveys have yet to be pulled together to develop generalizations with broad application throughout the region. Understanding the control of distributions of invertebrates in the region is still at a rudimentary stage, even though such understanding is a basic requirement for evaluating natural and man induced changes or potential changes in these ecosystems. (Baker-IVI)
W85-00922

FISHERIES: PAST, PRESENT, AND FUTURE IN THE GREAT LAKES,
Ontario Ministry of Natural Resources, Toronto. Outdoor Recreation Group.
K. H. Loftus.
Journal of Great Lakes Research, Vol. 10, No. 1, p 164-167, 1984. 5 Ref.

Descriptors: *Fisheries, *Management, *Great Lakes, Planning, Communication, Training, Education.

Training sessions held for management scientists and senior technicians in the field of fisheries to bring about effective fisheries management are contributing to at least three process fundamentals: transfer of the available science from research scientists to management staff so that it can be used when the opportunity arises; initiation of the flow of new science from the management scientists and technicians to the rest of the ministry staff and subsequently to the public so that it becomes common knowledge or common sense; and keeping the lines of communication open between research scientists and management scientists and technicians. The future for fisheries seems to be quite bright but continued efforts at communication between different but related fields is essential. (Baker-IVI)
W85-00923

LAKE TROUT (SALVELINUS NAMAYCUSH) SPAWNING HABITAT IN SENECA LAKE, NEW YORK,
Canada Centre for Inland Waters, Burlington (Ontario).
P. G. Sly, and C. C. Widmer.
Journal of Great Lakes Research, Vol. 10, No. 2, p 168-189, 1984. 13 Fig, 4 Tab, 30 Ref.

Descriptors: *Seneca Lake, *New York, *Trout, *Spawning, Hatcheries, Fisheries, Water pollution effects, Climatology, Temperature effects, Fish management, Fish populations, Population dynamics.

Lake trout from Seneca Lake are an important source of stock for Great Lakes rehabilitation programs, but the lake trout in Seneca Lake have themselves been hatchery supported for many years. The population of Seneca Lake is highly stressed, and natural replacement of the stock has virtually ceased. Part of the lack of replacement may be due to the effects of competition and/or predation. There is strong evidence of a degraded spawning habitat, resulting from various factors including reduced gravel supply, increased settlement of particulates, and increased debris from water plants. Since the lake trout spawn in Seneca Lake before turnover and below the top of the thermocline, they have been largely unaffected by long term climate fluctuations. On limited evidence, it appears that greatest egg concentrations occur at depths which are near, or exceed, the upper limit of the preferred spawning temperature range of most lake trout stocks and many eggs lie at depths where temperatures probably exceed survival conditions. It seems that while a deepwater spawning strategy by lake trout, near the southern limit of their range, may have largely insulated them from the effects of climatic fluctuation, it has also made them particularly vulnerable to the effects of cultural development. (Baker-IVI)
W85-00924

DEPLETION OF DISSOLVED OXYGEN IN THE HYPOLIMNION OF LAKE KIZAKI FROM APRIL TO JULY IN 1975,
Nagoya Univ. (Japan). Water Research Inst.
K. Matsunaga.
Japanese Journal of Limnology, Vol. 43, No. 3, p 164-172, 1982. 5 Fig, 2 Tab, 19 Ref.

Descriptors: *Lake Kizaki, *Japan, *Nagono Prefecture, *Dissolved oxygen, *Hypolimnion, Sediments, Diffusion models, Diffusion coefficient.

The oxygen uptake by biological reaction in the hypolimnetic water of Lake Kizaki (Nagano Prefecture, Japan) and the oxygen flux into the sediment were studied quantitatively in order to make clear the development of the oxygen depletion in the hypolimnion by application of a one-dimensional diffusion model. The biological O2 consumption rate constant (k) and eddy diffusion coefficient (D) were found to be 5 X 10 to the -8th power/s and 0.05 sq cm/s respectively, by applying the fixed initial and boundary conditions to the one-dimensional diffusion model. The total depletion of oxygen in the hypolimnion and oxygen flux into the sediment tended to increase with time to become maximum on June 25, 1975, and these values decreased rapidly thereafter, while the oxygen uptake by biological reaction decreased gradually with time throughout the whole period of observation. The oxygen uptake in the hypolimnetic water and oxygen flux into the sediment in May, June and July of 1975, were found to be 25,

nd 13 mmol/sq m/d and 11, 22 and 18 mmol/
/d respectively. (Author's abstract)
5-00930

ECTS OF VERTICAL MIXING ON PHO-
YNTHETIC RESPONSES,
artment of the Environment, Victoria (British
mbia). Inst. of Ocean Sciences.
M. Farmer, and M. Takahashi.
nese Journal of Limnology, Vol. 43, No. 3, p
181, 1982. 6 Fig, 1 Tab, 13 Ref.

criptors: *Vertical mixing, *Photosythesis,
nvection, Phytoplankton, Photoinhibition,
ing, Light exposure.

the basis of models describing convective
ng below lake ice due to solar radiation, an
nate was obtained of the time during which a
icle carried by a rising or sinking convective
ne is likely to be in the well illuminated region
e to the ice and of the time scales of light
uations likely to be encountered by an algal
circulating within a layer of a given thickness.
a mixed layer, 15 m deep, it takes about 45
ites to traverse up and down through the top
e meters, over which light intensity varies by a
or of 5; each ascent to the surface is seperated
bout 4 hours. Since the vertical speed in the
rior of the convective layer remains un-
nged, the duration of the dark period for differ-
layer depths differs proportionately, although
brief period of illumination for each particle as
raverses the top of the water column will
ain similar. For deep layers, phytoplankton
be adapted to low light levels and the brief
od of illumination will be exploited without
reciable photo-inhibition. Comparing the esti-
e of 45 minutes with previously obtained labo-
ry photo-inhibition results (based on the C-14
hod), little adjustment can take place with such
ief exposure to high light levels. (Collier-IVI)
5-00931

HAVIOR OF ORGANICALLY-BOUND
N IN LAKE OHNUMA,
kkaido Univ., Hakodate (Japan). Faculty of
eries.
Matsunaga, K. Igarashi, and S. Fukase.
nese Journal of Limnology, Vol. 43, No. 3, p
188, 1982. 6 Fig, 2 Tab, 23 Ref.

criptors: *Lake Ohnuma, *Japan, *Iron, Phyto-
kton, Nitrate, Fulvic acid.

er samples were taken from Lake Ohnuma
an) and a river which flows into it (from 1979
980). Concentrations of organically-bound iron
nitrate in both the lake and the river were
sured throughout one year. The iron complex
he river water is a dissolved small molecular
species and diffuses into the lake without phys-
deposition. The iron complex in the lake shows
ower concentration during the period from
ng to autumn than in the river because of
zation by phytoplankton. In winter the iron
plex concentration became equal to that in the
r. Throughout one year the iron complex
wed the same behavior as nitrate. The iron
plex increased the growth rate of phytoplank-
in a culture experiment and passed through a
ipermeable membrane with a pore size of 24 A.
iron complex was assumed to be fulvic acid-
(Author's abstract)
5-00932

RAMETERIZED MODEL FOR THERMO-
LUTAL CONVECTION DUE TO SURFACE
OLING,
kyo Univ. of Agriculture and Technology
an). Dept. of Environmental Science and Con-
vation.
Yusa.
nese Journal of Limnology, Vol. 43, No. 3, p
-198, 1982. 9 Fig, 3 Tab, 11 Ref.

scriptors: *Convection, *Surface cooling, *Sa-
ty gradients, Rayleigh number, Temperature
dient, Stratification.

When a water layer with a salinity gradient positive downwards undergoes surface cooling, the development of thermosolutal convection can be investigated by a simple model in which diffusivities are given by the effective thermosolutal Rayleigh number. Results showed: (1) the appearance of a series of convecting layers separated by non-convecting thin sheets; step-like structures of temperature and salinity profiles are formed; (2) the uppermost convecting layer extends downwards and the approximate uniformity of temperature and salinity is attained in a relatively short time; (3) the density difference between adjacent convecting layers increases with time; (4) even if the initial stratification is very stable because of the temperature gradient positive upwards, the convection develops rather rapidly due to the surface cooling; (5) magnitudes of apparent diffusivities are in the range of 0.02 to 1 sq cm/s. (Author's abstract)
W85-00933

FISHES OF AN URBAN STREAM; THE BRONX RIVER, NEW YORK,
Hudsonia Ltd., Annandale, NY.
R. E. Schmidt, and J. M. Samaritan.
Northeastern Environmental Science, Vol. 3, No. 1, p 3-7, 1984. 3 Fig, 1 Tab, 26 Ref. Public Health Service, Biomedical Research Support Grant 5S07RR07150.

Descriptors: *Bronx River, *New York, *Urban streams, *Urban areas, *Stream fisheries, Electroshocker, Seine, Substrates, Benthos, Fish populations, Species Diversity, Killfish, Darter, Eel, Water pollution effects.

Fish were collected from the urbanized Bronx River (New York) using a backpack electroshocker and a seine in 1979 at 16 stations along the river's length. Of seventeen species of fish in eight families collected, only one (Fundulus heteroclitus) was collected at all stations; the tessellated darter (Etheostoma olmstedi) and the American eel (Anguilla rostrata) were almost as widely distributed. These three species are considered pollution tolerant. The longitudinal distribution of fishes does not follow the pattern seen in unimpacted streams. Downstream increase in species' numbers was partially due to replacement, rather than entirely by addition. Comparison with the few other urban streams studied by others suggests the hypothesis that downstream replacement of species is typical of urban streams. In the Bronx River, untreated sewage and sand deposition were correlated with alterations in the species composition in the lower river. Sand substrates are too unstable to support the benthic communities necessary for subsistence of diverse fish communities. A high percentage of introduced and exotic fishes were also typical of the Bronx River fauna. (Collier-IVI)
W85-00935

ORIGIN OF HIGH FLUORINE CONTENTS IN GROUNDWATERS FROM PALEOCENE AQUIFER OF MBOUR AREA (SENEGAL). ROLE OF THE MAGNESIUM ION (ORIGINE DES FORTES TENEURS EN FLUOR DES EAUX SOUTERRAINES DE L'AQUIFERE PALEOCENE DE LA REGION DE MBOUR (SENEGAL). ROLE DE L'ION MAGNESIUM),
Dakar Univ. (Senegal). Dept. de Geologie.
Y. Travi, and G. Millot.
Comptes Rendus De L'Academie des Sciences Paris, Series II, Vol. 298, No. 7, p 313-316, 1984. 3 Fig, 10 Ref.

Descriptors: *Mbour Area, *Senegal, *Fluorine, *Magnesium, *Aquifers, Groundwater, Calcium phosphate, Attapulgite, Geochemistry.

Groundwaters from the Paleocene limestone of the Mbour area have high fluorine and magnesium contents. These elements are probably related to the presence of layers containing calcium phosphate and attapulgite at the upper part of this aquifer. The opposite influence of Ca(++) and Mg(++) ions upon the solubility of fluorine is discussed, as well as the transport by the MgF(+) complex of part of the aqueous fluorine. (Author's abstract)
W85-00947

QUANTIFYING A WITHIN-LAKE GRADIENT OF WAVE ENERGY IN GILLFILLAN LAKE, NOVA SCOTIA,
Guelph Univ. (Ontario). Dept. of Botany and Genetics.
P. A. Keddy.
Canadian of Botany, Vol. 62, No. 2, p 301-309, February, 1984. 4 Fig, 4 Tab, 52 Ref. Natural Sciences and Engineering Research Council of Canada grant A6963.

Descriptors: *Wave action, *Gillifillan Lake, *Nova Scotia, *Lake shores, Substrate, Fetch, Vegetation, Wind, Glacial till, Clay, Silt, Substrate, Zonation.

The zonation patterns of shoreline plants vary greatly within lakes and exposure to waves may be an important cause of this variation. The principal objective of this study was to find a method for ranking lakeshores from low to high exposure. Two methods for ranking were tried. The first was simply the percent of the substrate composed of silt and clay and the second was calculated based on fetch values from aerial photographs and wind data from a nearby weather station. Field data were collected from 30 points chosen at random along the shoreline of Gillfillan Lake in Yarmouth County, Nova Scotia. Each was sampled for the proportion of silt and clay in the substrate and the zone widths occupied by shoreline plants. Exposure values were calculated for all 30 points, using 16 different methods of calculation. The proportion of silt and clay in the substrate was negatively correlated with exposure, whichever method of calculation was used. Principal components analysis was then used to summarize the zonation patterns of 64 plant species. The positions of transects on the first principal component (PC1, 18.7% of variation) were not correlated with any measure of exposure; they appear to reflect two types of glacial till found in Gillfillan Lake. The positions of transects on PC2 and PC3 (12.9 and 9.6% of the variation, respectively) were strongly correlated with the percent of the substrate consisting of silt and clay but not significantly with the calculated exposure measure. Thus percent silt and clay is a more appropriate axis for gradient analysis of zonation patterns. Species such as Calamagrostis canadensis, Carex stricta, and Pontederia cordata had zone widths which were negatively correlated with exposure, whereas the widths of the zones occupied by Aster novi-belgii, Agrostis perennans, and Aster tradescanti were positively correlated with exposure. While exposure affects the zonation patterns of some species, these patterns are apparently superimposed upon those produced by different types of glacial till. (Author's abstract)
W85-00950

EMERGENT PLANT COMMUNITIES OF OXBOW LAKES IN NORTHEASTERN ALBERTA: SALINITY, WATER-LEVEL FLUCTUATION, AND SUCCESSION,
Lethbridge Univ. (Alberta). Dept. of Biological Sciences.
V. J. Lieffers.
Canadian of Botany, Vol. 62, No. 2, p 310-316, February, 1984. 7 Fig, 2 Tab, 37 Ref.

Descriptors: *Emergent plants, *Oxbow lakes, *Water level fluctuations, *Salinity, *Succession, Plant populations, Wetlands, Sedges, Cattails, Aquatic plants, Floating substrates.

Emergent vegetation was sampled in 15 oxbow lakes in a 50-km segment of the Athabasca River in northeastern Alberta. Cover of individual species was visually assessed in plots at the outer, middle and (or) inner edge of the emergent zone of each lake (n, 37 sample units). Detrended correspondence analysis showed two main axes of variation. The first axis related to salinity. Water conductivity ranged from 170 to 12,200 micro S/cm and community types ranged from freshwater fens to saline wetland communities dominated by Scolochloa festucacea, Scirpus maritimus, and Triglochin maritima. The second axis of variation related to water-level fluctuations. Half of the lakes had an increase in water level in the recent past (ca. 6-30 years). In these lakes, Typha latifolia was dominant

in both grounded and floating substrates subjected to increased water levels. Sedge communities dominated by Carex rostrata, C. aquatilis, and Acorus calamus were common in sites with stable water levels. In freshwater lakes, floating substrates were established over open water by the lateral growth of floating stems of Calla palustris and Potentilla palustris. Floating substrates were not in the saline sites probably because these open-water colonizers were not present under saline regimes. (Author's abstract)
W85-00951

APPLICATION OF NUTRIENT LOADING MODELS TO THE ANALYSIS OF TROPHIC CONDITIONS IN LAKE OKEECHOBEE, FLORIDA,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5B.
W85-00977

LIMNOLOGICAL EFFECTS OF PEATLAND DRAINAGE AND FERTILIZATION AS REFLECTED IN THE VARVED SEDIMENT OF A DEEP LAKE,
Joensuu Univ. (Finland). Karelian Inst.
H. Simola.
Hydrobiologia, Vol. 106, No. 1, p 43-57, September, 1983. 6 Fig, 2 Tab, 42 Ref.

Descriptors: *Lake Polvijarvi, *Finland, *Peatlands, *Drainage effects, *Fertilization, Varves, Limnology, Diatoms, Environmental effects, Agriculture, Sediment chemistry, Eutrophication, History.

Stratigraphy of diatoms and chemistry in the surface sediment deposited at 35 m depth in Lake Polvijarvi was studied. The existence of annual laminations or varves in the sediment allowed a precise dating of the profile. Diatoms were analysed in 0.5 cm sequences; from 0 to 16.0 cm continuously and then intermittently every fourth 0.5 cm down to 44.0 cm. Sediment chemistry (loss-on-ignition, C, N, Fe, Mn, Mg, P, chlorophyll and carotenoids) was analyzed from sediment surface down to 10.5 cm of altogether 33 subsamples, each containing 1-3 varves, and spanning the period 1921-1980. From 4.5 cm depth upwards the diatom concentration strongly increases, and the plankton diatom succession from Tabellaria flocculosa through Asterionella formosa to Melosira ambigua and Fragilaria crotonensis reflects a marked eutrophication of the lake. This algal succession occurs in pace with an increase in sediment accumulation rate and changes in sediment chemistry, which indicate increased allochthonous inputs and enhanced algal production in the lake. The change of the lake ecosystem is contemporaneous with extensive peatland draining and fertilizing that was carried out on its watershed during the past two decades. Existing chemical data from a number of lakes situated within the drainage area prove that at present the treated peatlands are the main source of nutrient loading of Lake Polvijarvi. A former period with indications of slightly increased productivity of the lake was dated by varve counting to AD 1690-1910 (35-12 cm). This period (characterized by Asterionella formosa) may coincide with that of the slash-and-burn cultivation in the area. (Author's abstract)
W85-00982

MICROHABITAT PREFERENCES OF BENTHIC FAUNA IN A WOODLAND STREAM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences.
D. J. Orth, and O. E. Maughan.
Hydrobiologia, Vol. 106, No. 2, p 157-168, September, 1983. 6 Fig, 5 Tab, 52 Ref.

Descriptors: *Benthic fauna, *Microhabitats, *Invertebrates, *Stream biota, Aquatic habitats, Biomass, Species diversity, Water depth, Substrates, Velocity, Turbulence, Instream flow.

Estimates of numbers, biomass and diversity of benthic macroinvertebrates were made quarterly over a two-year period to investigate microhabitat preferences. Although biomass of most taxa was significantly different among sampling times, physical factors also appeared to be important in determining abundance of many taxa. Optimum depth, velocity, substrate type, and turbulence were determined for major taxa. Optimum conditions for diversity appeared to be 34 cm depth, 60 cm/s velocity, and rubble and boulder substrate type. Habitat preference functions were derived for several taxa based on significant polynomial regressions of biomass on depth, velocity, substrate, and Froude number (turbulence). The relationship between abundance and physical habitat conditions was tested by using the product of the preference factors (range: 0-1) for depth, velocity and substrate type as a measure of habitat suitability (joint preference factor). There were significant correlations between biomass of 10 benthic species and the joint preference factor. The joint preference factors accounted for from 11 to 61% of the variation of biomass of the 10 benthic species. The intercepts of the relationships between biomass of individual species and the joint preference factor were not significantly different from zero for any species. Therefore, the joint preference factors appears to be valid indicators of biomass. The preference functions have utility in habitat assessment studies, specifically with regard to minimum instream flow determinations. (Author's abstract)
W85-00984

TRANSVERSE DISTRIBUTION OF BENTHIC MACROINVERTEBRATES IN AN ARM OF THE RHONE (REPARTITION TRANSVERSALE DES MACROINVERTEBRES BENTHIQUES DANS UN BRAS DU RHONE),
Lyon-1 Univ., Villeurbanne (France). Dept. de Biologie Animale et Zoologie.
O. Gaschignard, H. Persat, and D. Chessel.
Hydrobiologia, Vol. 106, No. 3, p 209-215, October, 1983. 2 fig, 2 Tab, 8 Ref.

Descriptors: *Spatial distribution, *Benthic fauna, *Invertebrates, *Rhone River, Aquatic animals, Species diversity, Rivers, Ecological distribution.

While the downstream distribution of benthic macrofauna has been studied in many rivers, its transverse distribution remains rather unknown. The present work concerns this problem in a semi-regulated arm of the Rhone. The characteristics of this arm are: width 80 m, depth 0.5 to 1 m in the section studied, pebble substrate, rocky banks, discharge regulated at 30 cu m/s except for floods up to 1,000 cu m/s. The substrate was sampled with a Hess cylinder which collects the fauna present on 0.125 sq m. Eight stations were located across the river, and 22 samples were collected. Correspondence analysis was applied to the Taxa x Samples matrix, and the results were studied by analysis of inertia, canonical correlation and variance analysis. A close correlation appears between the faunistic structures and the stations. Two main units are revealed. The first one includes a ten meter band along each bank, the other covers the main part of the bed, between these two bands. The two units differ in their taxonomic richness and abundance, many taxa being only present along the banks. A symmetrical gradient of density appears between the channel and the banks. Moreoever, the fifth factor of the correspondence analysis reveals that the fauna of one side is not identical to that of the other. The cause of these structures remains uncertain. Among the different parameters, the distance from the banks seems to be the most significant. The existence of a gradient may be due to a dissemination of the fauna from the banks towards the channel. This study suggests the importance of the banks in the dynamics of the benthic fauna of large, fast-flowing rivers, especially in connection with the floods. This must be taken into account when sampling in such rivers. (Author's abstract)
W85-00986

PRELIMINARY ORGANIC CARBON BUDGET FOR A SMALL DYSTROPHIC LAKE IN MARITIME CANADA,
University of Western Ontario, London. Dept. of Zoology.
J. W. Carpenter, R. H. Green, and C. G. Paterson.
Hydrobiologia, Vol. 106, No. 3, p 275-282, October, 1983. 3 Fig, 2 Tab, 31 Ref.

Descriptors: *Organic carbon, *Dystrophic lak
*Wood's Pond, *New Brunswick, Autotrop
production, Productivity, Seepage, Sphagnu
Fluvial transport, Carbon budget.

The results of a preliminary organic budget fo
small (1.13 h) dystrophic lake in Maritime Can
are presented. Wood's Pond is moderately autot
phically productive (395 mg C/sq m/day).
lochthonous inputs overwhelmed autochthon
production by an approximate ratio of 9.7:1. Se
age through the surrounding Sphagnum mos
accounted for 89.9% of all organic carbon enter
the lake while fluvial transport was responsible
over 90% of losses. The yearly balance was a
loss of approximately 1820 kg C. The mark
dominance of allochthonous inputs over autoch
onous production obviously influences the p
sico-chemical of Wood's Pond but it does
necessarily follow that this system is heterotroph
The yearly autotrophic production, approximat
1466 kg C, essentially balances an annual comm
nity respiration and insect emergence of 1481 kg
This suggests that, at least in theory, the biologi
functioning of this dystrophic lake system could
drive almost entirely by autotrophic productio
(Author's abstract)
W85-00989

DIEL VARIATION IN CONCENTRATION, A SIMILATION AND RESPIRATION OF DI SOLVED FREE AMINO ACIDS IN RELATIO TO PLANKTONIC PRIMARY AND SECON ARY PRODUCTION IN TWO EUTROPH LAKES,
Aarhus Univ. (Denmark). Inst. of Ecology a Genetics.
N. O. G. Jorgensen, M. Sondergaard, H. J.
Hansen, S. Bosselmann, and B. Riemann.
Hydrobiologia, Vol. 107, No. 2, p 107-122, N vember, 1983. 7 Fig, 4 Tab, 69 Ref.

Descriptors: *Amino acids, *Diel variation, *P ductivity, *Plankton, *Eutrophic lakes, *Denma Lake Mosso, Fredriksborg Slotsso, Concentrati Assimilation, Respiration, Bacteria, Zooplankt Organic carbon, Primary productivity, Seconda productivity.

Concentration of dissolved free amino ac (DFAA) and assimilation of the 5 most abunda DFAA (glutamic acid, serine, glycine, alanine a ornithine) were measured at 3-h intervals over 27 in two Danish, eutrophic lakes. The carbon flux the amino acid assimilation was compared with t major routes of carbon flux, including prima production, bacterial production and zooplankt grazing. In Frederiksborg Slotsso, the me DFAA concentration was 275 nM with distin peaks (up to 783 nM) 3 h after sunrise. Assimilati rates of the 5 amino acids amounted on the avera to 2.03 micro g C/l/h, but high values up to 7. micro g C/l/h occurred 3 h after sunrise and midnight. The mean turnover time of the ami acid pools was 3.2 h. In Lake Mosso, the me DFAA concentration was 592 nM with a peak 1,161 nM at dusk. The assimilation rate averag 0.44 micro g C/l/h, and the mean turnover time the amino acid pools was 39 h. In Lake Moss similar turnover times of glutamic acid and seri were determined from the C-14 amino acid trac technique and Michaelis-Menten uptake kineti indicating that the tracer technique gave reliab values of the actual assimilation. The average re piration percentages of the assimilated amino aci were 45% in Frederiksborg Slotsso and 51% Lake Mosso. Extracellular organic carbon (EO released from the phytoplankton contribut DFAA to the water. In Lake Mosso, 81% of t ambient EOC pool was < 700 daltons and 9.3% the EOC was DFAA. This corresponded to abo 2.4% of the DFAA pool. Bacterial productivit determined by means of frequency of dividing ce and S-35 SO4 dark uptake techniques gave simil results and constituted 4.5 and 3.7 micro g C/l/h Frederiksborg Slotsso and Lake Mosso, respectiv ly. The bacterial productivity suggested th DFAA were essential substrates to the bacteri

cially in Frederiksborg Slotsso. The zooplank-
biomass in Frederiksborg Slotsso was six times
r than that in Lake Mosso, but cladocerans
dominant in both lakes. The zooplankton
ing probably was an important regulatory
r for the bacterial productivity. (Author's ab-
t)
-00994

MARY PRODUCTIVITY OF THE RIVER
, SOUTH WALES, U.K.,
ersity Coll., Cardiff (Wales). Dept. of Plant
nce.
primary bibliographic entry see Field 5C.
-00996

IODAL DIEL DISSOLVED OXYGEN
RVES AND THERMAL STRATIFICATION
POLDER DITCHES,
sinstituut voor Natuurbeheer, Leersum (Neth-
nds).
Kersting.
robiologia, Vol. 107, No. 2, p 165-168, No-
ber, 1983. 2 Fig, 6 Ref.

criptors: *Ditches, *Dissolved oxygen, *Ther-
stratification, *Polders, Bimodal curve, Diel
ation, Turnover.

polder ditch with a water depth of 50 cm,
gen and temperature were measured continu-
y during 24 hours at 10 cm above the bottom
10 cm below the surface. Two examples are
n in which the diel oxygen curve of the lower
rode was bimodal. The curve of the upper
rode was unimodal in both cases. The occur-
e of the biomodal curve could be explained by
turnover of the stratified water column after
surface started to cool in the late afternoon.
hor's abstract)
-00997

PONSES OF LAKE WATERS TO ORGAN-
MATTER ADDITIONS,
fornia Univ., Berkeley. Lawrence Berkeley

arte, and D. Levy.
robiologia, Vol. 107, No. 3, p 203-212, No-
ber, 1983. 10 Fig, 4 Tab, 14 Ref. DOE con-
DE-AC03-76SF00098.

criptors: *Organic matter, *Nitrogen, Bacteria,
ae, Detritus, Decomposers, Microorganisms,
e water, Nutrients, Mineralization.

increase of inorganic nitrogen subsequent to
addition of organic matter was investigated in
icate lake-water aliquots. Each of the four ex-
ments was carried out with water samples
n from lakes in the San Francisco Bay area.
o experiments used freshly killed bacteria as the
nic addition. In both, inorganic nitrogen in the
er column increased only after a lag period
owing the organic addition, and only if the
unt of organic matter added exceeded a thresh-
value. Two other experiments used freshly
d algae as the organic addition; in these, nei-
the lag period nor the threshold value were
. Analysis of the data suggests strongly that
observed threshold phenomenon characterizes
itus-decomposer interactions and is not simply
flection of the kinetics of uptake of inorganic
ients by phytoplankton. In a model using a
le microbial carrying capacity mechanism,
ve a certain population density, decomposer
wth ceases while mineralization continues at
ificant rates. (Moore-IVI)
5-00998

YTOPLANKTON AS A FACTOR IN THE
CLINE OF THE SUBMERGED MACRO-
YTE MYRIOPHYLLUM SPICATUM L. IN
KE WINGRA, WISCONSIN, U.S.A.,
rge Mason Univ., Fairfax, VA. Dept. of Biol-
.
C. Jones, K. Walti, and M. S. Adams.
drobiologia, Vol. 107, No. 3, p 213-219, No-
ber, 1983. 5 Fig, 1 Tab, 17 Ref. NSF grants
B-19777, ENV 77010188 and DEB 78-10640.

Descriptors: *Phytoplankton, *Myriophyllum, *Lake Wingra, *Wisconsin, Biomass, Light penetration, Chlorophyll a, Macrophytes, Aquatic plants, Submerged plants.

A dramatic decline in biomass and areal coverage of the submerged macrophyte Myriophyllum spicatum in Lake Wingra, Wisconsin, USA during the mid-1970's is documented using aerial photography, vegetation surveys, and quadrat biomass sampling. Over the same period, light penetration as measured by Secchi disc transparency and extinction coefficient substantially. During this period, extinction coefficient was closely correlated with chlorophyll a levels implicating phytoplankton as the major source of decreased light penetration. A growth model for M. spicatum predicts a substantial decline in macrophyte biomass when extinction coefficient is increased to the levels reported since 1977. Available data do not show whether the phytoplankton increase preceeded or followed the marcophyte decline. Nonetheless it is clear that phytoplankton growth can account for a substantial portion of the decline and that macrophyte recovery will be difficult given the phytoplankton-induced decrease in water clarity. (Author's abstract)
W85-00999

SPATIAL AND TEMPORAL VARIATION IN THE SUMMER ZOOPLANKTON COMMUNITY OF A RIVERINE RESERVOIR,
Oklahoma Univ., Kingston. Biological Station.
S. T. Threlkeld.
Hydrobiologia, Vol. 107, No. 3, p 249-254, November, 1983. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Zooplankton, *Normandy Reservoir, *Tennessee, Ecological distribution Spatial distribution, Temporal distribution, Reservoirs, Biological communities, Model studies.

Zooplankton community structure was examined at five stations in Normandy Reservoir, Tennessee, on six dates from 11 July to 15 September 1980. Four physical and chemical parameters at three depths at each station were used to discriminate statistically among areas of the reservoir over time; a similar analysis based on nine taxomonic and ecological categories of zooplankton was also completed. Each of the two multivariate analyses provided a matrix of similarities among station-times ($n = 30$) in the reservoir. The two similarity matrices were compared by the Mantel test and were found to be not significantly concordant, suggesting that physical-chemical variation among areas in the reservoir during the summer months was not precisely reflected by zooplankton community structure. The lack of congruence between physically- and chemically-determined reservoir structure and structure implied by zooplankton taxa or functional groups was also observed in the results of a random-effects-model ANOVA of physical and chemical parameters and zooplankton densities. ANOVA of zooplankton densities revealed that spatial variation was generally greater than temporal variation, although most of the spatial variation was ephemeral (station-time interaction) rather than fixed (station effects). An ANOVA of physical and chemical variables revealed considerable fixed spatial variation over the same time scale. (Author's abstract)
W85-01001

EFFECTS OF ARTIFICIAL FRESHETS ON SUBSTRATUM COMPOSITION, BENTHIC INVERTEBRATE FAUNA AND INVERTEBRATE DRIFT IN TWO IMPOUNDED RIVERS IN MID-WALES,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
For primary bibliographic entry see Field 2E.
W85-01002

MIXING PATTERNS IN AMAZON LAKES,
Universidade Federal de Sao Carlos (Brazil). Dept. de Ciencias Biologicas.
J. G. Tundisi, B. R. Forsberg, A. H. Devol, T. M. Zaret, and T. M. Tundisi.
Hydrobiologia, Vol. 108, No. 1, p 3-15, January, 1984. 10 Fig, 43 Ref.

Descriptors: *Amazon River, *Lago Jacaretinga, *Lago Cristalino, *Rio Negro, *Mixing, Temperature, Oxygen, Ammonia, Phosphate, Chlorophyll, Thermal stratification, Hypolimnion, Productivity, Algae.

The diel mixing patterns of two small floodplain lakes, Lago Jacaretinga in the Amazon drainage, and Lago Cristalino in the Rio Negro system, were investigated during both the high-water and low-water states of the Amazon River hydrograph. Measurements included temperature, oxygen, ammonia, phosphate, and chlorophyll. In both lakes thermal stratification developed during the day and was eroded at night. During the low-water period when the lakes were shallow, nocturnal circulation extended to the lake bottom, whereas when the lakes were deeper (greater than about 5 m), circulation did not reach the bottom and an anoxic hypolimnion developed. During the low-water period, percent of oxygen concentrations were relatively high but always less than saturation. Low oxygen concentrations were observed during the high-water period. At all times nocturnal mixing supplied a significant amount of oxygen to the lake ecosystems. Nighttime upward mixing of recycled nitrogen and phosphorus also appeared to be important nutrient sources for algal productivity. (Author's abstract)
W85-01004

ECOGEOGRAPHICAL TOLERANCE RANGE VARIATION IN AQUATIC MACROPHYTES,
Winnipeg Univ. (Manitoba). Dept. of Biology.
E. Pip.
Hydrobiologia, Vol. 108, No. 1, p 37-48, January, 1984. 10 Fig, 1 Tab, 30 Ref.

Descriptors: *Canada, *Macrophytes, *Geography, *Ecological distribution, Dissolved solids, Hydrogen ion concentration, Alkalinity, Species composition.

A portion of central Canada (area B) and a smaller , soft-water area within it on the Precambrian Shield (area A) were surveyed for aquatic macrophytes in relation to eight water chemistry parameters. Total dissolved solids, pH, and total alkalinity appeared to be the three most important factors correlated with macrophyte distribution. T-tests indicated that species for which water chemistry affinities were not discrepant in areas A and B could be identified as specialized or unspecialized plants with respect to area A. Other species behaved quite differently in the two areas. In most cases for pH and dissolved inorganics macrophytes showed lower mean values and lower upper tolerance range limits in area A than in area B, reflecting the prevailing water chemistry values in the two areas. These results suggested that adaptation had occurred in one or both sets of populations. A number of interspecific associations were demonstrated in area A, many of which coincided with similarities in water chemistry affinities. (Author's abstract)
W85-01006

RESPONSE OF STREAM MACROINVERTEBRATES TO SUBSTRATE SIZE AND HETEROGENEITY,
California Univ., Berkeley. Dept. of Forestry and Resources Management.
D. C. Erman, and N. A. Erman.
Hydrobiologia, Vol. 108, No. 1, p 75-82, January, 1984. 4 Fig, 3 Tab, 24 Ref.

Descriptors: *Sagehen Creek, *California, *Crystal River, *Colorado, *Invertebrates, *Substrates, *Stream biota, *Heterogeneity, Particle size, Detritus, Water currents, Species diversity, Population density.

Manipulations of substrate size and components of heterogeneity were designed to test their independent effects and interactions on the abundance and species richness of stream macroinvertebrates. Two tests on particle size and heterogeneity (quartile deviation and number of size classes) were conducted in Sagehen Creek, in the Sierra Nevada of California, and a test on surface heterogeneity

was conducted at Crystal River, Colorado. For the Sagehen Creek tests, sediments were sieved into size classes, placed into trays, and the trays were then placed on the stream bed to permit colonization of the substrate. Rocks of similar chemical composition but different textures were selected in the Crystal River, placed on trays, and allowed to be colonized. Neither variation in size class proportions or number of size classes had any independent effect on abundance or richness and, in general, did not interact with median particle size. Median particle size, stream current, and detritus accounted for most of the significant variation in macroinvertebrates colonizing the experimental substrates. Rocks with high surface heterogeneity (roughness) were colonized by more individuals (but not taxa) than rocks with low surface heterogeneity. (Collier-IVI)
W85-01007

SEASONAL ABUNDANCES OF THE PSAMMIC ROTIFERS OF A PHYSICALLY CONTROLLED STREAM,
Union Coll., Barbourville, KY. Dept. of Biology.
W. A. Evans.
Hydrobiologia, Vol. 108, No. 2, p 105-114, 1984. 5 Fig, 3 Tab, 26 Ref.

Descriptors: *Racoon Creek, *Ohio, *Rotifers, *Stream biota, *Seasonal variation, *Population density, Sand, Substrates, Acid mine drainage, Manganese, Alkalinity, Water temperature, Lecane, Cephalodella, Trichocerca.

Sandy stream bottoms, which have a highly variable and unpredictable nature, may be classified as physically controlled and often support a fauna of diminished abundance. The psammic rotifer community inhabiting the predominantly sandy bottom of a second order, 1 m wide tributary of Racoon Creek (Vinton County, Ohio) was studied from May, 1978 to November, 1979. Racoon Creek is a 4th order stream flowing through a heavily strip-mined forested area contaminated by acid mine drainage. Thirty-one species of rotifers were found, but abundances were very low (range 0.0 to 8.6/cu cm). Highest densities occurred in the top 1 cm of sediment during periods of stream stability in the late summer and fall. Total rotifer density and densities of Lecane spp., Cephalodella spp. and Trichocerca spp. were positively correlated with alkalinity and negatively correlated with manganese (canonical correlation, $p < .05$). Densities of all taxa were negatively correlated with variability in water chemistry. Total rotifer density was found to be positively correlated with minimum monthly temperature ($r = 0.6$, $P < .05$) and to lag behind the temperature cycle by 6 weeks. Rotifer species were found to be randomly distributed in time and space with no evidence which might suggest competitive exclusion. A highly variable and unpredictable environment is thought to keep density and diversity low in this community. (Collier-IVI)
W85-01008

LANGSEE: A GEOCHEMICAL HISTORY OF MEROMIXIS,
VTN Consolidated, Inc., Irvine, CA.
R. V. Harmsworth.
Hydrobiologia, Vol. 108, No. 3, p 291-231, 1984. 6 Fig, 19 Ref.

Descriptors: *Lake sediments, *Meromixis, *Langsee, *Austria, *Geochemistry, Clay, Gyttja zone, History, Limnology.

Langsee lies in the southern Austrian alps and exhibits permanent meromixis. The lake sediment profile consists of a layer of glacial clay, then gyttja and an upper layer of sapropel. The 7 m core was analyzed for 24 metallic and 4 biophilic elements. The geochemical principles of isomorphism and atomic substitution were used to explain the association of chemically dissimilar element pairs such as K, Ba and Mg, Ni. High concentrations of S early in the gyttja zone indicate that meromixis occurred early in the history of the lake. The lake may have been meromictic even before the gyttja zone, although there is no unequivocal evidence for this possibility. The rapid onset of meromixis in the early gyttja zone suggests climate, topography and morphometry as the causal factors rather than the biogenic concentration of solutes. (Baker-IVI)
W85-01013

QUANTITATIVE IMPORTANCE OF CILIATES IN THE PLANKTONIC BIOMASS OF LAKE ECOSYSTEMS,
Toronto Univ. (Ontario). Dept. of Zoology.
M. A. Gates.
Hydrobiologia, Vol. 108, No. 3, p 233-238, 1984. 3 Fig, 2 Tab, 35 Ref.

Descriptors: *Lakes, *Ecosystems, *Ciliates, *Ontario, Plankton, Biomass, Protozoa, Oligotrophic lakes, Trophic level.

Ciliated protozoa increasingly are being realized to be important components of aquatic ecosystems, but their have been few studies of their relative importance or of their absolute contribution to overall biomass. Phytoplankton, zooplankton, and ciliated protozoa were sampled from 9 south-central Ontario lakes fortnightly during the ice-free period of 1981. Ciliates comprise on the order of 5 to 10% of the total planktonic biomass of these relatively oligotrophic lakes and exist there in densities of 20-40/ml. Therefore, ciliates constitute an important component of lake ecosystems that should not be ignored in limnological studies of zooplankton abundance and distribution. (Baker-IVI)
W85-01014

PHOSPHATE UPTAKE BY BLUE GREEN ALGAE IN VITRO AND IN A LAKE DURING AN ALGAL BLOOM: USEFUL APPLICATION OF A FORCE-FLOW RELATIONSHIP,
Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Limnologie.
G. Falkner, P. Strasser, and D. Graffius.
Hydrobiologia, Vol. 108, No. 3, p 265-271, 1984. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Phosphates, *Model studies, *Eutrophication, *Cyanophyta, Force-flow relationship, Threshold value, Algal growth.

A bioenergetic model was applied to the P-32 phosphate uptake data obtained with blue green algae. This model allowed the determination of a threshold concentration for the absorption of phosphate. The model connects uptake rates with an absorbing force. According to this model, plotting the uptake velocity against the phosphate concentration yields a logarithmic curve which has a shape similar to the traditional Michaelis-Menten hyperbola. A constant k is used which reflects the permeability of the membrane and a threshold value for phosphate uptake is considered which must be exceeded to allow phosphate incorporation. To test the validity of the model for phosphate incorporation experiments were performed with algal cultures in which the algae were allowed to incorporate all available phosphate. Here the threshold value, calculated by the bioenergetic model actually corresponded to the remaining phosphate concentration in the medium. The subsequent phosphate starvation caused an increase of the permeability of the membrane. During an algal bloom in a lake, a similar picture emerged. The bloom lasted as long as the phosphate concentration was above the threshold value of the algal material under the respective ecological condition. Algal growth ceased when the phosphate concentration dropped below the threshold value. During the following weeks the permeability of the membrane increased dramatically due to an activation or additional induction of the phosphate carrier. (Baker-IVI)
W85-01015

STRUCTURE AND FUNCTION OF ECOSYSTEMS OF THE FRENCH HAUT-RHONE (STRUCTURE ET FONCTIONNEMENT DES ECOSYSTEMES DU HAUT-RHONE FRANCAIS),
Lyon-1 Univ., Villeurbanne (France).
C. Amoros, and J. Mathieu.
Hydrobiologia, Vol. 108, No. 3, p 273-280, 1984. 3 Fig, 1 Tab, 18 Ref.

Descriptors: *Population dynamics, *Cop
*Alluvial channels, *Rhone river, *France,
systems, Interstitial water, Invertebrates.

On the alluvial plains of great rivers, aban
stream channels occur that are often provid
ternatively by river water or groundwater
the interstitial flow. Whether these channels
ence invertebrate populations was investiga
an abandoned channel of the River Rhone.
sampling stations were established, one was
face-water environment, the other was the in
tial water. Cyclopoid copepods, very abund
both biotopes, were studied for three years.
een speices were identified, 13 of them i
interstitial station and 9 in the surface station.
species were common to both stations. The
of the specific population evolution shows th
ference between both environments. The
poid populations from the interstitial flow
rather stable. The surface populations were
fluctuating and influenced by the river water
ing back into the abandoned channel. The
rence of common species for both station
their simultaneous abundance peaks indicate
there may be exchanges between both. Th
sence from the surface water of the troglo
species which are abundant in the subterr
station, raises the problem of the evoluti
abandoned stream channels. (Baker-IVI)
W85-01016

**ILLUSTRATION OF THE SPATIAL VA
BILITY OF LIGHT ENTERING A LAKE U
AN EMPIRICAL MODEL,**
McMaster Univ., Hamilton (Ontario). Dept. o
ography.
N. T. Roulet, and W. P. Adams.
Hydrobiologia, Vol. 109, No. 1, p 67-74, Febr
6, 1984. 3 Fig, 6 Tab, 19 Ref.

Descriptors: *Lakes, *Ice cover, *Light pe
tion, Spatial distribution, Snow,
Light, Model studies, Light transmission.

The importance of the spatial variability of a
winter cover as a control of the under ice
regime of a subarctic lake was examined. The
of the study was a large temporal and spatial i
experiment. An empirical model was used fo
spatial extrapolation. The light regime prod
by the model was then compared with the
regime indicated by a single sample. The s
variability of snow and snow-derived whit
exerted a substantial influence on the quanti
light reaching the unfrozen water beneath
cover. The transmission of light relative to su
irradiance varied from less than 0.02% in ma
and downwind areas to 4.50% in the central
of the lake. The spatial distribution of light t
mission is inversely related to the spatial dist
tion of depths of snow and/or white ice. Com
son of light reaching the unfrozen water su
based on both a single sample point and an
estimate, suggests that the conventional s
sample approach overestimates the quantit
light by more than 700%. (Baker-IVI)
W85-01017

**NUTRIENT ADDITION EXPERIMENTS
LAGO JACARETINGA, CENTRAL AMAZ
BRAZIL: 2. THE EFFECT OF HUMIC
FULVIC ACIDS,**
Washington Univ., Seattle. Coll. of Ocean
Fishery Sciences.
A. H. Devol, A. Dos Santos, B. R. Forsberg, a
T. M. Zaret.
Hydrobiologia, Vol. 109, No. 2, p 97-103, Fe
ary, 17, 1984. 4 Fig, 1 Tab, 30 Ref. NSF gr
DEB 78-07111 and DEB 80-17522.

Descriptors: *Algal growth, *Nutrients, *Lago
caretinga, *Brazil, Amazon, Humic acids, Fu
acid, Primary productivity, Tropical regions.

The effects of humic and fulvic acid on the gro
of natural algal assemblages from Lago Jacaret
were assessed relative to the effects of nutr
addition. Lago Jacaretinga, is a small, approxim
ly 5 ha, varzea white water lake located in

Central Amazon Basin. In contrast to previous laboratory culture studies, humic and fulvic acids appeared to have no effect on algal growth. In the presence of added nutrients, neither humic acid or fulvic acid appreciably altered the time course of nutrient uptake or final chlorophyll yield. The hypothesis that the lowered productivity of Amazonian black waters is due to toxicity of humic substances was not supported by the data presented here. (Baker-IVI)
W85-01018

CONTRIBUTION TO A STUDY OF THE SEDIMENTS OF A OLIGOMESOTROPHIC LAKE OF VOLCANIC ORIGIN (LAKE PAVIN, FRANCE) (CONTRIBUTION A L'ETUDE DU SEDIMENT D'UN LAC OLIGOMESOTROPHE D'ORIGINE VOLCANIQUE (LAC PAVIN, FRANCE)),
Clermont-Ferrand-2 Univ., Aubiere (France).
F. Restituito.
Hydrobiologia, Vol. 109, No. 3, p 229-234, February, 1984. 5 Tab, 24 Ref.

Descriptors: *Lake sediments, *Trophic level, *Metals, *Lake Pavin, *France, Zinc, Calcium, Magnesium, Sodium, Potassium, Iron, Manganese, Organic matter, Diatoms, Organic matter.

Sediments were collected from Lake Pavin, an oligomesotrophic lake at different depths. These sediments were then analyzed for Ca, Mg, Zn, Na, K, Mn, and Fe as well as for organic matter content. The role of diatoms in the sediment regarding fixation of Ca, Mg, K, and Fe cations was considered and a positive relation between the presence of these cations and the degradation of organic matter was demonstrated. In the -30 m layer, the iron concentration was relatively high, the organic matter concentration low, and the C/N ratio very high. (Baker-IVI)
W85-01019

CONTRIBUTION TO A STUDY OF A HYDROGEN SULFIDE LAYER IN A MEROMICTIC LAKE (LAKE PAVIN, FRANCE) (CONTRIBUTION A L'ETUDE D'UNE COUCHE A HYDROGENE SULFURE EN LAC MEROMICTIQUE (LAC PAVIN, FRANCE)),
Clermont-Ferrand-2 Univ., Aubiere (France).
F. Restituito.
Hydrobiologia, Vol. 109, No. 3, p 235-241, February, 1984. 5 Tab, 33 Ref.

Descriptors: *Lake Pavin, *France, *Hydrogen sulfide, *Meromictic lakes, *Sulfates, *Sulfides, Anaerobic bacteria, Iron, Magnesium, Anaerobic conditions, Chemical stratification.

The origin of Lake Pavin, France, is volcanic; it is meromictic because of its form and the climate of Auvergne (Massif Central). Sulfate is reduced into sulfide by bacteria in the anaerobic layer. The most important concentration of sulfate is found in the -2 m layer; H2S appears in the presence of Fe without Mn being present. In the water the concentrations of Mn and Fe increase from -55 m to -0 m. The high concentration of Fe (50 mg/l) is due to the presence of suspended FeS and maybe to the presence of Fe in the inorganic matter. (Author's abstract)
W85-01020

ZOOPLANKTON-TROPHIC STATE RELATIONSHIPS IN SOME NORTH AND CENTRAL FLORIDA LAKES,
Taxonomic Associates, Inc., Mobile, AL.
J. C. Blancher, II.
Hydrobiologia, Vol. 109, No. 3, p 251-263, February, 1984. 6 Fig, 5 Tab, 50 Ref. Army Corps of Engineers DACW39-76-C-006.

Descriptors: *Zooplankton, *Lakes, *Florida, Trophic level, Oligotrophic lakes, Eutrophic lakes, Seasonal variation, Rotifers, Copepods, Cladocera, Species diversity, Predation, Standing crop, Water temperature.

In a survey of eight lake systems located in north-central Florida, total zooplankton abundance showed a strong positive correlation (r squared = 0.87, a = 0.01) with trophic state. Zooplankton abundance averaged 100,000 organisms/sq m in oligotrophic systems and up to 820,000 organisms/sq m in the eutrophic systems. Seasonal variations in total abundance were greatest in the eutrophic lakes where rotifers dominated and periodically produced sharp population peaks (approaching 2,000,000/sq m). In contrast, the more oligotrophic systems had relatively stable levels of total abundance and were dominated by copepods. Diversities of the major taxa in the lakes were variable with one to three species of copepods, zero to four species of cladocera, and two to seven species of rotifers dominant at any one time. Planktonic cladoceran communities were often composed of only one or two species. Low cladocera diversity in these subtropical systems was suggestive of increased predation pressure on this group of crustaceans. A comparison of the total crustacean abundance in the Florida systems to those of some of the Great Lakes indicated that lower standing crops of crustacean zooplankton in the Florida lakes may be a response to both predation and temperature. (Author's abstract)
W85-01022

NILE: DESCRIPTION, HYDROLOGY, CONTROL AND UTILISATION,
Arab Authority for Agricultural Investment and Development, Khartoum (Sudan). Implementation Div.
A. M. Ibrahim.
Hydrobiologia, Vol. 110, No. 4, p 1-13, March, 1984. 3 Fig, 2 Tab, 9 Ref.

Descriptors: *Water resources development, *Environmental effects, *Nile River, Egypt, Sudan, Irrigation, Navigation, Hydroelectric power, Fisheries, Water resources development.

The Nile is a vital resource of north eastern Africa. After a description of its basin, and its hydrology, the different phases in the process of man gaining control over the river are discussed. Until the early part of the nineteenth century all irrigation on the Nile in both Egypt and the Sudan was practiced by using the basin irrigation method when, during the flood period, the adjacent low areas were inundated by lifting the water using sagias, shadufs and archemedian screws. By 1890 with increases in the cropped areas of the land, the whole of the natural flow of the Nile during the low period in Egypt was consumed. It became apparent that it was not possible to expand in irrigated agriculture without the establishment of control works across the Nile to store the excess flood water for supplementing the needs during periods of shortage. The first such step was construction of the Aswan Dam in 1902. Eventually the Sudan Government, in response to increased needs, proposed building a barrage across the Blue Nile at Sennar. This plan was modified to a Dam with ample storage to enable the Sudan to draw the stored water requested from January to July. Construction was suspended during the First World War, but Sennar Dam was completed in 1925. The second raising of the Aswan Dam was completed in 1933. In 1949 Owen Falls Dam was built in Uganda. In 1951 the Edfina barrage was completed on the Roseta branch of the Nile and in 1952 Egypt agreed to raise Sennar Dam. The High Aswan Dam was completed in 1966. The effects these various construction efforts have had on irrigation, the generation of hydroelectric power, navigation, and fisheries are considered. Future developments in the management of the Nile are summarized. (Baker-IVI)
W85-01024

PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE BLUE NILE AND THE WHITE NILE AT KHARTOUM,
Khartoum Univ. (Sudan). Dept. of Botany.
F. Sinada, and A. G. A. Karim.
Hydrobiologia, Vol. 110, p 21-32, March, 1984. 6 Fig, 1 Tab, 32 Ref.

Descriptors: *Blue Nile, *White Nile, *Physical properties, *Chemical properties, *Khartoum, Sudan, Seasonal variation, Floods, Nitrates, Phosphates, Iron, Organic matter, Alkalinity, Calcium, Sodium, Potassium, Silica.

Fortnightly measurements of physical and chemical variables were made at two locations on the Blue and White Niles near Khartoum from August 1968 to December 1970. Variables analyzed from each river were: temperature, pH, total residue, current velocity, oxygen, alkalinity, phosphate, nitrate, ammonia, silica, sulfate, iron, calcium, magnesium, sodium, potassium and oxidizable organic matter. The seasonal variations of these factors in the two Niles are compared and the interrelationships existing between some of them are discussed. Comparisons with earlier studies on the Nile and with some tropical rivers are made. In the Blue Nile, the amounts of suspended matter and nutrients are largely dependent upon the flood regime. Nitrate, phosphate, iron, oxidizable organic matter and total residue increase considerably in the Blue Nile when the river is in flood (peaks: 1,880 micro g NO3-N/l; 0.31 mg Fe/l; 3,842 mg total residue/l). In the White Nile, concentrations of nitrate, phosphate, iron, oxidizable organic matter and total residue attain their peaks during the rainy season (270 micro g NO3-N/l; 163 micro g PO4-P/l; 0.46 mg Fe/l; 502 mg total residue/l). In both rivers, alkalinity, calcium, sodium and potassium tend to increase during the dry season while declining in the rainy season. Silica is depleted at certain times of the year, yet relatively high concentrations are maintained throughout the year and were not expected to limit growth of diatoms. Fall in silica concentrations, unlike nitrate, phosphate and iron, was always followed by a rapid restoration of a high level. Silica and magnesium showed no response to changes in discharge rates. (Author's abstract)
W85-01026

FAUNISTIC RECONNAISSANCE OF LAKES KUNDI AND KEILAK, WESTERN SUDAN,
Westfield Coll., London (England). Dept. of Zoology.
J. Green, A. I. el Moghraby, and O. M. M. Ali.
Hydrobiologia, Vol. 110, No. 4, p 33-44, March, 1984. 3 Fig, 7 Tab, 18 Ref.

Descriptors: *Aquatic animals, *Seasonal variations, *Lake Kundi, *Lake Keilak, *Sudan, Macrophytes, Crustaceans, Birds, Rotifers, Zooplankton.

Both lakes show large seasonal fluctuations in area, but both are permanent, with residual areas rich in aquatic macrophytes. The two lakes differ markedly in their conductivities, with that of L. Kundi being about one fifth that of L. Keilak. Yet from several aspects L. Kundi appears to be the richer lake. A total of 130 animal species was found in L. Kundi, compared to 91 in the other. Copepods were bigger and were producing more eggs per female in Kundi. The numbers of aquatic birds were also much higher at Kundi, both in terms of species and individuals. Zooplankton of the open water in the two lakes showed greater similarity in the Crustacea than in the Rotifera. Moina micrura was the dominant planktonic cladoceran in both, and both had the same species of planktonic copepods. Among the Rotifera Keratella tropica was dominant in Kundi, but Brachionus caudatus was dominant in L. Keilak. The fauna of L. Kundi includes the protomonad Phipidodendron huxleyi, which has not been previously recorded in Africa. In L. Keilak Neozonocypris mirabilis was found which had previously only been known from L. Tanganka. (Baker-IVI)
W85-01027

QUANTITATIVE STUDY OF THE PHYTOPLANKTON IN THE BLUE AND WHITE NILES AT KHARTOUM,
Khartoum Univ. (Sudan). Dept. of Botany.
F. Sinada, and A. G. A. Karim.
Hydrobiologia, Vol. 110, p 47-55, March, 1984. 3 Fig, 8 Ref.

Descriptors: *Blue Nile, *White Nile, *Khartoum, *Sudan, *Phytoplankton, Algae, Biomass, Dia-

toms, Cyanophyta, Seasonal variation, Dam effects, Environmental effects, Water hyacinth.

The variation in numbers of the major planktonic algae in the surface waters of the Blue Nile and White Nile were followed for 29 months (August 1968-December 1970). In terms of biomass, the phytoplankton was dominated by diatoms and blue-green algae; other groups were of minor importance. High phytoplankton densities occurred during winter in both rivers, and during summer in the Blue Nile, with values in the latter river greater than in the former. Melosira granulata and its variety angustissima and Anabaena flos-aquae var. intermedia f. spiroides were the most important taxa in the two Niles. Melosira distans and Attheyazachariasi, which are reported for the first time in the present study, preponderated at certain times in the Blue Nile. Microcystis flos-aqua which had been a minor component of the phytoplankton in both rivers during the early 1950s, showed a profuse growth in the Blue Nile. Lyngbya limnetica, Anabaenopsis cunningtonii and A. tanganyikae, which constituted important components of the phytoplankton in the early 1950s, either disappeared or maintained themselves in reduced numbers during the present study. This change in the algal flora of the two Niles may be attributed to the construction of the Roseres dam across the Blue Nile in 1966 and to the invasion of the While Nile by Eichhornia crassipes in 1957. (Author's abstract)
W85-01029

PRIMARY PRODUCTION AND RESPIRATION OF THE PHYTOPLANKTON IN THE BLUE AND WHITE NILES AT KHARTOUM,
Khartoum Univ. (Sudan). Dept. of Botany.
F. Sinada, and A. G. A. Karim.
Hydrobiologia, Vol. 110, p 57-59, March, 1984. 1 Fig, 8 Ref.

Descriptors: *Blue Nile, *White Nile, *Khartoum, *Sudan, *Phytoplankton, *Primary productivity, Respiration, Seasonal variation, Flooding.

Phytoplankton production and respiration in the Blue Nile and White Nile at Khartoum were measured during the period November 1969-January 1971 using the light and dark bottle technique. Maximum rates of production coincided with periods of maximum phytoplankton densities. In the Blue Nile gross production varied between 0.00 g C/cu m/d during the flood season and 2.19 g C/cu m/d (0.49 mg O2/l/h) during November 1969. In the White Nile the range was from 0.41 g C/cu m/d (0.09 mg O2/l/h) in May to 3.74 g C/cu m/d (0.83 mg O2/l/h) in November. The maximum rates of respiration in the Blue Nile and White Nile were 0.10 and 0.63 mg O2/l/h respectively. The ratios net:gross production were generally higher in the White Nile than in the Blue Nile. (Author's abstract)
W85-01030

FISHES AND FISHERIES OF LAKE NUBIA, SUDAN,
Fisheries Research Centre, Khartoum (Sudan).
M. T. Ali.
Hydrobiologia, Vol. 110, p 305-314, March, 1984. 9 Fig, 2 Tab, 7 Ref.

Descriptors: *Lake Nubia, *Sudan, *Commercial fisheries, *Reservoirs, Dam effects, Fish populations, Aswan High Dam, Seasonal variation, Fish food.

Lake Nubia is the southern part (within Sudan) of the man-made reservoir formed as the result of the construction of the Aswan High Dam in 1961 in Egypt. Developing lake conditions in Lake Nubia offered good commercial fisheries potential. This prospect initiated fishery research since 1967. In 1975-1976, 26 fish species belonging to 10 families were recorded. Compared with previous studies the total number has decreased and some of the species that were commercially important during the early years of the lake formation, are now negligible in occurrence (Distichodus, Citharinus, Bagrus). The species widely distributed in the lake are Labeo niloticus, Sarotherodon niloticus, Hydrocynus forskallii, Alestes baremose and Eutropius niloticus. Their highest production occurs during two periods: February to May and July to September. The different dominant fish species feed on different items of food, counterbalancing each other, and resulting in some equilibrium with the ecological and biological conditions. (Moore-IVI)
W85-01033

EFFECT OF GROUNDWATER INFLOW ON EVAPORATION FROM A SALINE LAKE,
Saskatchewan Research Council, Saskatoon.
J. M. Whiting.
Journal of Climate and Applied Meteorology, Vol. 23, No. 2, p 214-221, February, 1984. 6 Fig, 2 Tab, 11 Ref. DSS contract KW 111-2-1077.

Descriptors: *Groundwater inflow, *Saline lakes, *Evaporation, *Big Quill Lake, *Saskatchewan, Remote sensing, Satellite technology, Mixing, Convection, Water temperature, Water circulation.

A decade study of the hydrometeorology of Big Quill Lake in Saskatchewan, a saline prairie lake, has effectively used remote sensing to delineate groundwater inflow. The lake covers an area of 250 square kilometers with the groundwater seeping through 4 square kilometers. The salinity of the lake water forces the fresher groundwater to the surface by convection and spreads the colder groundwater by diffusion over an area of 50 square kilometers. The magnitude, source and discharge rate were determined using thermal diffusivity from data supplied by thermal infrared line scanning. Two thermal scans were made of the lake and the data extended to provide a seasonal index using LANDSAT computer compatible tapes. The seasonal thermal index was extended further using four shore-based climatological stations to provide areal evaporation using a modified Penman equation and a diffusion equation. (Author's abstract)
W85-01043

CONTRIBUTION OF CILIATED PROTOZOA TO THE PLANKTONIC BIOMASS IN A SERIES OF ONTARIO LAKES: QUANTITATIVE ESTIMATES AND DYNAMICAL RELATIONSHIPS,
Toronto Univ. (Ontario). Dept. of Zoology.
M. A. Gates, and U. T. Lewg.
Journal of Plankton Research, Vol. 6, No. 3, p 443-456, 1984. 6 Fig, 1 Tab, 34 Ref. NSERC of Canada grant U0090.

Descriptors: *Protozoa, *Ontario, *Lakes, *Ciliates, Plankton, Biomass, Standing crop, Nitrogen, Inorganic carbon, Organic carbon, Conductivity, Algae.

The plankton of nine Ontario lakes spanning several physiographic regions was sampled every two weeks during the ice-free period of 1981, and one lake was studied in the three previous years. Phytoplankton, zooplankton, and ciliated protozoa were sampled, counted and sized. The size data were converted to biomass estimates to yield quantitative comparisons of the relative allocation of biomass among different functional compartments. This is the first study to look simultaneously and quantitatively at the total plankton system of lakes (including ciliates, phytoplankton and net zooplankton) over a broad physiographic region. Ciliates constitute ca. 10% of the non-algal biomass and 5% of the total planktonic biomass of these lakes. Ciliate standing crops among lakes are significantly correlated with total organic and total inorganic carbon concentrations in the water column, while the dynamics of ciliate biomass fluctuations are significantly correlated with variations in total phosphorus concentration, in conductivity, in Kjeldahl nitrogen concentration, and in inorganic carbon content. There appears to be a significant dynamical relationship between ciliates as a proportion of the total planktonic biomass, exclusive of filamentous and large (> 30 micro m) spherical algae, and the relative biomass of small algae (2-5 micro m) as a fraction of total algal biomass, again exclusive of filaments and large (> 30 micro m) algae. The hypothesis is advanced that ciliates primarily function as bacterial grazers in planktonic ecosystems and that their primary competitors in this role are rotifiers. (Author's abstrac
W85-01045

QUANTIFYING WITHIN-LAKE GRADIENT OF WAVE ENERGY: INTERRELATIONSHIP OF WAVE ENERGY, SUBSTRATE PARTICL SIZE AND SHORELINE PLANTS IN AX LAKE, ONTARIO,
Guelph Univ. (Ontario). Dept. of Botany and G netics.
P. A. Keddy.
Aquatic Botany, Vol. 14, No. 1, p 41-58, Septe ber, 1982. 5 Fig, 3 Tab, 31 Ref.

Descriptors: *Wave action, *Lake shores, *Veg tation, *Particle size, *Axe Lake, *Ontario, Exp sure, Ecological distribution, Fetch, Wind, Se ments, Sand sorting coefficient, Silt, Clay.

Exposure is defined as the total effect of waves lakeshore vegetation. Waves may affect shoreli plants directly (e.g., by uprooting seedlings) indirectly (e.g., by eroding fine sediments). Exp sure may be an important ecological factor affe ing the within-lake distribution of shoreline plan The object of this study was to develop a meth for identifying exposure gradients, using wind da and fetch measurements. Fetch was either measured directly from aerial photographs for compass bearings ('direct fetch') or (2) calculat from 32 compass bearings to compensate for t shape of the lake basin ('effective fetch'). Wi data were either (1) mean wind velocity multipli by directional percent frequency or (2) exceedan by direction. Four time periods (1) May, (2) gro ing season, (3) ice-free season and (4) entire ye were considered. This yielded 2 x 2 x 4 = measures of exposure. Twenty-five points on a 6 m section of shoreline on Axe Lake, Ontar Canada were sampled for sediment characteristi (proportion silt and clay; sand sorting coefficie and shoreline plants (depth ranges occupied by selected species). Exposure values then were calc lated for all 25 points using the 16 different me ods of calculation. Spearman rank correlation co ficients were used to determine the correlati between calculated exposure values, sedim characteristics and species distributions. The sa sorting coefficient, Eriocaulon septangulare Wit Nymphoides cordata (Ell.) Fern. and Utricula cornuta Michx. were positively correlated with measures of exposure. Proportion silt and cl Brasenia schreberi Gmel., Dulichium arundi ceum (L.) Britt. and Pontederia cordata L. w negatively correlated with all measures of exp sure. Calculations based on direct fetch yielded strongest correlations. When effective fetch w used, measurements based on annual or May, ceedance by direction values yielded the best sults. It is concluded that calculated measures exposure provided a biologically meaningful w to rank areas of shoreline along an exposure gra ent. (Author's abstract)
W85-01079

EFFECTS OF AQUATIC MACROPHYTES THE STREAM MICROENVIRONMENT,
Idaho State Univ., Pocatello. Dept. of Biolo
W. W. Gregg, and F. L. Rose.
Aquatic Botany, Vol. 14, No. 4, p 309-324, Dece ber, 1982. 3 Fig, 5 Tab, 38 Ref.

Descriptors: *Aquatic plants, *Macrophy *Streams, *Microenvironments, Sedimentati Detritus, Diatoms, Velocity, Substrate, Ecolog distribution, Invertebrates.

Aquatic vascular plants are often common c stituents of streams with an open canopy, such are found in many Rocky Mountain areas. T are also considered to be integral components middle sections of typical rivers. The effects aquatic macrophytes on various aspects of stream microenvironment were observed and c pared to conditions found in unvegetated substr Specifically, factors of micro-current velocity, s strate surface area, fine particle sediment dep tion, detritus deposition and attached diatom av ability were examined. Macrophytes were tra

anted into substrate trays and microenvironment onditions found within them were compared to onditions found in adjacent trays containing unve-tated substrate. Macrophytes were found to alter ow characteristics and create reduced current elocities near the substrate. They also provided gnificantly more substrate surface area, more fine rticle sediments and more detritus than unvege-ted substrates. Macrophytes supported signifi-ntly lower attached diatom biomass per sq m in oderate current regions than stones, but in slow ater they may support higher biomasses, because dimentation adversely affects diatom populations unvegetated substrate. Macrophytes appear to fect all of the factors that relate directly to vertebrate microdistribution in streams: current elocity, substrate and food availability in the form detritus and diatoms. Substantial changes in vertebrate microdistribution resulting from the istence of macrophytes would be expected and tal invertebrate abundance in streams would be pected to increase due to the existence of macro-ytes. (Moore-IVI)
85-01085

OSSBAUER SPECTROSCOPIC AND CHEMI-AL STUDIES OF PARTICULATE IRON MA-ERIAL FROM A SEASONALLY ANOXIC AKE,
reshwater Biological Association, Ambleside ngland).
. Davison, and D. P. E. Dickson.
emical Geology, Vol. 42, No. 1/4, p 177-187, nuary, 1984. 1 Fig, 2 Tab, 26 Ref.

escriptors: *Lake sediments, *Particulate matter, ron, *Esthwaite Water, *England, Chemical alysis, Sediments, Mossbauer spectra, Anoxic nditions, Ferrous sulfide, Seasonal variation.

e Mossbauer spectra of sediment and water lumn material, collected under anoxic condi-ns, are presented for Esthwaite Water, a season-y anoxic, small soft-water lake. Samples were llected at a buoy located at the deepest (15 m) e in the lake. The Mossbauer spectra of the mples are all similar, yielding two distinct spec-al components, both of which are quadrupole-lit doublets. The water column material differs om that in the sediment. It appears to consist rgely of amorphous ferric oxy/hydroxides. The tense black color of the particles is attributed to a rface coating of ferrous sulfide. There is an ap-eciable component due to aquated ferrous iron hich indicated that either the ferrous sulfide is esent as an outer sphere complex or that soluble ecies from the surrounding water are associated ith the solid phase. High-spin ferrous iron, indica-ve of chlorite, is not detectable in the particles om the water column, although it is the major mponent (77%) of the sediment material. This parent discrepancy is attributed either to parti-es having different settling rates or to a seasonal-dependent mechanism of supply. (Baker-IVI)
85-01096

OMBINED RADIOMETRIC AND MINERAL AGNETIC APPROACH TO RECENT EOCHRONOLOGY IN LAKES AFFECTED Y CATCHMENT DISTURBANCE AND SEDI-ENT REDISTRIBUTION,
iverpool Univ. (England). Dept. of Geography.
or primary bibliographic entry see Field 2J.
85-01100

AYETTEVILLE GREEN LAKE, NEW YORK, .S.A., VIII. MASS BALANCE FOR 137-CS IN ATER, VARVED AND NON-VARVED SEDI-ENTS,
epartment of Fisheries and Oceans, Winnipeg anitoba). Freshwater Inst.
or primary bibliographic entry see Field 5B.
85-01102

EDIMENTATION AND SEDIMENT ACCRE-ION IN MICHIGAN COASTAL WETLANDS .S.A.),
ichigan Univ., Ann Arbor. Dept. of Chemical ngineering.
For primary bibliographic entry see Field 2J.
W85-01103

OXIDATION PRODUCTS OF MN(II) IN LAKE WATERS,
Freshwater Biological Association, Ambleside (England).
E. Tipping, D. W. Thompson, and W. Davison.
Chemical Geology, Vol. 44, No. 4, p 359-383, June, 1984. 2 Fig, 3 Tab, 54 Ref.

Descriptors: *Lakes, *Manganese, *Chemical reactions, *Oxidation, Esthwaite Water, Rostherne Mere, England, Particulate matter, Bacteria.

Oxygenation of Mn(II)-rich water samples taken from two English lakes during the summer months caused the precipitation of Mn-oxide, the process being catalyzed by particulate matter. Naturally occurring Mn-oxides present in Esthwaite Water during the summer resemble the products of oxygenation in their fine morphology and contents of other elements. Mn-oxides present during the winter are somewhat different morphologically. In one summer sample of particulate matter from Esthwaite Water no Mn-oxide could be found by electron microscopic examination, but Mn was found concentrated in bacteria. This observation, the rapid rates of oxidation and the high Mn oxidation states, suggest that bacteria might play a role in catalyzing the oxidation of Mn(II). (Baker-IVI)
W85-01107

RATES OF PRIMARY PRODUCTION, RESPIRATION AND GRAZING IN ACCORDANCE WITH THE BALANCES OF ENERGY AND ENTROPY,
Akademie der Wissenschaften der DDR, Berlin. Inst. fuer Geographie und Geooekologie.
P. Mauersberger.
Ecological Modelling, Vol. 17, No. 1, p 1-10, September 1982. 9 Fig, 5 Ref, 1 Append.

Descriptors: *Ecology, *Thermodynamics, *Entropy, *Respiration, *Grazing, *Primary productivity, Water quality, Modeling, Water temperature, Light intensity, Biomass, Nutrients.

In water-quality modeling a variety of functions are used for describing the dependence of production rates on temperature, light intensity, biomass, nutrient concentrations, etc. The question arises as to which of these functions is 'correct' in the sense that it is in accordance with 'basic physical laws.' Besides the law of conservation of mass, the balances of energy and entropy also lead to restrictions of the 'physically possible types' of laws governing biological processes in ecosystems. Applying methods of thermodynamics of irreversible processes, it is possible to deduce at least the types of equations which describe how the rates of primary production, respiration, grazing and other processes depend on temperature, light intensity, biomass, concentrations of nutrients and dissolved oxygen. (Author's abstract)
W85-01110

IDENTIFICATION OF PHOSPHORUS DYNAMICS IN KOOTENAY LAKE, CANADA,
Bologna Univ. (Italy). Ist. di Automatica.
S. Beghelli, R. Guidorzi, F. Terragni, and E. Halfon.
Ecological Modelling, Vol. 17, No. 1, p 11-32, September 1982. 12 Fig, 4 Tab, 18 Ref.

Descriptors: *Kootenay Lake, *British Columbia, *Phosphorus, *Cycling nutrients, Model studies, Eutrophication, Lakes, Limnology.

The development of mathematical models for phosphorus dynamics in freshwaters constitutes a small but important step towards a more specific understanding of the eutrophication process and towards a complete mathematical formulation. An identification analysis was performed on data from experiments on phosphorus cycling in Kootenay Lake, British Columbia, Canada, in order to determine the minimal number of compartments required to model the phosphorus dynamical behaviour. Forty-nine experiments were conducted at six stations from May to October, 1977. Canonical state-space models have then been identified both from raw and smoothed data. The parameters in these models do not have a direct physical meaning; they can, however, be identified from the measured data and the obtained models describe with good accuracy the considered kinetics. The identification of physical models has also been performed; in this case, however, only two compartments have been considered according to the results of the identifiability analysis of the complete model parameters. Results give further insight on the phosphorus processes and show that the complete phosphorus cycle through a four compartment model can be identified only when phosphorus cycles rapidly through the system. (Collier-IVI)
W85-01111

OPTIMIZATION MODEL FOR THE ECONOMIC CONTROL OF RESERVOIR EUTROPHICATION,
Ceskoslovenska Akademie Ved, Prague. Ustav Teorie Informace a Automatizace.
R. Kalceva, J. Outrata, and Z. Schindler.
Ecological Modelling, Vol. 17, p 121-128, 1982. 1 Fig, 11 Ref.

Descriptors: *Reservoirs, *Eutrophication, *Optimization, *Cost analysis, Ecosystems, Water management, Decision making, Model studies.

An attempt is made to combine the forces of ecologists and engineers in an evaluation of possible strategies for the management of eutrophication of water bodies, which is becoming an urgent water management problem. A fairly complex ecosystem model is combined with advanced optimization methods, using a generalized penalty optimization technique to calculate the combination of control actions that minimize cost under the condition that given water quality indices are preserved. The fourth order Runge-Kutta method with a one day step was applied with restarts at every discontinuity of the control. Agreement with the measured data for the real system was satisfactory. (Baker-IVI)
W85-01112

PROBLEMS OF APPLICATION OF THE ECOLOGICAL MODEL SALMO TO LAKES AND RESERVOIRS HAVING VARIOUS TROPHIC STATES,
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
J. Benndorf, and F. Recknagel.
Ecological Modelling, Vol. 17, No. 2, p 129-145, October 1982. 9 Fig, 23 Ref.

Descriptors: *German Democratic Republic, *Lake Stechlin, *Saidenbach Reservoir, *Bautzen Reservoir, *Bleiloch Reservoir, *Model studies, *Ecology, *Trophic state, Phytoplankton, Zooplankton, Phosphate, Water quality management.

A short description is given of a dynamic ecological model, SALMO (Simulation by means of an Analytical Lake MOdel), of the pelagic zone of reservoirs and lakes. The model involves only three state-variables (two groups of phytoplankton, zooplankton, orthophosphate), but nevertheless a great number of internal control mechanisms are considered. The applicability of this model to quite different water bodies is checked by comparing simulation results with observations. Four water bodies are used for these comparisons: Lake Stechlin (deep, oligotrophic), the Saidenbach reservoir (deep, mesotrophic), the Bautzen reservoir (shallow, hypereutrophic), and the Bleiloch reservoir (deep, hypereutrophic, high light extinction). Despite numerous deviations between the simulations and observations, the general result of this validation justifies the use of SALMO in water-quality management. A relative comparison of simulated scenarios is regarded to be the most adequate method in such an application because it minimizes the influence of inaccuracies in the model. An example of a scenario analysis for decision-making

in the management of a multipurpose reservoir is given in detail. (Author's abstract)
W85-01113

THREE-LAYER AQUATIC ECOSYSTEM MODEL: SEDIMENT SUBMODEL TESTS AND SOME SIMULATIONS,
Akademie der Wissenschaften der DDR, Berlin. Inst. fuer Geographie und Geooekologie.
H.-P. Kozerski, and M. Dvorakova.
Ecological Modelling, Vol. 17, No. 2, p 147-156, October 1982. 4 Fig, 4 Ref.

Descriptors: *Model studies, *Ecosystems, *Limnology, *Sediments, Algae, Phosphorus, Zooplankton, Organic matter.

Some recent simulations using a previously developed three-layer aquatic ecosystem model are presented. The mathematical model consists of eight mass-balance equations for algae and dissolved phosphorus in the epilimnion and in the hypolimnion, for zooplankton in the epilimnion, and for organic matter and dissolved and absorbed phosphorus in a very thin, active upper sediment layer. Special emphasis is laid on testing the sediment submodel. Changes of the parameters in the sediment submodel only influence significantly other components within the sediment; the free-water components are affected much less. Comparison with laboratory experiments conducted by others gives good agreement. (Collier-IVI)
W85-01114

GRAPHICAL TECHNIQUE FOR RIVER WATER TEMPERATURE PREDICTIONS,
Polish Academy of Sciences, Warsaw. Inst. of Computer Sciences.
W. F. Krajewski, A. K. Kraszewski, and W. J. Grenney.
Ecological Modelling, Vol. 17, No. 3-4, p 209-224, December 1982. 5 Fig, 2 Tab, 10 Ref.

Descriptors: *Water temperature, *Mathematical models, *Graphical analysis, *Thermodynamics, Heat transfer, Meteorological conditions, Air temperature, Solar radiation, Humidity, Atmospheric pressure, Wind, Flow.

The average equilibrium temperature of a stream is the temperature about which the instantaneous temperature tends to oscillate. A technique was developed that provides a low-resolution, straightforward, graphical solution technique for solving the equilibrium-temperature equation for a stream reach; the technique represents average conditions on a river over some time period not less than the travel time of the river through the reach being studied. The equilibrium temperature (T sub e) and thermal exchange coefficient (K) are estimated on the basis of meteorological conditions including solar radiation, cloud cover, air temperature, wind speed, relative humidity, and atmospheric pressure. The technique may also be used to calibrate coefficients for a specific stream and to predict water temperature for a variety of flow alterations and thermal loadings; the most useful application is in estimating K and T sub e. Precision of the technique is approximately + or - 0.5 degrees C when using large graphs (11 X 17 inches). The technique may be programmed on a programmable calculator using the equations developed in the paper. (Collier-IVI)
W85-01117

2I. Water In Plants

NON-WATER-STRESSED BASELINES: A KEY TO MEASURING AND INTERPRETING PLANT WATER STRESS,
S. B. Idso.
Agricultural Meteorology, Vol. 27, No. 1-2, p 59-70, November, 1982. 11 Fig, 1 Tab, 22 Ref.

Descriptors: *Water stress, *Plants, Air temperature, Foliage temperature, Vapor pressure deficit, Transpiration, Shade, Grain crops.

A plant water stress index has recently been developed which employs a radiometric measurement of foliage temperature and a psychometric measurement of the vapor pressure deficit of the air. To utilize the index, it is necessary to know the relationship that exists between foliage-air temperature differential and air vapor pressure deficit for the plant in question when it is well watered and transpiring at the potential rate. This information is provided for 26 different species for clear sky conditions in the format of non-water-stressed baselines. For six of these plants, including one aquatic species, such information is also included for cloudy or shaded conditions; and two grain crops have results presented for both pre-heading and post-heading growth stages. (Author's abstract)
W85-01073

WATER USE EFFICIENCY OF CASSAVA. I. EFFECTS OF AIR HUMIDITY AND WATER STRESS ON STOMATAL CONDUCTANCE AND GAS EXCHANGE,
Centro Internacional de Agricultura Tropical.
M. A. El-Sharkawy, and J. H. Cock.
Crop Science, Vol. 24, No. 3, p 497-502, May-June 1984. 8 Fig, 32 Ref.

Descriptors: *Cassava, *Humidity, *Water stress, *Gas exchange, *Stomatal conductance, *Stomatal transpiration, *Water use efficiency, Photosythesis, Water potentials, Leaves, Soil moisture deficiency, Vapor pressure.

Measurements of CO2 and H2O exchange of attached cassava (Manihot esculenta Crantz) leaves in water-stressed (unwatered) and control (well watered) plants of cultivars M Col 90 and M Col 88 were made at various leaf-air vapor pressure differences (VPD) (0.8 to 4.5 kPa). Apparent photosynthesis and transpiration were sharply reduced by increase in VPD above 1.8 to 2.0 kPa in both stressed and nonstressed plants. This trend coincided with changes in leaf conductance over similar ranges of VPD. The rapid closure of stomata in dry air was independent of bulk leaf water potential (Psi sub L). Furthermore, the response was completely reversible in humid air after short exposure to dry air, suggesting a direct response to changes in air humidity. Water use efficiency (WUE) decreased as VPD increased over the range of 1 to 4 kPa. The significance of the stomatal response to humidity is discussed in relation to WUE in long dry periods. (Author's abstract)
W85-01108

WATER USE EFFICIENCY OF CASSAVA. II. DIFFERING SENSITIVITY OF STOMATA TO AIR HUMIDITY IN CASSAVA AND OTHER WARM-CLIMATE SPECIES,
Centro Internacional de Agricultura Tropical.
M. A. El-Sharkawy, J. H. Cock, and A. A. Held K.
Crop Science, Vol. 24, No. 3, p 503-507, May-June 1984. 4 Fig, 2 Tab, 24 Ref.

Descriptors: *Cassava, *Stomata, *Humidity, *Columbia, *Water use efficiency, Vapor pressure, Leaves, Andropogon, Beans, Sirato, Rice, Eucalyptus, Amaranth, Sorghum, Photosynthesis, Transpiration, Gas exchange, Carbon dioxide.

Measurements of CO2 and H2O exchange and the calculated leaf conductance of attached leaves in well-watered plants were conducted over a range of leaf-air vapor pressure differences (VPD) (1.0 to 4.0 kPa) to compare the response of cassava with that of other warm-climate species. Species tested were cassava (Manihot esculenta Crantz), andropogon (Andropogon gayanus Kunth), beans (Phaseolus vulgaris L.), sirato (Macroptilium atropurpureum (DC) urb), rice (Oryza sativa L.), eucalyptus (Eucalyptus deglupta Blume), amaranth weed (Amaranthus retroflexus L.) and grain sorghum Sorghum bicolor (L) Moench. Plants were grown in pots outdoors at the CIAT headquarters, Palmira, Colombia, South America. All except andropogon showed a decrease in leaf conductance with increase in VPD. The degree of stomatal sensitivity decreased as follows: cassava > siratro, amaranthus, eucalyptus, bean > sorghum, rice > andropogon. The greater sensitivity in cassava was associated with reduction in transpiration and stable leaf water potential (Psi sub L) at [illegible] VPD. In other less sensitive species, transpira increased and bulk leaf water potential decre at large VPD. The response of cassava to cha in VPD resulted in higher water use effici (WUE = micro mol CO2 uptake per mmol loss) compared with other C3 species. This contribute to the comparative advantage of sava when grown under conditions of lim availability of water. The WUE of the C4 sp (sorghum, andropogon, amaranthus) were hi than those of the C3 species. This greater WU C4 species were attributed mainly to the hi photosynthetic rates of C4 species rather than lower transpiration rate. (Author's abstract)
W85-01109

2J. Erosion and Sedimentation

SUSPENSION OF SAND BY WAVES,
J. F. A. Sleath.
Journal of Hydraulic Research, Vol. 20, No. 439-452, 1982. 9 Fig, 1 Tab, 17 Ref.

Descriptors: *Sand, *Suspension, *Wave act Entrainment, Sediment erosion, Oscillatory wa Bed load, Sediment transport, Wave action, Co al zone management, Beach erosion, Path of lutants.

The way in which sand is carried into suspens by wave action is a major factor in probl involving erosion or sedimentation in the coa zone. Measurements of sediment concentrati over rippled beds of sand in an oscillatory fl water tunnel were made to study the way in wh sediment is lifted from the bed into suspension. measurements were made using a light-absorpt type of probe. The sediment was observed to entrained from the bed in two ways. Firs during most of each half cycle, bed-load carr over the crest is hurled in an initially thin jet o the lee vortex; this thin jet has certain similari to a plume of pollutant released by a line sou Secondly, the lee vortex, ejected at the end of e half cycle as the flow reverses, throws up a plu of sediment into the flow. Calculations of m mum sediment transport rate, based on measu ments of concentration in the lee of the ripp correlate with measurements for flat beds of se ment. The variation of concentration with hei for the sediment hurled up by the vorticies ejec at the end of each half cycle agrees with pred tions based on the defect-velocity distribution flat beds of sand or gravel. (Collier-IVI)
W85-00525

METHOD FOR RELATING SUSPENDE CHEMICAL CONCENTRATIONS TO SU PENDED-SEDIMENT PARTICLE-SIZE CLAS ES IN STORM-WATER RUNOFF,
Geological Survey, Portland, OR. Water R sources Div.
For primary bibliographic entry see Field 5B.
W85-00614

SUPRAGLACIAL RE-SEDIMENTATIO FROM MELT-WATER STREAMS ON T SNOW OVERLYING GLACIER ICE, SYLGJ JOKULL, WEST VATNAJOKULL, ICELAND,
Colorado Univ. at Boulder. Inst. of Arctic a Alpine Research.
J. A. Dowdeswell.
Journal of Glaciology, Vol. 28, No. 99, p 365-3 1982. 7 Fig, 2 Tab, 25 Ref.

Descriptors: *Sedimentation, *Snowmelt, *Glac streams, *Sylgjujokull, *Iceland, Snow, Volcan ash, Suspended sediments, Stream discharg Debris, Resedimentation.

Sediment deposition on to snow overlying glaci ice occurs in a marginal zone extending 200-300 up-glacier from the terminus of Sylgjujoku Debris on ice above the marginal snow zone com from debris-rich layers, and 85% of this debris fa between 1 and 4 theta the characteristic grain-si of volcanic ash within Icelandic glaciers. The a is transported down-glacier as suspended load

melt-water streams at concentrations between 61 and 430 m/l, and loads from 0.2 to 32.7 g/s. A diurnal hysteretic loop is present in the relationship between suspended sediment and discharge for one stream. Supraglacial streams flow from relatively impermeable ice on to more permeable snow near the glacier terminus. As they move across the snow, stream discharge (up to 0.1 cu m/s on ice) is reduced and debris is resedimented as linear debris trains 1-3 cm thick and oriented orthogonal to the glacier margin. Since sediment deposition reduces the permeability of the snow substrate, the debris trains are successively extended across the snow cover at rates of up to 36.5 m/d. If the debris is then let down on to glacier ice, linear dirt-cone assemblages may be produced. Re-sedimented debris trains are of little stratigraphic significance if deposited pro-glacially. (Author's abstract)
W85-00677

MEASUREMENT OF FLUVIAL SEDIMENT TRANSPORT COMPARED WITH LACUSTRINE SEDIMENTATION RATES: THE FLOW OF THE RIVER JORDAN INTO LAKE KINNERET,
Haifa Univ. (Israel). Dept. of Geography.
M. Inbar.
Hydrological Sciences Journal, Vol. 27, No. 4, p 439-449, December, 1982. 4 Fig, 21 Ref.

Descriptors: *River Jordan, *Lake Kinneret, Sediment transport, *Sedimentation rates, Suspended sediments, Floods, Cesium radioisotopes, Samplers, Measuring instruments, Lake sediments.

Standard measurements of fluvial sediment transport have been carried out over a 12 year period in the River Jordan, which is the main river flowing into Lake Kinneret. Suspended sediment has been sampled using a US D49 sampler and a smaller sampler of the same type. Concentrations reach maximum values of 1000 to 8000 mg/l on the rising stage of floods and the mean annual suspended sediment transport is 70,000 t or 44 t/sq km/year. The annual sediment discharge values are consistent with the rates of lacustrine deposition determined by two independent methods involving firstly, the use of sediment traps to collect suspended matter settling to the bottom of the lake; and secondly, the interpretation of the Cs-137 profile in the upper layer of lake bottom sediments. (Author's abstract)
W85-00691

INFLUENCE OF LONG-TERM TILLAGE AND CROP ROTATION ON WATER EROSION,
Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 5G.
W85-00755

MODELLING THE TRANSPORT OF REACTING CHEMICAL CONTAMINANTS IN NATURAL STREAMS,
Commonwealth Scientific and Industrial Research Organization, Ryde (Australia). Physical Technology Unit.
For primary bibliographic entry see Field 5B.
W85-00778

SEDIMENT SUPPLY AND ACCUMULATION IN A SMALL MOROCCAN LAKE: AN HISTORICAL PERSPECTIVE,
University Coll., London (England). Palaeoecology Research Unit.
S. J. Flower, J. A. Dearing, and R. Nawas.
Hydrobiologia, Vol. 112, No. 2, p 81-92, May, 1984. 8 Fig, 3 Tab, 31 Ref.

Descriptors: *Dayat-er-Roumi, *Morrocco, *Sedimentation, *History, *Lake sediment, Oued Rhaba, Sedimentology, Erosion, Soil erosion, Lead radioisotopes, Isotope studies, Magnetic studies, Trees, Wetlands, Drainage.

Dayat-er-Roumi is a small lake (73 ha) located in the sub-humid region of NE Morocco. The lake catchment has undergone recent disturbance, including partial aforestation with olive trees and drainage of a wetland; agriculture in the surrounding region is not extensive. During much of the year, the lake is fed by ground water and two small inflows but winter rains cause the Oued Rhaba to flow into the lake, so reversing the normal outflow direction. Lake sediment and catchment soils collected in 1979 were examined to identify areas of sediment supply to the lake. Magnetic measurements and clay mineralogy show that recent lake sediment is derived predominantly from eroded topsoil. Pb-210 dating of one sediment core provided a chronology for the calculation of sediment accumulation rates. The rate of sediment accumulation increased slowly throughout the earlier part of the 20th century and then rapidly in the mid-1970's. These increases are attributed to human disturbances in the catchment, initially by olive planting and then by drainage of a wetland area. The erosional response to the drainage operation has diminished in the last two or three years. (Collier-IVI)
W85-00792

SUSPENDED-SEDIMENT DATA IN THE SALT RIVER BASIN, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-00859

TRANSPORT OF SUSPENDED MATTER IN A BAR-BUILT DANISH ESTUARY,
Copenhagen Univ. (Denmark). Inst. of Geography.
J. Bartholdy.
Estuarine, Coastal and Shelf Science, Vol. 18, No. 5, p 527-541, May, 1984. 9 Fig, 17 Ref.

Descriptors: *Sediment transport, *Model studies, *Estuaries, *Denmark, Varde A, Ho Bugt Bay, Estuarine environment, Suspended matter, Water movements, Tidal effects, Turbidity, Water currents.

Tidal fluxes of water and sediment in the Varde A estuary are considered. The river Varde A discharges into the bay of Ho Bugt on the western coast of Jutland forming a small, bar-built estuary. The water flowing in at flood tide in the river estuary is part of a turbidity maximum in the northern part of Ho Bugt. At high tide slack water, the suspended material deposits inside the estuary. During ebb tide it is resuspended, and the estuary bottom is washed clean. At the end of the ebb period the estuary is filled with less turbid water from the drainage area. Based on measurements from one station in the estuary mouth, the cross sectional discharge was calculated using a theoretical distribution of velocities over the cross section. This method was tested by measuring velocities simultaneously at different places in the cross-section, and by comparing the discharge measurements with values from a gauging station 20 km upstream. Simulations of the half-tidal water movements were carried out on the basis of the equation of continuity with the following input variables: mean water level, tidal range, half-tidal period, and freshwater discharge from the drainage area. The discharge-weighted mean concentration of flood and ebb current respectively were successfully correlated with expressions containing the following variables: flood current and ebb current. The expressions describing the water movements and the discharge weighted mean concentrations made it possible to construct a computer program simulating the half tidal transport of water and suspended material through a cross section in the estuary mouth. All calibrations of the elaborate expressions were carried out using multiple linear regression. The model is only valid when the currents are restricted to the estuarine channel. In storm surge situations, it will predict too much outflowing material. (Baker-IVI)
W85-00913

BEHAVIOUR OF METALLIC AND RADIOACTIVE ELEMENTS IN LAGOONAL SEDIMENTS: THE EXAMPLE OF THE CANET-ST NAZAIRE POND (MEDITERRANEAN COAST),
Nice Univ. (France). Groupe de Recherches de Sedimentologie et Geochronologie Marines.
For primary bibliographic entry see Field 2L.
W85-00914

ESTUARINE DEVELOPMENT OF A REGULATED RIVER IN A SUB-BOREAL CLIMATE: THE OUTARDES RIVER (NORTH COAST OF THE ST. LAWRENCE GULF, QUEBEC) (EVOLUTION ESTUARIENNE D'UNE RIVIERE REGULARISEE EN CLIMAT SUB-BOREAL: LA RIVIERE AUX OUTARDES (COTE NORD DU GOLFE DU ST-LAURENT, QUEBEC)),
Insitut National de la Recherche Scientifique, Rimouski (Quebec). Centre d'Oceanologia.
D. Cataliotti-Valdina, and B. F. Long.
Canadian Journal of Earth Sciences, Vol. 21, No. 1, p 25-34, January, 1984. 6 Fig, 4 Tab, 22 Ref.

Descriptors: *Estuaries, *Outardes River estuary, *Quebec, *Sedimentation, Dam effects, Flow discharge, Floods, Seasonal variation, Tidal wedge, River regulation, Erosion.

The sedimentological evolution of the Outardes River estuary was modified considerably during and after the construction of the hydroelectric dams on the river. Prior to 1965, the dominant river discharge was 1350 cu m/s and the flood peak reached 2700 cu m/s. Between 1965 and 1975, during the building activities, it fell to 430 cu m/s and since 1955 it remained steady at 555 cu m/s. Now, the variations from 1300 cu m/s during discharge periods to 0 cu m/s during some filling periods. The most significant variations in the river discharge related to the creation of the reservoirs have modified the sedimentary equilibria and it is the aim of the present study to improve the understanding of the flow of the non-cohesive materials in the estuary. Before regulation, the sedimentary processes were dominated by seasonal variations of the river regime; the floods flushed out the fine material from the estuary. Between 1965 and 1975, the river discharge decreased, and the tidal wedge moved upstream. The erosion rate of the cliff edges decreased during working periods of regulation and the entry of marine material was increased particularly at the mouth of the river. The influence of the swell and the tide is more important than the effect of the river discharge. In the present estuarine system, the sedimentary budget is positive and the source of non-cohesive materials has been changed since the regulation of the river. The principal hydrodynamic processes in the estuarine environment of the Riviere aux Outardes are compared with those of non-regulated rivers in a subboreal climate, such as the St-Jean River and the La Grande River. (Author's abstract)
W85-00956

SEDIMENTOLOGY OF PLAYA LAKES OF THE NORTHERN GREAT PLAINS,
Manitoba Univ., Winnipeg. Dept. of Earth Sciences.
W. M. Last.
Canadian Journal of Earth Sciences, Vol. 21, No. 1, p 107-125, January, 1984. 18 Fig, 4 Tab, 42 Ref.

Descriptors: *Playas, *Saline lakes, *Great Plains, *Sedimentology, Hypersaline lakes, Salts, Brines, Minerals, Evaporative concentration, Flooding, Sediment deposition.

The semi-arid plains of western Canada and northern United States contain a large number of saline and hypersaline lakes, with many of the shallow lakes exhibiting playa characteristics. For over 60 years a number of these playas have provided a source of valuable industrial minerals. The present study deals with the modern sediments and sedimentary processes operating in selected playa basins located throughout the northern Great Plains regions. The playas generally occupy small, closed basins commonly having an elongate, riverine shape. Most of the brines are dominated by sodium, magnesium, and sulfate ions; however, examples of lakes rich in chloride and bicarbonate ions are also present. Significant variation in the brine chemistry can exist on a seasonal as well as diurnal basis. The modern sediments of the playas consist of: (1) very soluble salts of mainly sodium and magnesium sulfates and carbonates; (2) spar-

ingly soluble precipitates, including calcite, protodolomite, gypsum, and mixed layer clays; (3) detrital minerals consisting dominantly of quartz, carbonates, feldspars, and clays; and (4) organic matter. Much of the physical and mineralogical character of the playas is due to processes that are largely of a chemical nature and are associated with either evaporative concentration of the brines or groundwater discharge. The most significant processes include: cyclic flooding and desiccation of the playa surface, formation of salt crusts, efflorescent crusts, spring deposits, and intrasedimentary salts, formation of solution pits and chimneys, wind displacement of brines, and periodic detrital sedimentation by sheet flow and wind. These processes combine the create a very modern depositional environment. The establishment and prolonged maintenance of delicate physical and chemical equilibria have allowed the deposition of over 40 m of salt in some basins. (Author's abstract)
W85-00957

WILLIAM RIVER: AN OUTSTANDING EXAMPLE OF CHANNEL WIDENING AND BRAIDING CAUSED BY BED-LOAD ADDITION,
Illinois Univ. at Chicago Circle. Dept. of Geological Sciences.
N. D. Smith, and D. G. Smith.
Geology, Vol. 12, No. 2, p 78-82, February, 1984. 8 Fig, 21 Ref.

Descriptors: *William River, *Saskatchewan, *Braided streams, *Bed load, *Channel width, Sand, Dunes, Wind erosion, Channel morphology.

The lower William River in northwestern Saskatchewan, Canada, presents an excellent and unambiguous example of rapid channel adjustment to abrupt additions of sandy bed load. A relatively narrow and deep single-channel stream as it flows northward to Lake Athabasca, the river picks up a 40-fold increase of bed load over a 27-km reach as it encounters a large dune field just south of the lake. As a result of the large infusion of eolian sand, the channel develops a thoroughly braided pattern while undergoing a 5-fold increase in width and a 10-fold increase in width/depth ratio. (Author's abstract)
W85-00981

ALLUVIAL FAN SEDIMENTATION OF THE HORSESHOE PARK FLOOD, COLORADO, U.S.A., JULY 15TH, 1982,
Plymouth Polytechnic (England). Geology Div.
J. P. Tunbridge.
Sedimentary Geology, Vol. 36, No. 1, p 15-23, October, 1983. 7 Fig, 16 Ref.

Descriptors: *Sedimentary structures, *Alluvial fans, *Floods, *Horseshoe Park Flood, *Colorado, Lawn Lake, Roaring River, Falls River, Dam failure, Sedimentation, Particle size, Morphology, Braided streams.

On July 15, 1982, an earth dam broke at Lawn Lake in the Rocky Mountain National Park, Colorado, discharging over 933,000 cu m of flood water in a six to ten meter high wall of water down the 10 km course of Roaring River, and incising a gorge in glacial till up to 6 m deep. The alluvial fan, covering an area of over 70 ha, was deposited at the point where the steeply graded Roaring River meets the flat ground of Horseshoe Park and the gently graded meandering Falls River. Five main facies can be recognized in this flood-derived depositional complex. Passing downslope there are: proximal boulder beds, gravel braid bards, braided stream sands, and sandy flood sheets, and finally distal fine sands and muds. The Horseshoe Park flood illustrated through its deposits a number of features which may aid the understanding of ancient flood events. The downstream transition from coarse to fine sediment is rapid, as in only 1.5 km there is a change from boulders to fine sand and mud, thus showing that sediment grain size as an indicator of proximality to source must be used with care. Thicknesses of sediments range from nearly 10 m to less than 30 cm and can clearly be shown to have resulted from a single depositional event of only a few hours duration. The flood produced a major change in the channel morphology of the Falls River in the area of sand deposition, altering it from a meandering stream to a braided channel pattern. (Baker-IVI)
W85-01052

SIGNIFICANCE OF NATURAL AND ANTHROPOGENIC SEDIMENT INPUTS TO THE SAGUENAY FJORD, QUEBEC,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Geoscience Centre.
C. T. Schafer, J. N. Smith, and G. Seibert.
Sedimentary Geology, Vol. 36, No. 2/4, p 177-194, November, 1983. 9 Fig, 1 Tab, 15 Ref.

Descriptors: *Saguenay Fjord, *Quebec, *River flow, *Sediments, Sand, Particle size, Flow discharge, Fjords, Landslides, Dam construction, Environmental effects, Sand waves.

The Saguenay Fjord is situated in a 93 km long and 1-6 km wide valley that joins the St. Lawrence estuary at Tadoussac, Quebec. One-centimeter interval Pb-210 dating and 4-cm interval size analysis was carried out on a sediment core collected in a prodelta depositional environment near the head of the Saguenay Fjord. Sand modal diameters measured in the sediment cores show a direct relationship to the magnitude of the annual maximum mean monthly discharge of the river. An increase in the maximum mean monthly discharge of the river by a faction of 5 causes a corresponding shift in the modal diameter of sand from approximately 0.08 to 0.14 mm. The range and end-point diameters of this shift compared favorably to sediment modes measured in a series of intervals in a core covering a high river discharge event. Indirect evidence of sediment flux to the head of the fjord includes a series of sand waves that are developed on a prograding submarine delta at the mouth of the Saguenay River. Clay-pellet zones observed in a gravity core are related to catastrophic events such as the 1971 St. Jean Vianney landslide, or to anthropogenic activities associated with the construction of dams and powerhouses at upriver locations. A subtle change in the slope of a graph relating cumulative annual mean river discharge and sediment accumulation for the 1950-1970 interval is in agreement with the timing of dam construction on the lower reaches of the Saguenay River system. (Moore-IVI)
W85-01053

MORPHOLOGY AND SEDIMENTOLOGY OF DELTAS IN FJORD AND FJORD VALLEY LAKES,
Oslo Univ. (Norway). Dept. of Geography.
J. Bogen.
Sedimentary Geology, Vol. 36, No. 2/4, p 245-267, November, 1983. 14 Ref. 3 Tab, 46 Ref.

Descriptors: *Norway, *Deltas, *Fjord lakes, *Fjords, Gaupnefjord, Tunsbergdalsvatn, Veitastrondsvatn, Sediment deposition, Particle size, Sedimentation rates, Velocity, Estuarine environment, Foreset slope, Bed load.

Sediment supply, depositional processes and the associated morphology and sedimentology of deltas were studied in Gaupnefjord, and branch of Sognefjord and the lakes Tunsbergdalsvatn and Veitastrondsvatn which belong to the Sognefjord valley system (Norway). The deltas in the lakes receive sediments from fluvial erosion of Quaternary glacial deposits and are only to a slight extent influenced by modern glaciers. The other deltas are in the drainage area of the Jostedalsbreen icecap. The meltwater rivers draining this glacier are characterized by a high rate of sediment transport in a wide range of grain sizes. The main modes of the grain-size distribution curves occur in the silt, sand and cobble fractions. Differences in downstream sedimentation rates of the various deltas are related to dynamic and geometrical properties of the systems. The downstream decrease in the sedimentation rate is related to the velocity decay of the river jet and follows a potential equation with an exponent determined by the dynamic and geometric properties of the system. Low values of the exponent characterize a basin with a fast flow, whereas high values were observed in systems where the velocity decay was rapid. The exponent apparently decreased with grain settling velocity, but several of the individual grain fractions follow rather complex curves. The morphology of the foreset slopes is influenced by several variables. When the ratio of bed load to total load is large and the basin is not too deep, a shape comparable to the classical model develops. In very deep basins with a large sediment supply in a broad spectrum of grain fractions, the foreset is the upper segment of a curve that slopes gently down to greater depths. Marine deltas seem to be more influenced than lake deltas by subaqueous sliding. (Moore-IVI)
W85-01054

137-CS AND 210-PB TRANSPORT AND GEOCHRONOLOGIES IN URBANIZED RESERVOIRS WITH RAPIDLY INCREASING SEDIMENTATION RATES,
Case Western Reserve Univ., Cleveland, OH. Dept. of Geological Sciences.
P. L. McCall, J. A. Robbins, and G. Matisoff.
Chemical Geology, Vol. 44, No. 1/3, p 33-65, May, 1984. 11 Fig, 8 Tab, 17 Ref.

Descriptors: *Sediment transport, *Reservoirs, *Ohio, Sedimentation, Cesium radioisotopes, Lead radioisotopes, Zinc, Copper, Varves, Geochronology, Soil erosion, Fallout.

Sedimentation rates were measured in three reservoirs in northeastern Ohio by means of Cs-137 and Pb-210 geochronologies, volumetric surveys and varve counting. Dramatic increases in rates of sediment accumulation in each system were noted to occur between 1940 and 1977. Mass sedimentation rates are very nearly proportional to the size of the population in the region and possess a doubling time of roughly 19 yr. In systems possessing large watershed/reservoir area ratios, increasing erosion is evidently accompanied by a proportionate increase in the erosion of excess Pb-210. High near surface activities of Cs-137 are due to system integration effects with time constraints the order of 10 yr to a few decades. Total accumulation of fallout Cs-137 and excess Pb-210 far exceed direct atmospheric loadings, thus indicating the importance of watershed contributions and implying annual retention of the radionuclides in the reservoirs of between 15 and 80%. In Lake Rockwell, sedimentary fluxes of Zn, Pb and Cu have increased with time. The flux of Cu in particular has increased since 1970, and concentrations are high in surface materials due in large part to the addition of copper sulfate, an algicide, to the water. Because of increased rates of sedimentation, the remaining useful life of Lake Rockwell has decreased from 103 to 67 yr, while the remaining useful life of Mayfair Lake is now less than 5 yr. (Baker-IVI)
W85-01099

COMBINED RADIOMETRIC AND MINERAL MAGNETIC APPROACH TO RECENT GEOCHRONOLOGY IN LAKES AFFECTED BY CATCHMENT DISTURBANCE AND SEDIMENT REDISTRIBUTION,
Liverpool Univ. (England). Dept. of Geography.
F. Oldfield, and P. G. Appleby.
Chemical Geology, Vol. 44, No. 1/3, p 67-83, May, 1984. 7 Fig, 2 Tab, 29 Ref.

Descriptors: *Lake sediments, *Sedimentation rate, *Geochronology, Sedimentation, Catchments, Lead radioisotopes, Mineral magnetic measurement, Environmental effects.

As a result of empirical testing of Pb-210 dating models in a wide variety of lakes it was concluded that there are many situations where, despite major changes in sedimentation rates resulting from lake or catchment disturbance, the CRS (constant flux) model provides a sound basis for establishing recent chronology. Factors which may complicate or vitiate the assumptions of the model include short water residence time, bioturbation, discontinuous or disturbed sedimentation, sediment resuspension, and shifts in sediment source. In the case of the last three processes ways are illustrated in which the problems can be identified and evaluat-

using mineral magnetic measurements. An evaltive approach to Pb-210 dating projects with phasis on independent dating evidence is prosed on tests of internal consistency and on the of data from several correlatable cores. (Baker-I)
85-01100

YETTEVILLE GREEN LAKE, NEW YORK, S.A. VII. VARVE CHRONOLOGY AND SEDIENT FOCUSING,
assachusetts Univ., Amherst. Dept. of Zoology.
D. Ludlam.
emical Geology, Vol. 44, No. 1/3, p 85-100, ay, 1984. 3 Fig, 2 Tab, 56 Ref.

escriptors: *Sediment focusing, *Lake sediments, arves, *Geochronology, *Fayetteville Green ke, *New York, Sedimentation rate, Water pth, Lake morphometry, Meromixis.

rficial sediment samples with intact sediment-ter interfaces were obtained from Fayetteville een Lake. While many well dated stratigraphic rkers found in sediment profiles from the main in were absent in the neck, two were conspicusly present, occurring in 1963 and 1972. The rve chronologies in the neck and in the basin re correlated using varve-year designations. man activities have left no easily dated stratiphic markers in the sediment of the neck so ing of individual varves and turbidities was sed on varve counts. Varve sedimentation rates ve significantly increased throughout the lake ring the last 30 years with no changes in the ative ratio of varve sedimentation rates in the ck and the main basin although there is considere year to year variation in this ratio. Higher rve sedimentation rates occur in shallower pors of the permanently stratified water, probably cause resuspension is unlikely in this low energy vironment. Because of basin morphometry and romixis, sediment focusing creates higher varve limentation rates in relatively shallow water ar the upper limit of the permanently stratified ter rather than in the deepest water. (Baker-IVI)
85-01101

DIMENTATION AND SEDIMENT ACCRETON IN MICHIGAN COASTAL WETLANDS S.A.),
chigan Univ., Ann Arbor. Dept. of Chemical gineering.
H. Kadlec, and J. A. Robbins.
emical Geology, Vol. 44, No. 1/3, p 119-150, ay, 1984. 18 Fig, 14 Tab, 19 Ref. NOAA grant A-80-AA-D-00072.

escriptors: *Lake sediments, *Wetlands, *Sediintation, *Lake Michigan, Accretion, Sediment nsport, Forest watersheds, Sediment load, Susnded solids, Water quality, Storms.

e net effect of the two wetland systems investited on the sediment load to the Great Lakes peared to be negligible. Although Cranberry g, a forested bottom land ecosystem, tends to port a good fraction of its organic detritus, the ceiving filling-lake-bog system of Cranberry Bog pears to retain much of this material. This was nfirmed via radioisotope studies, with cores owing higher accretion rates than in the bottom d wetland. The river delta wetland at ntwater, Michigan, had little sediment trapping ility. Large amounts of water and suspended terials entered this riverine wetland, but no nual average removal was found. Radioisotope dies of cores at selected locations within this stem showed little or no accretion in stream annels, and normal accumulation of organic maial in non-channel areas. No net annual effect on ater quality of the streams as they discharged to ke Michigan was found. Storm events caused no table import or export of suspended material. esumably the sand substrate in the vicinity of all e studied wetlands caused runoff events to be diated by subsurface flow through this porous l. These three sand-based coastal wetlands pear to have little net effect on suspended solids. aker-IVI)
85-01103

PATTERNS OF RECENT SEDIMENT ACCUMULATION IN CHESAPEAKE BAY (VIRGINIA-MARYLAND, U.S.A.) TRIBUTARIES,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
For primary bibliographic entry see Field 2L.
W85-01105

2K. Chemical Processes

FACTORS INFLUENCING BULK PRECIPITATION CHEMISTRY AT AN UPLAND SITE IN MID-WALES,
Institute of Terrestrial Ecology, Bangor (Wales).
B. Reynolds, M. Hornung, and P. A. Stevens.
International Journal of Environmental Studies, Vol. 22, No. 3-4, p 195-205, 1984. 2 Fig, 6 Tab, 35 Ref.

Descriptors: *Chemistry of precipitation, *Afon Cyff, *Wales, *Bulk deposition, Plynlimon, Chemical composition, Sea breezes, Wind direction, Solutes.

Controls governing the chemical composition of bulk precipitation inputs at a sub-catchment of the Afon Cyff, an upland grassland catchment on the eastern slopes of Plynlimon, mid-Wales, currently being used in a nutrient cycling study, were studied over a two year period using a continuously open collector. The data were analyzed to establish the relative contributions from marine and non-marine sources and the influence of wind direction and speed on precipitation chemistry. The precipitation is dilute, acidic and dominated by sea derived solutes. The relative contribution of marine-derived solutes is related to weather conditions dominated by autumnal storms from the west and southwest; periods of calm weather in spring with light easterly winds are an important control on the chemistry of non-marine ions. The sea-salt contribution to rainfall at Plynlimon was calculated by assuming that all the sodium is derived from the sea and recalculating the chemical composition in conjunction with the standard sea water analyses. Magnesium, chlorine, sodium, and potassium are mainly derived from the sea. (Collier-IVI)
W85-00509

COMPOSITION OF PRECIPITATION IN REMOTE AREAS OF THE WORLD,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
J. N. Galloway, G. E. Likens, W. C. Keene, and J. M. Miller.
Journal of Geophysical Research, Vol. 87, No. 11, p 8771-8786, October, 1982. 9 Fig, 6 Tab, 50 Ref.

Descriptors: *Chemistry of precipitation, *Global Precipitation Chemistry Project, Sulfates, Acid rain, Water pollution sources, St. Georges, Bermuda, San Carlos, Venezuela, Katherine, Australia, Poker Flat, Alaska, Amsterdam Island, Fate of pollutants, Path of pollutants.

The Global Precipitation Chemistry Project collects precipitation by event to determine composition and processes controlling it in five remote areas. Compositions (excluding seasalt) at St. Georges, Bermuda, were primarily controlled by anthropogenic processes; compositions and acidities at San Carlos, Venezuela, Katherine, Australia, Poker Flat, Alaska, and Amsterdam Island were controlled by unknown mixtures of natural or anthropogenic processes. Precipitation was acidic; average volume-weighed pH values were 4.8 for Bermuda; 5.0, Alaska; 4.9, Amsterdam Island; 4.8, Australia; 4.8, Venezuela. Acidities at Bermuda and Alaska were from long-range transport of sulfate aerosol; at Venezuela, Australia, and Amsterdam Island, from mixtures of weak organic and strong mineral acids, primarily H2SO4. Relative proportions of weak to strong acids were largest at Venezuela and lowest at Amsterdam Island. Weak and strong acids were from mixtures of natural and anthropogenic processes. Once contributions from human activities were removed, the lower limit of natural contributions was probably > or = pH 5. (Author's abstract)
W85-00514

CHEMICAL ANALYSIS OF CLOUD WATER COLLECTED OVER HAWAII,
National Oceanic and Atmospheric Administration, Boulder, CO. Office of Weather Research and Modification.
F. Parungo, C. Nagamoto, I. Nolt, M. Dias, and E. Nickerson.
Journal of Geophysical Research, Vol. 87, No. C11, p 8805-8810, October, 1982. 5 Fig, 1 Tab, 13 Ref, 1 Append.

Descriptors: *Hawaii, *Clouds, *Chemical analysis, *Chemistry of precipitation, Acid rain, Sodium, Chloride, Sulfates, Ammonium, Nitrates, Calcium.

A limited cloud water sampling program over Hawaii was conducted to provide data on the long-range transport of air-pollutants. Two types of airborne cloud water collectors were developed; one is effective for collecting rainwater (Liquid Water Content (LWC) > or = 0.3 g/cu m) and the other, which is nitrogen cooled, is effective for collecting nonprecipitating cloud water (LWC in the range of 0.1 to 1.0 g/cu m). The chemical analyses of cloud water showed that Na(+), Cl(-), and SO4(2-) ion concentrations were approximately 0.0001 m; NH4(+), NO3(-), and Ca(2+) were one order of magnitude lower. Comparison between cloud water data and seawater chemistry indicates that cloud water has higher molar ratios of SO4(2-)/Cl(-) or SO4(2-)/Na(+) than seawater by more than one order of magnitude. The pH values were in the range of 4 to 5 regardless of sampling location relative to Hilo City; local anthropogenic sources did not contribute the acidity in this case. The high acidity of cloud water over Hawaii may originate in the ocean from precursors such as H2S, COS, CS2, or organic sulfur compounds or from long-range transport of anthropogenic pollution, in addition to local pollution, if present. (Collier-IVI)
W85-00515

CHEMISTRY OF WESTERN ATLANTIC PRECIPITATION AT THE MID-ATLANTIC COAST AND ON BERMUDA,
Delaware Univ., Newark. Coll. of Marine Studies.
T. M. Church, J. N. Galloway, T. D. Jickells, and A. H. Knap.
Journal of Geophysical Research, Vol. 87, No. C13, p 11,013-11,018, December, 1982. 3 Fig, 2 Tab, 28 Ref.

Descriptors: *Western Atlantic Ocean, *Lewes, *Delaware, *Sargasso Sea, *Bermuda Island, *Chemistry of precipitation, Acid rain, Sulfates, Sodium, Path of pollutants, Precipitation, Air pollution.

The major ion composition of western Atlantic precipitation falling at the coast of eastern United States (Lewes, Delaware) and at the Sargasso Sea (Bermuda Island) has been measured by event year round (May 1980 to April 1981) to assess the influence of the ocean on precipitation from storms that leave the North American continent and transit over the western Atlantic. Particular attention is paid to the oceanic influence on the sulfur and nitrogen precursors of 'acid rains.' While sea salt contributes over half (by weight) of the salt in precipitation at the coast and over three quarters at Bermuda, most of the sulfate (90% at the coast and 50% at Bermuda) is in excess to sea salt sodium. Since Bermuda precipitation is still acidified some factor of 8 relative to pure equilibrium with atmospheric carbon dioxide, this strong acidity has been attributed to the long-range transport of sulfur and nitrogen precursors in the marine troposphere during which the sulfuric acid component dominates. A sulfur budget for the western Atlantic troposphere shows that of the total amount of sulfur exported from the North American continent (> 3.9 Tg S/yr) less than 3% (0.1 Tg S/yr) is from natural sources, the rest being from anthropogenic emissions. If Bermuda precipitation is taken as typical of wet fallout of sulfur over the western Atlantic, then no more than half (< 2 Tg S/yr) of North American excess (nonsea salt) sulfur export falls out to the western Atlantic and at least half undergoes potential transoceanic transport as acid

rain precursors to the east of Bermuda. (Author's abstract)
W85-00520

CHEMICAL CHANGES OF SNOW COVER BY MELTING,
Hokkaido Univ., Sapporo (Japan). Lab. of Fundamental Research.
K. Suzuki.
Japanese Journal of Limnology, Vol. 43, No. 2, p 102-112, April, 1982. 10 Fig, 2 Tab, 15 Ref.

Descriptors: *Japan, *Sapporo, *Snowmelt, *Snow cover, Acidity, Chemistry of precipitation, Hydrogen ion concentration, Path of pollutants, Chemical composition, Segregation, Melting, Water pollution sources.

Snow meltwater causes large drops in the pH of surface waters during initial short periods of snowmelt. The concentration of chemical constituents, pH, and water equivalent of snow cover were observed together with other related factors in Sapporo during the winter of 1979-80. During the melting periods, the concentration of chemical constituents of the total snow cover decreased and pH increased. During the temporary snowmelts and the early phase of the snowmelt season, only the surface snow layer melted, and showed a decreased concentration of chemical constituents. In these phases the meltwater flowed downwards in the form of a water channel flow. When the meltwater began flowing downwards in the form of a water-film flow as the snowmelt progressed, the snow particles changed into large granular snow and the concentration of the chemical constituents of the inner layers began to decrease. The earlier meltwater contained extremely large amounts of chemical constituents and had a low pH. In the refreezing process, the chemical constituents segregate from the granular snow particles. The meltwater produced at or near the surface of the snow cover permeates the snow layers while scavenging the segregated chemical constituents. The meltwater flowing down through the water channels was refrozen at lower layers and the concentration of chemical constituents in the meltwater gradually increased. The outflow of concentrated meltwater caused a decrease in the concentration of chemical constituents in the total snow cover prior to a decrease of the water equivalent in the early phase of the snowmelt season. (Collier-IVI)
W85-00531

STUDIES ON CHEMICAL SPECIES DISSOLVED IN GROUNDWATERS FROM THE NEOGENE STRATA. A COMPARISON BETWEEN SHALLOW AND DEEP GROUNDWATERS (IN JAPANESE),
Konan Univ., Kobe (Japan). Dept. of Chemistry.
For primary bibliographic entry see Field 2F.
W85-00537

DISSOLVED SILICON IN THE YAQUINA ESTUARY, OREGON,
Corvallis Environmental Research Lab., OR.
R. J. Callaway, and D. T. Specht.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 5, p 561-567, 1982. 4 Fig, 19 Ref.

Descriptors: *Estuarine environment, *Chemical reactions, *Silicon, *Yaquina Estuary, *Oregon, Manganese, Drainage basins, Tidal effects, Diatoms, Residence time.

The Yaquina Estuary drainage basin is about 622 sq km. The mean tide range at the entrance is 1.80 and 1.92 m at Toledo, 20 km upstream. Analyses indicated that the distribution of diatom species in the estuary is strongly influenced by runoff and that plankton assemblages in spring, summer and fall had fewer diatom species and exhibited a more rapid rate of change of species composition than in winter. In this small coastal plain estuary it is clear that residence time is the dominant factor determining whether the longitudinal distribution of silicon is described as either conservative or nonconservative, conditions for removal being present. This result was derived from a quasisynoptic, essentially one-dimensional sampling scheme. Preliminary examination of data for dissolved manganese showed an apparent addition of manganese modulated in such a way as to approach linearity with an increase in flow. Residence time must be fully considered in any discussion of chemical processes in estuaries. (Baker-IVI)
W85-00661

BEHAVIOR OF IRON, MANGANESE AND SILICON IN THE PECONIC RIVER ESTUARY, NEW YORK,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2L.
W85-00663

CHEMICAL KINETICS OF WATER-ROCK INTERACTIONS,
Pennsylvania State Univ., University Park. Dept. of Geosciences.
A. C. Lasaga.
Journal of Geophysical Research, Vol. 89, No. B6, p 4009-4025, June, 10, 1984. 12 Fig, 5 Tab, 56 Ref.

Descriptors: *Weathering, *Rocks, *Sedimentary petrology, *Chemical kinetics, Chemical reactions, Kinetics, Silicates, Carbonic acid.

Recent literature on the kinetics of water-rock interactions is reviewed. The data are then extended to provide a quantitative framework for the description of weathering and alteration. The available experimental data on dissolution of silicates verifies quantitatively the usual mineral stability series in sedimentary petrology. The rate of hydration of carbonic acid is a possible limiting factor in water-rock interactions. The framework is developed to enable use of lab dissolution experimental results and thermodynamics to arrive at a rate law applicable up to equilibrium and therefore applicable to natural systems. The kinetic justification for the significance of a water-rock ratio is discussed. While much more experimental data are still needed, one can begin to use the available data to describe quantitatively the disappearance of unstable minerals and the appearance of metastable and stable new minerals during water-rock interaction in the field. The evolution of the composition of the solution and the changes in porosity of the rock can also be analyzed. Because dissolution rate laws have been shown experimentally to be functions of pH, temperature, and the surface chemistry of the minerals, it is probably simpler to obtain precipitation rate laws from dissolution rate laws. Once the general rate law is known, the approach of a system to equilibrium or steady state can be followed. Using the kinetic equations, the time scale of rock alteration can be obtained as well as the spatial patterns of the alteration products. (Baker-IVI)
W85-00722

POLYCYCLIC AROMATIC HYDROCARBONS IN RAINWATER,
Institut d'Hygiene et d'Epidemiologie, Brussels (Belgium).
For primary bibliographic entry see Field 5B.
W85-00741

PREDICTING SOLUTE YIELDS IN THE NATURAL WATERS OF A SUBALPINE SYSTEM IN ALBERTA, CANADA,
Northern Forest Research Centre, Edmonton (Alberta).
T. Singh, and Y. P. Kalra.
Arctic and Alpine Research, Vol. 16, No. 2, p 217-224, May, 1984. 2 Fig, 3 Tab, 33 Ref.

Descriptors: *Solute transport, *Streamflow, *Subalpine regions, *Alberta, Cold regions, Watersheds, Calcium, Magnesium, Bicarbonates, Sulfates, Sodium, Silicon dioxide, Nutrients, Vegetation, Mathematical models, Water pollution effects.

An intensive sampling of the natural waters originating from a subalpine watershed, the Marmot Creek Experimental Watershed, was carried out during 1971 and 1972 in efforts to determine the main geochemical constituents of the waters ori nating from the spruce-fir watershed, to devel mathematical models for expressing relationshi between streamflow and solute loads of the ma geochemical constituents, and to generate synth ic sequences for the yields of the main constitue on a daily basis to assess their statistical characte istics and seasonal fluctuations. Use of a quadrat model to estimate accurately the yield of ge chemical constituents in the watershed was fou to be suitable. Estimating solute yields from t continuously measured daily streamflow on an i strumented watershed provided a simple and co venient mechanism for determining geochemic outputs if dependable statistical relationships ha been established for such predictions. Calcium the most abundant cation and bicarbonate the mo abundant anion, with mean yields of 18.4 and 72 t/sq km/yr. Magnesium and sulfate are the ne most commonly occurring cation and anio having yields of 4.9 and 5.2 t/sq km/yr, respectiv ly. Increase in solute yields is usually direct proportional to the increase in streamflow. Ma mum solute transport loads occur during th months having maximum streamflow, while th lowest yields are in those having minimum strea flow. Conservation practices aimed at maximizi vegetation cover are likely to minimize nutrie losses from subalpine catchments caused by redu tion in streamflow as a result of increased transp ration losses and direct nutrient uptake and storag by vegetation. Increased streamflow caused b forest vegetation removal is likely to mask th nutrient removal or deposition because of a dil tion effect if judged on the basis of concentratio of geochemical constituents alone. It is necessar to establish mass loading standards, in addition t concentration standards, to define the extent o nutrient depletion from originating sites and t assess the pollutant effects on receiving wate from nonpoint sources. (Baker-IVI)
W85-00876

IONIC STRENGTH CORRECTION FO EXTENT OF AMMONIA IONIZATION I FRESHWATER,
Utah State Univ., Logan. Dept. of Civil and Env ronmental Engineering.
J. J. Messer, J. Ho, and W. J. Grenney.
Canadian Journal of Fisheries and Aquatic Scieu es, Vol. 41, No. 5, p 811-815, May, 1984. 2 Tab, 1 Ref.

Descriptors: *Ammonia, *Environmental effects *Model studies, Acidity, Temperature effects, Dis solved solids, Mathematical equations, Predictions

A tabulation of percent un-ionized ammonia as function of temperature and pH, was publishe earlier, based on a critical evaluation of the litera ture. The statement that the effects of ioni strength at total dissolved solids concentration below 200-300 mg/L were negligible was mad earlier and has been found to result in significan error when the tabulated values are used for hard water. A corrected tabulation of the fraction o ammonia ionization for a range of pH, tempera ture, and ionic strength values of environmenta interest is presented. A computational formula fo use in calculating the fraction of ammonia-nitroge that exists in the toxic, un-ionized form in environ mental fate and effects models is also given (Baker-IVI)
W85-00895

VARIATION IN SUBSTRATE CHEMISTR ALONG MICROTOPOGRAPHICAL AN WATER-CHEMISTRY GRADIENTS IN PEAT LANDS,
Ramapo Coll. of New Jersey, Mahwah. School o Environmental Studies.
For primary bibliographic entry see Field 2L.
W85-00949

MINERAL-GROUNDWATER INTERACTIONS AND THE FORMATION OF AUTHIGENIC KA OLINITE WITHIN THE SOUTHEASTERN INTAKE BEDS OF THE GREAT AUSTRALIAN

TESIAN) BASIN, NEW SOUTH WALES, TRALIA,
Australia Ltd., Sydney. Exploration Dept.
. Arditto.
mentary Geology, Vol. 35, No. 4, p 249-261, ust, 1983. 5 Fig, 27 Ref.

criptors: *Groundwater, *Kaolinite, *Minerals, w South Wales, *Australia, Great Australian n, Petrography, Potassium felspar, Mica, Hyeology.

ographic studies undertaken on samples from rops of the Jurassic Pilliga Sandstone intake in the extreme southeastern portion of the t Australian Basin reveal an abundance of low ringent clay material filling pore spaces and tal grain fractures. Thin-section petrography scanning electron microscopy indicate that n of this material is authigenic and X-ray difion studies show it to be essentially monomin-c, consisting of well-ordered kaolinite. Algh the Pilliga Sandstone is quartz-rich, micro-ic analysis indicates that potassium feldspar is ent in quantities up to 20% of the total detrital rial. Sporadic biotite mica is also present, con-ting up to 3% of the detrital volume. Mecha-s for the formation of authigenic kaolinite are ssed in terms of chemical equilibrium and tal mineral stability in aqueous systems. Chem-data from bore water and surface waters from stratigraphic unit indicate that kaolinite is the r stable mineral phase in contact with these al waters and that minerals such as potassium par or mica would chemically alter to kaolin-Such alteration of detrital mineral grains is orted by thin-section petrography and this anism is considered to be the source for the rity of the authigenic kaolinite observed. The ogeological characteristics of the Pilliga Sand-e intake beds are related to the extent of devel-ent of authigenic kaolinite. (Author's abstract) -01051

RINE AND NON-MARINE CONTRIBUN TO THE CHEMICAL COMPOSITION SNOW AT THE RIISER-LARSENISEN ICE LF IN ANTARCTICA,
gen Univ. (Norway). Geofysisk Inst.
jessing.
ospheric Environment, Vol. 18, No. 4, p 825-1984. 2 Fig, 3 Tab, 17 Ref.

criptors: *Snow, *Antarctica, *Chemical com-ion, Riiser-Larsenisen Ice Shelf, Ions, Sodium, ates, Volatilization, Seawater, Wind.

he central areas of the Greenland and the rctic ice caps the chemical composition of the ice snow and of the low altitude atmosphere closely related. The distribution with depth of n different ions in three snow profiles, 1, 60 120 km from the coast on Riiser-Larsenisen Ice f (72 degrees 30'S, 15 degrees E) shows a close ariation between ions of marine origin and correlation between these ions and ions of umptively non-marine origin. The Riiser-Larsen Ice Shelf is 3-4000 km from the nearest ropogenic sources of atmospheric contami-s. The chemical variations with depth indicate the deposition of marine ions even in this area isodic. The deposition rates of ions of marine in vary as 50:1 over some 120 km distance the coast. The SO4(2-) Na(+) ratio in snow the coast is lower than for bulk sea water cating a loss of SO4(2-) in snow to the atmos-e by volatilization. This occurs when catabatic ds from inland with very low S content blow the area. (Moore-IVI)
-01087

DROGEOCHEMISTRY OF CONTINENTAL ACKISH WATERS IN THE SOUTHERN STAL PLAIN, ISRAEL,
zmann Inst. of Science, Rehovoth (Israel).
t. of Isotope Research.
Magaritz, A. Nadler, U. Kafri, and A. Arad.
mical Geology, Vol. 42, No. 1/4, p 159-176, uary, 1984. 6 Fig, 1 Tab, 42 Ref.

criptors: *Groundwater, *Brackish waters, ochemistry, *Chemical reactions, *Israel, Coastal waters, Besor River, Sodium, Chloride, Water analysis.

A new mechanism is suggested to explain a groundwater system in a low precipitation area. Reactions which govern the chemical composition of the coastal aquifer water are mainly the result of soil-water interaction. These reactions are dissolution of calcium ion bearing minerals (carbonates and sulfates), base exchange in clays and wetting/drying cycles. The Southern Coastal Plain in Israel incorporates a transitional fringe of the desert in which three different chemical types of groundwater are found: near surface waters from springs along the Besor River course; shallow to moderate depth waters from the slightly westward dipping Pleistocene coastal aquifer, and deep waters of the westward-dipping Upper Cretaceous Judea Group carbonates, which are recharged in the mountains in the east. The Besor waters are isotopically similar to the Judea Group waters, reflecting their origin in the mountain region and flow through the surficial river gravels and sands. Leakage of the Besor waters into the underlying southern Coastal Plain aquifer may result in mixing of the two water types. The most prominent chemical feature characterizing the ground water of the southern Coastal Plains is that the sodium to chloride ion ratio is > 1. This ratio can be maintained only by a continuous input from a non-marine source of sodium. The most plausible source is the dissolution of feldspar derived from the windblown loess deposits which cover the area and/or leaching of trona minerals found in the unsaturated zone, combined with base-exchange processes. (Baker-IVI)
W85-01095

ACTIVITY COEFFICIENTS OF IONS IN ALKALI AND ALKALINE-EARTH CHLORIDE DOMINATED WATERS INCLUDING SEAWATER,
University of Western Ontario, London. Dept. of Geology.
H. W. Nesbitt.
Chemical Geology, Vol. 43, p 127-142, 1984. 3 Fig, 4 Tab, 28 Ref.

Descriptors: *Chemical analysis, *Chlorides, *Ions, Surface waters, Groundwater, Water analysis, Seawater, Alkaline earths, Alkali.

Natural surface and ground waters display a great diversity of compositions. However, chloride-rich waters probably are of much greater importance in geology than are other water types. The ratios of single-ion activity coefficients are thermodynamically defined quantities and adsorption of a pH convention alone permits calculation of all other single-ion activity coefficients in mixed electrolyte solutions. The activity coefficients of ions measured using this approach are compatible with the ionic mobility and conductance data. The chloride ion activity coefficient is similar in alkali and alkaline-earth chloride solutions and apparently it is little influenced by the type of cation in solution. The circumstances of the study permit simple, accurate estimates within 10% of single-ion activity coefficients in most chloride-dominated natural solutions. (Baker-IVI)
W85-01097

AGGREGATION OF AQUATIC HUMIC SUBSTANCES,
Freshwater Biological Association, Ambleside (England).
E. Tipping, and M. Ohnstad.
Chemical Geology, Vol. 44, No. 4, p 349-357, June, 1984. 4 Fig, 2 Tab, 18 Ref.

Descriptors: *Humic substances, *Aggregation, Reservoirs, Lakes, Esthwaite Water, England, Penwhirn Reservoir, Scotland, Hydrogen ion concentration, Calcium, Protonation.

Humic substances were isolated from Penwhirn Reservoir and Esthwaite Water and their removal from solution by centrifugation was studied as a function of pH, humic concentration and molecular weight, and calcium chloride concentration. Large amounts of Penwhirn Reservoir humic substances could be removed but only small amounts of Esthwaite Water humic substances. At pH greater than 5, removal of Penwhirn Reservoir humic substances by calcium ion can be explained satisfactorily in terms of decreases in humic solubilities induced by complexation with the cation. Removal induced by protonation of the humic substance is unusual in that it decreases with increasing humic concentration. Penwhirn Reservoir humic substances apparently comprise a range of molecules differing in solubility, with the high molecular weight components being the least soluble. The Esthwaite Water humic substances consist of molecules of weight-average molecular weight 5000 and resemble similarly sized Penwhirn Reservoir humic substances in that they remain unaggregated in solution even when highly complexed with calcium ions. (Baker-IVI)
W85-01106

OXIDATION PRODUCTS OF MN(II) IN LAKE WATERS,
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 2H.
W85-01107

2L. Estuaries

VARIABILITY OF THE NEAR-SURFACE RESIDUAL CURRENT IN THE LOWER ST. LAWRENCE ESTUARY,
Quebec Univ., Rimouski. Dept. of Oceanography.
M. I. El-Sabh, H.-J. Lie, and V. G. Koutitonsky.
Journal of Geophysical Research, Vol. 87, No. C12, p 9589-9600, November, 1982. 13 Fig, 6 Tab, 22 Ref.

Descriptors: *St. Lawrence estuary, *Water currents, *Residual currents, Time series analysis, Spectral energy density, Tidal currents, Eddies, Baie-Comeau, Pointe-au-Pere.

Current measurements of 1- and 4-month duration from May 1979 taken at 10 stations in the lower St. Lawrence estuary were subject to time series analysis. We find that the spectral energy density of the near-surface current in the sub-inertial frequency range is comparable to the energy concentrated in the semi-diurnal frequency band. The strong residual current decreases rapidly with depth while the tidal current is more or less uniform from surface to bottom. A cross-spectral analysis showed that the longshore current at a station near the south shore was negatively correlated to the current at a north shore station with high coherence in the period range greater than 7 days. Evidence was found for the existence of a cross-channel current at stations in the center of the channel. The near-surface circulation system in the area can be classified into three types of patterns: (1) one anticyclonic eddy centered between the estuary-gulf boundary and the Baie-Comeau cross-section (region I) accompanied by a cyclonic eddy located to the landward between the two cross sections at Baie-Comeau and Pointe-au-Pere (region II), (2) a cyclonic eddy in regional I with an anti-cyclonic eddy in region II, and (3) the transition phase between phases 1 and 2. The intensity of these eddies and cross-channel currents is related to sea level changes in the estuary. (Author's abstract)
W85-00516

STUDIES ON THE SEAWATER INTRUSION IN COASTAL GROUNDWATER; II. GROUNDWATER AT THE MOUTH OF THE KIKI RIVER (IN JAPANESE),
Ehime Univ., Matsuyama (Japan). Dept. of Applied Physics.
For primary bibliographic entry see Field 2F.
W85-00543

RENEWAL AND USE OF THE MISSISSIPPI RIVER DELTAIC PLAIN,
Coastal Environments, Inc., Baton Rouge, LA.
For primary bibliographic entry see Field 6G.
W85-00579

ROLE OF INTERNAL TIDES IN THE NUTRIENT ENRICHMENT OF MONTEREY BAY, CALIFORNIA,
Moss Landing Marine Labs., CA.
R. E. Shea, and W. W. Broenkow.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 1, p 57-66, July, 1982. 8 Fig, 1 Tab, 22 Ref. NOAA grants G-2-35137 and 04-5-158-20.

Descriptors: *Monterey Bay, *Monterey Canyon, *California, *Internal tides, *Nutrients, Tidal effects, Tidal bores, Coastal waters, Marine environment, Density.

Semidiurnal internal tides in Monterey Canyon are shown to be partially responsible for macronutrient enrichment of surface waters in Monterey Bay, California. CTD time series at five stations in the canyon revealed the presence of semidiurnal internal tides with heights between 50 and 120 m. Thermistor data demonstrated an internal tidal bore at the head of the canyon. Data and theory suggest that internal tidal bores may be breaking, due to either shear instability or direct overturning, there enriching the immediate area near the canyon head. Transects normal to Monterey Canyon showed a 20-m thick lens of 12 degrees C water moving out of the canyon at high internal tide. This lens was then pinched off from the canyon, and led to a density-induced divergence. The nutrient transport associated with the internal tidal divergence could support as much as 30% of the daily primary productivity in the northern part of Monterey Bay during non-upwelling periods. (Author's abstract)
W85-00650

EFFECTS OF PHYSICAL PHENOMENA ON THE DISTRIBUTION OF NUTRIENTS AND PHYTOPLANKTON PRODUCTIVITY IN A COASTAL LAGOON,
Oregon State Univ., Corvallis. School of Oceanography.
R. Millan-Nunez, S. Alvarez-Borrego, and D. M. Nelson.
Estuarine, Coastal and Shelf Sciences, Vol. 15, No. 3, p 317-335, September, 1982. 14 Fig, 37 Ref.

Descriptors: *Coastal lagoons, *Nutrients, *Phytoplankton, *Coastal waters, *Bahia San Quintin, *Mexico, Salinity, Water temperature, Nitrates, Nitrites, Phosphates, Silicates, Chlorophyll, Phaeophytin, Upwelling, Tidal effects, Turbidity.

Sea level, salinity, temperature, nitrate, nitrite, phosphate, silicate, chlorophylls a, b and c and their phaeophytins, phytoplankton abundance and phytoplankton productivity time series were generated for the mouth and three interior locations of Bahia San Quintin, Baja California, Mexico, for 10 days during summer of 1979. The samples were taken once every 2 h. This was done to describe space and time variability of these ecological properties and to elucidate the main factors that cause this variability. Upwelling events bring nutrient reach waters near the bay mouth and tidal currents propagate those waters throughout the bay. Nutrient remineralization at the sediments and the effect of turbulence induced by tidal currents and winds increase nutrient concentrations in the interiors of the bay. In comparison with available information on nutrients limited growth of planktonic algae, nutrients seemed not to be limiting to phytoplankton growth during the sampling period. Phytoplankton cell abundances at the extremes of the lagoon are an order of magnitude lower than at the mouth due to greater turbidity. Chlorophyll concentrations at the extremes are about one-third of those of the mouth. Primary productivity decreases from the mouth to the interiors in the same manner as chlorophyll does. There is not a significant difference in cell size between phytoplankton at the bay mouth and those at the extremes of the bay. Primary productivity in the bay is comparable to the productivity maxima of other upwelling areas. There is no clear permanent dominance of diatoms over dinoflagellates, or vice versa, at any location in the bay. The alternation of upwelling and nonupwelling played an important role, together with that of the spring-neap tide cycle, in producing low frequency (<0.01 cycles/h) temporal variability of ecological properties throughout the bay. (Author's abstract)
W85-00652

EMERSION CURVE IN SEMIDIURNAL TIDAL REGIMES,
Liverpool Univ., Port Erin (England). Dept. of Marine Biology.
R. G. Hartnoll, and S. J. Hawkins.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 4, p 365-371, October, 1982. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Emersion curves, *Tidal effects, *Semidiurnal tides, *Great Britain, Shores, Intertidal areas, Distribution, Littoral environment, Environmental distribution.

Environmental conditions clearly change with height on the shore, and this change must be a major factor in determining the vertical range of intertidal species and their pattern of distribution. The environmental stress for aquatic organisms must be strongly influenced by the percentage of time exposed to air. Exposure to air is conveniently represented by an emersion curve, in which the percentage emersion (usually for a period of 1 year) is plotted against height on shore. Emersion curves are presented for the following eight locations in Britain experiencing semidiurnal tides: Aberdeen, Devonport, Larne, Liverpool, Oban, Portland, Southhampton and Swansea. Curves were produced by computer analysis of reduced hourly tide gauge observations over a 1-year period, and were not based upon predicted times of HW and LW. The locations differ in tidal constants and the form of the tide curve. The shape of the emersion curve varies markedly between locations, and for each curve the slope, which indicates the rate of change of environmental conditions, is analysed with respect to height at the tide gauge. Critical tide levels, where conditions change particularly rapidly, are obvious on some curves but less evident on others. It is not possible to predict the shape of the emersion curve from data on the tidal constants or from the shape of the tidal curve. (Moore-IVI)
W85-00653

STRUCTURE AND CHEMISTRY OF SEDIMENTS IN BELFAST LOUGH, A SEMI-ENCLOSED MARINE BAY,
Department of Agriculture for Northern Ireland, Coleraine. Fisheries Research Lab.
For primary bibliographic entry see Field 5B.
W85-00654

NUTRIENT EXCHANGE ACROSS THE SEDIMENT-WATER INTERFACE IN THE POTOMAC RIVER ESTUARY,
Geological Survey, Reston, VA.
E. Callender, and D. E. Hammond.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 4, p 395-413, October, 1982. 3 Fig, 7 Tab, 66 Ref. NSF grant OCE-79-09412.

Descriptors: *Potomac River, *Sediment-water interfaces, *Nutrients, *Estuarine environment, Ammonia, Phosphates, Silica, Radon, Tidal rivers, Bioturbation, Path of pollutants.

The flux of ammonia, phosphate, silica and radon-222 from Potomac tidal river and estuary sediments is controlled by processes occurring at the sediment-water interface and within surficial sediment. Calculated diffusive fluxes range between 0.6 and 6.5 mmol/sq m/day for ammonia, 0.020 and 0.30 mmol/sq m/day for phosphate, and 1.3 and 3.8 mmol/sq m/day for silica. Measured in situ fluxes range between 1 and 21 mmol/sq m/day for ammonia, 0.1 and 2.0 mmol/sq m/day for phosphate, and 2 and 19 mmol/sq m/day for silica. The ratio of in situ fluxes to diffusive fluxes (flux enhancement) varied between 1.6 and 5.2 in the tidal river, between 2.0 and 20 in the transition zone, and from 1.3 to 5.1 in the lower estuary. The large flux enhancements from transition zone sediments are attributed to macrofaunal irrigation. Nutrient flux enhancements are correlated with radon flux enhancements, suggesting that fluxes may originate from a common region and that nutrients are regenerated within the upper 10-20 cm of the sediment column. The low fluxes of phosphate from tidal river sediments reflect the control benthic sediment exerts on phosphorus through sorption by sedimentary iron oxyhydroxides. In the tidal river, benthic fluxes of ammonia and phosphate equal one-half and one-third of the nutrient input of the Blue Plains sewage treatment plant. In the tidal Potomac River, benthic sediment regeneration supplies a significant fraction of the nutrients utilized by primary producers in the water column during the summer months. (Author's abstract)
W85-00655

MIXING CAUSED BY LATERAL INTERNAL SEICHING WITHIN A PARTIALLY MIXED ESTUARY,
Institute of Oceanographic Sciences, Taunton (England).
K. R. Dyer.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 4, p 443-457, October, 1982. 2 Fig, 1 Tab, 22 Ref, 1 Append.

Descriptors: *Seiches, *Estuaries, *Mixing, *Southhampton Water, *England, Turbulence, Water currents, Salinity, Standing waves, Internal waves.

Mixing in estuaries is caused by turbulence produced by bottom friction and by internal shear. In partially mixed estuaries both are important. Interaction of a current with a sill can produce internal seiching if the waves are continually reflected. In Southampton Water a broad, shallow shelf is present on the eastern side of the estuary which is close to the depth of the halocline over the deep channel. Southampton Water is a partially mixed estuary. The salinity fluctuations at two stations near the halocline in Southamptom Water were spectrally analyzed. The largest salinity fluctuations were equivalent to a 2.25 m amplitude in a water depth of 13 m. They had a period of approximately 2.5 min. Generally, the amplitude was 0.5-1 m. Mixing commences at a layer Richardson number of about 20. The predominant energy inputs have periods of 7-9 and 3.5-4.5 min. These motions arise from lateral internal seiching and they are produced by interaction of the surface seiche with the shallow side of the estuary. The wavelengths of the standing wave are calculated to be about 120 and 60 m respectively, and these compare well with echo-sounding surveys of the elevation of the halocline. Lateral internal seiching is the most likely explanation for the salinity fluctuations in Southampton Water. Interaction of the internal waves with the longitudinal current may produce enhanced mixing especialy at the lower current velocities. (Moore-IVI)
W85-00656

FATTY ACIDS IN RECENT SEDIMENTS IN THE ST. LAWRENCE ESTUARY,
Quebec Univ., Rimouski. Dept. of Oceanography.
L. Rodier, and M. F. Khalil.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 5, p 473-483, November, 1982. 1 Fig, 3 Tab, 32 Ref.

Descriptors: *Sediments, *Fatty acids, *St. Lawrence estuary, Bacteria, Tracers, Recent sediments, Sediment-water interfaces, Estuarine environment, Biological activity.

The St. Lawrence maritime estuary is a site of intensive biological activity. Fatty acids have long been considered as useful tracers of the source of organic matter and indicators of the biological activity of waters and sediments. The upper, biologically active layers of Recent estuarine sediments contain saturated and unsaturated fatty acids. Fatty acids can be derived from plankton, terrigenous runoff, benthic organisms, sea grasses and marsh plants. Surface sediments from the Rimouski section in the St. Lawrence estuary were sampled at the surface and at 10 cm depth. Fatty acids were extracted and analyzed. Total fatty acid concentrations in the surface sediments of the St. Lawrence lower estuary vary from 22 to 84 micro g/g dry weight. Saturated and unsaturated fatty

contents at the two depths vary with the
e of the sediments. The clay sediments rich in
nic matter contain more fatty acids than the
esponding sand or gravel. Unsaturated fatty
were more abundant in the surface sediments.
e iso- and anteiso-odd carbon fatty acids were
ted in the sediments; these acids could indi-
a microbial activity. Comparison of the rela-
distribution of the different fatty acids in the
ce layer, in the water column and in the
ents suggests that the fatty acids in the sur-
sediments in the St. Lawrence originate from
ongoing biological activity in the water
mn. (Moore-IVI)
-00657

RT-TERM VARIABILITY OF THE SIZE CTRA OF SUSPENDED PARTICLES IN A IDLY CHANGING ENVIRONMENT,
ec Univ., Rimouski. Dept. of Oceanography.
Chanut, and S. A. Poulet.
arine, Coastal and Shelf Science, Vol. 15, No.
497-513, November, 1982. 6 Fig, 1 Tab, 28

criptors: *Suspended solids, *Particle size, *St.
rence estuary, Tidal effects, Water currents,
culate matter, Estuarine environment, Veloci-
tratification, Mixing.

ysis of suspended matter collected in the
r St. Lawrence estuary indicated short-term
abilities in both the structure and dynamics of
articles. Variations with time and depth were
bed to fluctuation of particle concentrations
in the size ranges of the major peaks of con-
ration. A deterministic pattern was found for
temporal succession of the spectra when total
cle concentrations were high. This was due to
binations of three factors that act in one of two
s, either (i) high current velocity-spring tide-
ified waters, or (ii) lower current velocity-
tide-mixed waters. In the first case, the cur-
effect prevailed, while the tide effect was
inant in the second one. A random pattern
rred in the succession of the spectra when
r particle concentrations and patches of small-
imensions were present in well mixed water
es. Successions of spectra were not always in
e at different depths within the water column.
thor's abstract)
5-00658

DIOCAESIUM AND 210PB IN CLYDE SEA CH SEDIMENTS,
sgow Univ. (Scotland). Dept. of Chemistry.
primary bibliographic entry see Field 5B.
5-00659

NAMICS OF A BATHYMETRICALLY AR-STED ESTUARINE FRONT,
ney Univ. (Australia). Coastal Studies Unit.
M. Huzzey.
arine, Coastal and Shelf Science, Vol. 15, No.
537-552, November, 1982. 8 Fig, 2 Tab, 24

criptors: *Port Hacking, *New South Wales,
stralia, *Estuarine fronts, Tidal effects, Densi-
Bathymetry, Mixing, Water circulation, Tidal
raulics.

t Hacking is a large and branching estuary fed
several small creeks and the Hacking River
w South Wales). During the flooding tide a
inctive front forms close to the inner margin of
flood tide delta where the incoming dense tidal
v encounters the less dense water of the Port
cking Basin. It is a density form and is remarka-
for its persistence, quasi-steady nature and its
dictability. The mixing and circulation associat-
with this bathymetrically arrested estuarine
nt was studied using hydrographic and current
a. The quasi-steady front, exhibiting strongly
nvergent surface flows, is formed along the
eply sloping inner margins of the flood tide
ta during each semi-diurnal tide cycle. This
nt separates the brackish ambient water within a
ep estuarine basin from the incoming oceanic
al water. The position of the front is dependent on the local water depth and the difference in density between the two water masses. The surface front has a typical width of about 0.5-1.0 m; beneath the surface, the frontal interface is inclined downwards at an angle of approximately 17 degrees, parallel to the bed slope. The frontal interface is characterized by low static stability and intense vertical mixing. A vertically integrated horizontal momentum equation was derived for flow in the upper layer and an estimate made as to the value of the associated entrainment coefficient. The large-scale hydraulics of this frontal system is controlled primarily by the bathymetry which in turn modifies the flow of the incoming tidal currents. (Moore-IVI)
W85-00660

DISSOLVED SILICON IN THE YAQUINA ESTUARY, OREGON,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 2K.
W85-00661

BEHAVIOR OF IRON, MANGANESE AND SILICON IN THE PECONIC RIVER ESTUARY, NEW YORK,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
R. J. Wilke, and R. Dayal.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 5, p 577-586, November, 1982. 5 Fig, 1 Tab, 38 Ref. Petroleum Research Fund grant PRF-9404-G2.

Descriptors: *Peconic river estuary, *New York, *Iron, *Manganese, *Silicon, Dissolved solids, Particulates, Geochemistry, Chlorinity, Estuarine environment, Sediments.

The behavior of dissolved and particulate iron and manganese and dissolved silicon has been studied as a function of chlorinity in the Peconic River estuary, New York. This study sought to identify important geochemical processes in a relatively pristine estuary facing increasing anthropogenic impact. Dissolved iron behaved in the classical non-conservative manner exhibiting removal of nearly 80% at very low chlorinities, while particulate iron increased by a corresponding amount over the same chlorinity range. Dissolved manganese was enriched by up to 200% over its predicted concentration at low and intermediate chlorinities by desorption from suspended particulates and by a probable benthic flux. Dissolved silicon was enriched by up to 100% at low and intermediate chlorinities also from a probable benthic flux. These fluxes were estimated to be 5 micro g/sq cm/day for dissolved manganese and 70 micro g/sq cm/day for dissolved silicon. The quantity of both particulate iron and manganese increased at high chlorinities due to an influx of suspended inorganic particulates. In the intermediate to high chlorinity region, oxidation of sediment-derived manganese is believed to contribute to the observed increase in particulate manganese. Total iron was essentially conservative throughout most of the estuary, while total manganese was non-conservative presumably due to extensive remobilization of dissolved manganese from the sediments. (Author's abstract)
W85-00663

INFLUENCE OF LOCAL WINDS AND THE SOUTHERN NORTH SEA ON THE LEVEL OF THE RIVER THAMES,
K. R. Thompson.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 6, p 605-610, December, 1982. 4 Fig, 1 Tab, 4 Ref.

Descriptors: *River Thames, *England, *Wind, *Water level fluctuations, *North Sea, Estuaries, Sea level, Water level, Tidal effects.

Subtidal changes of the level of the River Thames are examined over the period September-October 1973. Almost 98% of the total subtidal variance can be accounted for by a spatial mode describing uniform changes of level at all tide gauges. This mode is due to changes of the level of the southern North Sea into which the River Thames flows. The remaining 2% of total variance can be almost completely described by a tilting of level. This tilting is partly due to a delay in the response of the river to elevation changes at the mouth and partly to the effect of local wind. The effect of local wind could cause the level at Greenwich to differ from that at Southend by as much as 35 cm. (Author's abstract)
W85-00664

CARBON AND NITROGEN PRIMARY PRODUCTIVITY IN THREE NORTH CAROLINA ESTUARIES,
Duke Univ., Beaufort, NC. Marine Lab.
T. R. Fisher, P. R. Carlson, and R. T. Barber.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 6, p 621-644, December, 1982. 15 Fig, 5 Tab, 42 Ref.

Descriptors: *Primary productivity, *Carbon, *Nitrogen, *Estuarine environment, *North Carolina, Plankton, Chlorophyll a, Algae, Light intensity, Euphotic zone, South River estuary, Neuse River estuary, Newport River estuary.

Uptake of inorganic carbon and ammonium by the plankton community of three North Carolina estuaries was measured using C-14 and N-15 isotope methods. At 0% light, C appeared to be lost via respiration, and at increasing light levels uptake of inorganic carbon increased linearly, saturated (mean Ik = 358 +/- 30 micro Ein/sq m/s), and frequently showed inhibition at the highest light intensities. At 0% light, NH4(+) uptake was significantly greater than zero and was frequently equivalent to uptake in the light (light independent); at increasing light levels NH4(+) uptake saturated (mean Ik = 172 +/- 44 micro Ein/sq m/s) and frequently indicated strong inhibition. Light-saturated uptake rates of inorganic carbon and NH4(+) were a function of chlorophyll a (r sq = 0.7-0.9); average assimilation numbers were 625 nmol CO2/(micro g chl. a)/h and 12.9 nmol NH4(+)/(micro g chl. a)/h and were positively correlated with temperature (r sq = 0.3-0.7). The ratio of dark to light-saturated NH4(+) uptake tended to be near 1.0 for large algal populations at low NH4(+) concentrations, indicating near light independence of uptake; whereas the ratio was lower for the opposite conditions. These data are interpreted as indicative of nitrogen stress, and it is suggested that uptake of NH4(+) deep in the euphotic zone and night are mechanisms for balancing the C:N of cellular pools. A 24-h study using summed short-term incubations confirmed this; the cumulative C:N of CO2 and NH4(+) uptake during the daylight period was 10-20, whereas over the 24-h period the ratio was 6 due to dark NH4(+) uptake. Annual carbon and nitrogen primary productivity were respectively estimated as 24 and 4.0 mol/sq m/year for the South River estuary, 42 and 7.3 mol/sq m/year for the Neuse River estuary, and 9.6 and 1.6 mol/sq m/year for the Newport River estuary. (Author's abstract)
W85-00665

NATURAL ORGANICS AS FLUORESCENT TRACERS OF RIVER-SEA MIXING,
South Carolina Univ., Columbia. Dept. of Chemistry.
J. E. Dorsch, and T. F. Bidleman.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 6, p 701-707, December, 1982. 4 Fig, 15 Ref. NOAA grant R-82-290.

Descriptors: *Tracers, *Fluorescent tracers, *Mixing, *Estuaries, Organic compounds, Humic acids, Fulvic acids, Salinity, Piedmont rivers, Coastal plain rivers, Hydrocarbons.

River-sea mixing is usually studied by following the salinity, but if more than one river enters an estuary, salinity measurements alone are inadequate to deduce the relative contributions of the individual freshwater sources. A feature of many rivers in the southeastern US is the yellowish brown water caused by the presence of humic and fulvic acids (here called HA). HA fluoresce strongly when excited by long wavelength ultra-

violet light. The fluorescence-salinity characteristics were investigated in two estuaries: one in which two rivers having different HA concentrations mixed with seawater and the other where a single river of high HA content entered the sea. Fluorescence declined linearly with seawater dilution in laboratory mixing studies, and also behaved conservatively in the estuary where a single river emptied into a bay. In the estuary where a piedmont river (high suspended sediment, low fluorescence) and a coastal plains river (low sediment, high fluorescence) mixed with ocean water, the factor of 2 or greater differences in fluorescence between the two rivers allowed their relative contribution to the estuarine water mass to be distinguished. Petroleum hydrocarbons, measured in estuarine water at 0.7-1.8 micro g/l concentrations, contributed negligibly to water fluorescence. Natural fluorescence is a sensitive, conservative mixing tracer which should prove useful for differentiating piedmont and coastal plains inputs to estuaries. (Moore-IVI)
W85-00667

MIXING OF BURDEKIN RIVER FLOOD WATERS IN THE GREAT BARRIER REEF,
Western Australia Univ., Nedlands. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W85-00776

OXYGEN BUDGET FOR AN URBAN ESTUARY,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
D. W. Connell, H. C. Morton, and B. M. Bycroft.
Australian Journal of Marine and Freshwater Research, Vol. 33, No. 4, p 607-616, 1982. 3 Fig, 4 Tab, 22 Ref.

Descriptors: *Estuaries, *Urban watersheds, *Dissolved oxygen, *Norman Creek Estuary, *Brisbane, *Australia, Aeration, Biochemical oxygen demand, Respiration, Photosynthesis.

The factors affecting dissolved oxygen concentrations in an urban estuary were studied using a static model indicating the magnitude of oxygen flow between different compartments of the stream and its associated environment over a fixed period. The basic objective was to provide a budget, quantifying additions and losses of dissolved oxygen in the water mass of the stream, thereby identifying in which compartments the demands of dissolved oxygen were occurring and how these were satisfied by replenishment processes. The study area was a 7 km length of the Norman Creek estuary in Brisbane from the mouth where the creek flows into the Brisbane River estuary to Stones Corner. The addition of oxygen to the estuary is discussed as it is related to accrual, aeration and deaeration, and photosynthesis. Losses of oxygen are considered through export, deaeration, biochemical oxygen demand, total respiration, and benthic demand. On the basis of average concentrations of dissolved oxygen, the stream was clearly divided into two sections: an upper section where photosynthetic oxygen results in elevated oxygen levels, at midtide during daylight hours, and a lower section where the lack of this oxygen source results in depression of oxygen concentrations. From the mean concentration of dissolved oxygen and the total volume of the study area, the total amount of oxygen present at midtide during daylight is 928 kg. The consumption rate of 642 kg/day will be largely maintained throughout the diurnal cycle and thus there will be a substantial turnover of oxygen every 24 hr. (Baker-IVI)
W85-00777

TRACE METALS IN SEDIMENTS FROM THE YARRA RIVER,
Melbourne Univ., Parkville (Australia). Dept. of Geography.
For primary bibliographic entry see Field 5B.
W85-00780

BENTHIC COMMUNITIES OF THE GIPPSLAND LAKES, VICTORIA,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Lab.
G. C. B. Poore.
Australian Journal of Marine and Freshwater Research, Vol. 33, No. 5, p 901-915, 1982. 7 Fig, 4 Tab, 27 Ref.

Descriptors: *Benthos, *Gippsland Lakes, *Victoria, *Australia, Estuarine environment, Bottom sediments, Mud, Catchment areas, Salinity, Seagrasses, Temperature effects, Dissolved oxygen, Suspended solids.

Samples of benthos from muddy or sandy bottoms along the axis of a large estuarine system (Gippsland Lakes) and on shallow seagrass beds were taken between November 1978 and October 1979. The benthic communities are described and the likely effects resulting from changes in water usage in the catchment are discussed. The points of most significant change in the benthos of the Gippsland Lakes are at McLennans Strait where salinity varies greatest temporally and spatially, near the lower end of Lake Victoria at a point below which salinity is rarely less than 27, and in the Reeve Channel where salinity is near that of seawater and sediments are coarse. The salinity gradient that prevailed along Lakes Victoria and King was not correlated with community diversity or composition. Geographical features such as McLennans Strait, and seasonal poikilohalinity either shift or dampen boundaries, making use of rigorous estuarine models of little value. Increased salinity in the future may allow establishment of euryhaline species in more placid parts of the lakes but that deoxygenation of bottom water and high benthic mortalities may occur if a salt wedge is maintained. (Baker-IVI)
W85-00785

INTENSIVE SURVEY: MANASQUAN ESTUARY, MAY-SEPTEMBER 1978,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
For primary bibliographic entry see Field 5A.
W85-00818

EFFECT OF THE PROPOSED COOPER RIVER REDIVERSION ON SEDIMENTATION IN CHARLESTON HARBOR, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 4D.
W85-00846

EVALUATION OF WATER LEVELS IN MAJOR AQUIFERS OF THE NEW JERSEY COASTAL PLAIN, 1978,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-00854

SOUTH FLORIDA'S WATER DILEMMA: A TRICKLE OF HOPE FOR THE EVERGLADES,
K. Hansen.
Environment, Vol. 26, No. 5, p 14-20 and 40-42, June, 1984. 12 Fig, 48 Ref.

Descriptors: *Water resources management, *Wetlands, *Florida, *Everglades, Ecosystems, Water pollution control, Legislation, Regulations, Water use, Planning, Management.

The discovery early in the 1900's of the great potential for farming in areas of the Everglades wetlands triggered a series of efforts to build dikes, levees, and canals to drain the land that has resulted in the continued deterioration of conditions in the rare subtropical region. Despite conservation and legislative victories to preserve the Everglades, highlighted in 1947 by the creation of the Everglades National Park from the southwestern sector of the area, the environmental health of the entire Everglades area is deteriorating more rapidly than ever before. Water releases, distribution of flow, amount of water released into the park, and the quality of water entering the park are each considered in turn. The conflicts of management policies and special interest groups are reviewed. Saving the Everglades will require the cooperative and decisive efforts of the state of Florida, Army Corps of Engineers, Department of the Interior, South Florida Water Management District, and the myriad local municipalities situated in the Everglades watershed basin. (Baker-IVI)
W85-00905

DISTRIBUTION AND FLUX OF PARTICULATE MATTER IN THE BIDEFORD RIVER ESTUARY, PRINCE EDWARD ISLAND, CANADA,
McGill Univ., Montreal (Quebec). Redpath Museum.
S. Youakim, and H. M. Reiswig.
Estuarine, Coastal and Shelf Science, Vol. 18, No. 5, p 511-525, May, 1984. 5 Fig, 5 Tab, 26 Ref. National Sciences and Engineering Council of Canada Strategic grant G0225.

Descriptors: *Estuaries, *Particulate matter, *Bideford River estuary, *Prince Edward Island, Spatial distribution, Temporal distribution, Organic matter, Rivers, Sediments, Resuspension, Sediment transport, Fluctuations, Phytoplankton.

The Bideford River estuary is well mixed. The soft mud bottom composed mostly of silt and clay sized particles derived from the surrounding watershed, is easily resuspended by tide and wind-induced turbulence. Resuspension, lateral transport and deposition of these particles, result in a general homogenous distribution of organic matter in the sediment compartment. The effective mixing processes also produce a homogenous distribution of organic matter in the water column throughout the estuary. Resuspension and the autochthonous phytoplankton biomass are the primary sources of the water borne organic matter. Benthic microalgae and their detritus make a minor contribution to the organic pool of the sediment, and the settling of phytoplankton cannot account for the high levels of organic matter on the surface sediment. Most of the organic matter on the sediment of the estuary is derived from allochthonous sources, including terrestrial and possibly littoral macrophytic detritus. Low levels of decomposition permit high levels of organic matter to accumulate, making the sediment surface the primary reservoir of organic matter in the estuary. Suspended particulate matter in the water, both organic and inorganic, is exported from the estuary to Malpeque Bay. Sediment flux from the estuary to the bay is restricted. As a result, the bay's sediment receives little terrestrial and macrophytic detritus and it has a lower organic content compared to the estuary sediment. The organic matter on the bay sediment is primarily derived from autochthonous plant detritus and its associated epifauna. (Baker-IVI)
W85-00912

TRANSPORT OF SUSPENDED MATTER IN A BAR-BUILT DANISH ESTUARY,
Copenhagen Univ. (Denmark). Inst. of Geography.
For primary bibliographic entry see Field 2J.
W85-00913

BEHAVIOUR OF METALLIC AND RADIOACTIVE ELEMENTS IN LAGOONAL SEDIMENTS: THE EXAMPLE OF THE CANET-ST NAZAIRE POND (MEDITERRANEAN COAST),
Nice Univ. (France). Groupe de Recherches de Sedimentologie et Geochronologie Marines.
M. Bernat, G. Cauwet, B. Chassefiere, D. Faguet, and F. Gadel.
Estuarine, Coastal and Shelf Science, Vol. 18, No. 5, p 557-570, May, 1984. 6 Fig, 5 Tab, 14 Ref.

Descriptors: *Lagoons, *Metals, *Radionuclides, Clay, Organic matter, Mediterranean coast, Coastal waters, Chemical reactions, Suspended matter, Sediments, Calcium, Magnesium, Sodium, Potassium, Manganese, Zinc, Uranium, Thorium.

The behavior of Ca, Mg, Na, K, Fe, Mn, Zn, and radionuclides (U, Th, Pc, and Ra) was studied in water, suspensions and sediments of an euxinic lagoonal environment of the French Mediterrane-

oast, the Canet-St Nazaire pond. The pond is acterized by a great variability of environmenonditions. The strong periodical north-western d, which has an important influence on the er and surface sediment dynamics, the large g up by the fluviatile runoff and the limited nection with the sea determine the polyhaline re of the waters and a high sedimentation rate. avior of the metallic elements and radionues is connected with the sedimentological and sicochemical processes and the well marked x gradients within the sediment. When enterthe more saline nature of the lagoon, the fine r suspensions enriched with smectite flocculate fresh organic matter. Some elements such as and Fe are carried along by flocculation and ch the sediments at the river mouth. For Zn, a tively slow remobilization process takes place e upper layer of sedimentation. The suspension overished in the swelling clay mineral then inues up to the center of the pond, carrying g the manganese as dissolved or colloidal subces which is deposited further. Within the sedit, where the redox gradients are well defined, e redistribution of elements (Mn, Fe, and Ra), s place which may be connected with the e fraction of the organic matter more abundant perficial layers. (Baker-IVI)
5-00914

RIATION IN SUBSTRATE CHEMISTRY ONG MICROTOPOGRAPHICAL AND TER-CHEMISTRY GRADIENTS IN PEATNDS,
apo Coll. of New Jersey, Mahwah. School of ironmental Studies.
. Karlin, and L. C. Bliss.
adian Journal of Botany, Vol. 62, No. 1, p 142- January, 1984. 3 Fig, 4 Tab, 57 Ref.

criptors: *Chemical composition, *Peatlands, bstrates, *Alberta, Plant communities, Ecologidistribution, Species diversity.

road range of water chemistry (pH 3.5-8.2; Ca, 0 mg/L) and substrate chemistry (pH 3.3-7.8; 4-138 mequiv. 100/g) exists among peatlands in tral Alberta. The six peatlands comprising the n study sites included strongly minerotrophic, derately minerotrophic, and weakly minerotro- systems. Variation in substrate chemistry g the hollow to hummock gradient in strongly moderately minerotrophic peatlands was high ging from highly minerotrophic peats to omtrophic peats), while variation in substrate mistry in weakly minerotrophic peatlands was ht (weakly minerotrophic peats to ombrotro- peats) along the same gradient. Substrate mistry and plant community composition of ow and low-hummock communities varied siderably along the strongly minerotrophic to kly minerotrophic peatland gradient. In cont, the chemistry of the upper peat layers of the mocks and hummock plant community comition were similar in all of the peatlands studied. tributional patterns of plant species in weakly erotrophic peatlands are not primarily in rense to gradients in substrate chemistry but arise n gradients in substrate moisture and biotic ractions. This is not the case for strongly and derately minerotrophic systems, where gradis in substrate chemistry may also strongly influe plant species distribution. The increase in plexity of the substrate environment in peatds along the weakly minerotrophic to strongly erotrophic gradient is reflected by a parallel rease in plant species diversity. (Author's abct)
5-00949

TAL ACCUMULATION BY BRYOPHYTES SOME ZINC-RICH BLANKET BOGS, LWYN MOUNTAINS, YUKON TERRITORY,
partment of Scientific and Industrial Research, merston North (New Zealand). Applied Bomistry Div.
Lee, I. R. Jonasson, and W. D. Goodfellow.
nadian Journal of Botany, Vol. 62, No. 4, p 722-, April, 1984. 1 Fig, 4 Tab, 14 Ref.

scriptors: *Bryophytes, *Zinc, *Lead, *Cadmi-, *Blanket bogs, *Yukon territory, Selwyn Mountains, Peat, Heavy metals, Spring water, Lead sulfide, Zinc sulfide.

Collections of Pohlia wahlenbergii, Leptobryum pyriforme, Philonotis fontana, and Drepanocladus aduncus were made at the XY Zn-Pb sulfide deposit, Howard's Pass, Y.T., Canada. Brilliant lime green growths of mosses flourish in hillside blanket bogs fed by Zn-, Pb-, and Cd-rich spring waters derived from faults which crosscut sulfide mineralizations. All species showed elevated levels of accumulation of these metals, but the concentration of Zn in the upper thalli was higher than Pb or Cd. However, the relative enrichments favor accumulation of Pb rather than Cd and Zn. The bryophyte D. aduncus is unusual in that it gathers cadmium in preference to Pb and Zn, according to calculated relative enrichment factors. The bog materials which provide the substrate for moss blankets are unusual in composition: more than 60% of the material comprises secondary Zn minerals, viz, zincic calcite ((Zn, Ca)CO3), smithsonite (ZnCO3), and wurtzite (ZnS), and the remainder is humified peat derived from buried moss strata. The end product of burial and replacement of decaying moss layers is the hydrated zinc silicate, hemimorphite (Zn4Si2O7(OH)2.H20), which results from the cell by cell replacement of moss fiber with complete preservation of the rhizoid structure. (Author's abstract)
W85-00952

MOVEMENT OF WATER FROM PEATLAND INTO SURROUNDING GROUNDWATER,
Western Michigan Univ., Kalamazoo. Dept. of Biology.
J. R. Keough, and R. W. Pippen.
Canadian Journal of Botany, Vol. 62, No. 4, p 835-839, April, 1984. 5 Fig, 1 Tab, 16 Ref.

Descriptors: *Bogs, *Peatlands, *Groundwater movement, *Michigan, Wetlands, Vegetation, Water table, Alkalinity, Calcium, Hydrogen ion concentration, Surface-groundwater relations.

The flow of groundwater between and out of two adjacent bogs in southwest Michigan was investigated. Both wetlands are kettlelike depressions located in a complex upland covered by glacial outwash and till. Neither bog has an inlet or outlet stream. Their vegetation is typical of bogs, dominated by Sphagnum spp. Chamaedaphne calyculata, and Vaccinium corymbosum; however, only the south bog is forested with Larix laricina. The water table within the study area slopes through the north bog to the south bog. Both wetland surfaces are somewhat elevated above the surrounding groundwater and surrounded by 'lagg' zones. The groundwater table around the bogs is only slightly affected by heavy precipitation, and water table fluctuations are least on the downslope side of each bog. Alkalinity, pH, and Ca(2+) generally decrease from north of the north bog to the south end of the south bog. This is evidence that groundwater is moving down gradient through both bogs and that waters seeping out of the wetlands locally change the chemical nature of surrounding groundwater. (Author's abstract)
W85-00953

INTERSTITIAL WATER METABOLITE CHEMISTRY IN A MARINE MINE TAILINGS DEPOSIT, RUPERT INLET, B.C.,
British Columbia Univ., Vancouver. Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W85-00955

SALT MARSH VEGETATION CHANGE IN RESPONSE TO TIDAL RESTRICTION,
Connecticut Coll., New London. Dept. of Botany.
C. T. Roman, W. A. Niering, and R. S. Warren.
Environmental Management, Vol. 8, No. 2, p 141-150, March, 1984. 6 Fig, 2 Tab, 18 Ref.

Descriptors: *Salt marshes, *Vegetation, *Tidal restriction, *Connecticut, Tidal effects, Tide lands, Wetlands, Tide gates, Dikes, Flood control, Mosquito control, Environmental effects, Salinity, Water table, Reeds, Spartina.

Vegetation change in response to restriction of the normal tidal prism of six Connecticut salt marshes is documented. Tidal flow at the study sites was restricted with tide gates and associated causeways and dikes for purposes of flood protection, mosquito control, and/or salt hay farming. One study site has been under a regime of reduced tidal flow since colonial times, while the duration of restriction at the other sites ranges from less than ten years to several decades. The data indicate that with tidal restriction there is a substantial reduction in soil water salinity, lowering of the water table level, as well as a relative drop in the marsh surface elevation. These factors are considered to favor the establishment and spread of Phragmites australis (common reed grass) and other less salt-tolerant species, with an attendant loss of Spartina-dominated marsh. Based on detailed vegetation mapping of the study sites, a generalized scheme is presented to describe the sequence of vegetation change from typical Spartina- to Phragmites-dominated marshes. The restoration of these Phragmites systems is feasible following the reintroduction of tidal flow. At several sites dominated by Phragmites, tidal flow was reintroduced after two decades of continuous restriction, resulting in a marked reduction in Phragmites height and the reestablishment of typical salt marsh vegetation along creek-banks. It is suggested that large-scale restoration efforts be initiated in order that these degraded systems once again assume their roles within the salt marsh-estuarine ecosystem. (Author's abstract)
W85-00978

ALGAL DYNAMICS AND NITROGEN AND PHOSPHORUS CYCLING IN A CYPRESS STAND IN THE SEASONALLY FLOODED GREAT DISMAL SWAMP,
Old Dominion Univ., Norfolk, VA. Dept. of Biological Sciences.
J. A. Atchue, III, F. P. Day, Jr., and H. G. Marshall.
Hydrobiologia, Vol, 106, No. 2, p 115-122, September 1983. 4 Fig, 1 Tab, 22 Ref. DEB 77-08609 A01.

Descriptors: *Algae, *Swamps, *Cycling nutrients, *Great Dismal Swamp, *Virginia, Population dynamics, Periphytic algae, Seasonal variation, Floods, Phytoplankton.

Both periphytic and planktonic algae are found in areas of the seasonally flooded Great Dismal Swamp in Virginia. The dynamics of these algae were studied in a cypress stand and the periphytic algae appeared to be important as nutrient conservers. Clear temporal patterns in phytoplankton dominance were also noted. Mean periphytic algal and phytoplankton biomass were 19.9 g/sq m and 3.4 g/sq m respectively. This equals or exceeds the biomass of herb layers in some swamps and other forests. The periphytic algae had mean nutrient standing crops of 0.42 g N/sq m and 0.04 g P/sq m. This suggests that the algae may be conserving nutrients within the system in patches where the algae occur. The periphytic algae were composed of Chlorophyceae and Cyanophyceae. In addition, the phytoplankton were represented by the Bacillariophyceae, Chrysophyceae, Dinophyceae and Xanthophyceae. The Bacillariophyceae were the most important group on the basis of their numbers during the study period. Several distinct assemblages of phytoplankton were noted at different times throughout the study. (Baker-IVI)
W85-00983

TRANSPARENCY AND SESTON WEIGHT OF THE ETANG DE BERRE (MEDITERRANEAN COAST OF FRANCE); RELATIONS BETWEEN THE TRIBUTARIES AND THE MARINE ENVIRONMENT (LA TRANSPARENCE ET LA CHARGE SESTONIQUE DE L'ETANG DE BERRE (COTE MEDITERRANEENNE FRANCAISE); RELATIONS AVEC LES AFFLUENTS ET LE MILIEU MARIN VOISIN),
Endoume Marine Station and Oceanography Centre, Marseille (France).
K.-T. Kim, and M. Travers.

Hydrobiologia, Vol. 107, No. 1, p 75-95, October, 1983. 14 Fig, 2 Tab, 62 Ref.

Descriptors: *Transparency, *Seston, *Etang de Berre, *Etang de Vaine, *France, Brackish waters, Marine environment, Tributaries, Estuarine environment, Phytoplankton, Light attenuation, Turbidity.

Water transparency and seston weight were measured in the brackish Etang de Berre and Etang de Vaine (between the Rhone River and Marseilles), in nearby seawater and in four main tributaries of the Etang de Berre. The large quantities of seston conveyed by rivers, particularly the Durance diversion, strongly reduced the transparency in the brackish waters. The transparency progressively increases from freshwater to open seawater, as mineral particles sink to the bottom (about 1.7 km/sq m/a on the average in brackish lakes). Comparatively, the role played by phytoplankton in light attenuation amounts to only 5% in seawater and 10-17% in Etang de Berre. In spite of turbidity, the euphotic layer generally extends to the bottom, in both the shallow brackish waters and in the deeper seawater. (Author's abstract)
W85-00993

ROOT AND RHIZOME DISTRIBUTION AS AN INDICATOR OF UPPER SALT MARSH WETLAND LIMITS,
Oregon State Univ., Corvallis. Dept. of Botany and Plant Physiology.
D. M. Seliskar.
Hydrobiologia, Vol. 107, No. 3, p 231-236, November, 1983. 1 Fig, 1 Tab, 14 Ref. EPA grant R806013010.

Descriptors: *Roots, *Rhizomes, *Salt marshes, *Wetlands, Soil water, Vertical destribution, Saturation.

Four wetland plant species, Deschampsia cespitosa, Distichlis spicata, Grindelia integrifolia, and Salicornia virginica, were tested to determine the effect of soil moisture on the vertical distribution of roots and rhizomes. In an 8-month greenhouse experiment involving plants grown from seeds and rhizomes the occurrence of more than 65% of the root and rhizome mass in the upper 10 cm of soil was indicative of saturated conditions. Roots and rhizomes were more evenly distributed under field capacity and low moisture conditions. The percent of total root and rhizome biomass in the upper 10 cm of a 35 cm core may be useful in determining whether or not a plant is experiencing saturated soil conditions, a criterion often used for defining wetlands. Limited field studies support the conclusion of the greenhouse study. (Author's abstract)
W85-01000

DIATOM FLORA OF A KETTLE-HOLE BOG IN RELATION TO HYDRARCH SUCCESSION ZONES,
De Paul Univ., Chicago, IL. Dept. of Biological Sciences.
D. L. Cochran-Stafira, and R. A. Andersen.
Hydrobiologia, Vol. 109, No. 3, p 265-273, February, 1984. 3 Fig, 5 Tab, 40 Ref.

Descriptors: *Kettle-hole bogs, *Diatoms, *Succession, Vegetation, Bogs, Water temperture, Hydrogen ion concentration, Conductivity, Color, Calcium, Wetlands.

Diatom assemblages were compared to the vegetational seres and to physical and chemical parameters of a kettle-hole bog which had distinct hydrarch successional zones and was in turn surrounded by a cattail marsh and a willow swamp. Multivariate analysis of variance showed the water parameters (temperature, pH, conductivity, color, free calcium) among the zones were significantly different ($p < 0.0001$). Diatoms were enumerated using the first 500 valves counting method and results showed each zone had a distinct flora. Cluster analysis of the diatom data by both species and zones grouped the bog successional zones into one major group and the marsh/swamp zones into the second major group. The occurrence of well defined seral stages of vegetation and diatoms suggests microorganisms are undergoing ecological succession in kettle-hole bogs. (Author's abstract)
W85-01023

PERMANENT SWAMP VEGETATION OF THE UPPER NILE,
Westfield Coll., London (England). School of Biology.
P. Denny.
Hydrobiologia, Vol. 110, p 79-90, March, 1984. 4 Fig, 1 Tab, 19 Ref.

Descriptors: *Sudd, *Sudan, *Upper Nile, *Vegetation, *Swamps, Wetlands, Water hyacinth, Submerged plants, Papyrus, Reeds, Cattails, Turbidity, Floating plants, White Nile.

This paper describes vegetation in the northern Sudd area of the Sudan. A visit by boat was made in April 1978 along the White Nile from Malakal to Lake No; to the inflow regions of the Bahr el Jebel, the Bahr el Zeraf and to the Bahr el Ghazal. Only the vegetation along the fringe of the rivers was observed as plants were tall and dense and it was not possible to penetrate into the inner swamps. The outer edge of the vegetation was fringed by extensive mats of free-floating Eichhornia crassipes which was easily dislodged and formed floating islands to be carried downstream. The main rivers, excluding the Bahr el Ghazal, were too deep and turbid to support beds of submerged species but plants such as Ceratophyllum demersum could be found amongst floating plants. Vossia cuspidata usually produced a broad zone to the landward of Eichhornia. It dominated the shallow water with a floating raft of stems growing out from the shore over the water surface. Massive stands of Cyperus papyrus and/or Phragmites karka, over 5 metres tall, dominated the vegetation behind and sometimes excluded the Vossia zone. The papyrus could form dense, floating rafts of rhizomes at the water's edge, but Phragmites always remained firmly rooted to the bottom. Floating papyrus and Vossia would become detached from the main beds and drifted downstream with Eichhornia. Creepers were common amongst papyrus but less common amongst Phragmites where the vegetation was generally more dense. Large stands of Typha domingensis were observed behind the fringe vegetation. The vegetation of the Bahr el Ghazal, in marked contrast to the rest, was stunted, and reasons for this are suggested. Species diversity was greater and the less turbid waters allowed considerable development of floating-leaved and submerged species. Estimates of fresh weights and heights of dominant vegetation types were attained but methods were very laborious and alternative ways have been suggested. The fresh weight of Eichhornia from a one meter square quadrat in the White Nile was around 70 kg. The shoots of Phragmites weighed 18.5 kg and Cyperus papyrus, 11.0 kg/sq m. (Author's abstract)
W85-01031

GEOCHEMISTRY OF THE SEDIMENT INTERSTITIAL WATER IN THE ADJACENT SEA AREA TO THE CHANGJIANG RIVER ESTUARY,
Y. Li, Z. Hu, and X. Zhu.
Oceanologia et Limnologia Sinica, Vol. 14, No. 5, p 460-472, September, 1983. 6 Fig, 4 Tab, 30 Ref.

Descriptors: *Interstitial water, *Sediments, *Estuaries, *Geochemistry, *Changjiang River Estuary, Nutrients, Calcium, Magnesium, Sulfate, Chloride, Phosphate, Silicate, Copper, Lead, Cadmium, Acidity.

The geochemical characteristics of the sediments and interstitial waters in the adjacent sea area to the Changjiang River Estuary are related to the hydrological and geological conditions of this area. Redox parameters and the contents of major and minor elements such as calcium, magnesium, sulfate, chloride, phosphate, silicate, copper, lead, and cadmium have been measured in the interstitial waters of the surface layer sediments. Nutrient measurements were also taken. The different mutual confluence of the Changjiang diluted water, the Huanghai Sea Coastal Current, the Taiwan Warm Current, and the Kuroshio system gives rise to the variations of the transport way and distribution of the sedimentary matter in this area. The constituents in the interstitial waters of surface layer sediments are approximately in the sequence of major elements > nutrients > minor elements. The interstitial waters appear supersaturated and undersaturated with respect to quartz and amorphous silica and it seems to be possible to convert kaolinite into gibbsite in the bottom layer waters at some points. The continental shelf sediments of the East China Sea should be of terrigenous material. The concentrations of soluble trace metals such as cadmium, lead, and copper in the interstitial waters are higher than the equilibrium concentrations of their sulfide solids and lower than that of their carbonate solids. (Baker-IVI)
W85-01048

STUDY OF STRONTIUM-90 IN SEDIMENT OF THE BOHAI BAY,
For primary bibliographic entry see Field 5B.
W85-01049

MORPHOLOGY AND SEDIMENTOLOGY OF DELTAS IN FJORD AND FJORD VALLEY LAKES,
Oslo Univ. (Norway). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W85-01054

SEASONAL AND ENVIRONMENTAL VARIATION IN CADMIUM, COPPER, LEAD AND ZINC CONCENTRATIONS IN EELGRASS (ZOSTERA MARINA L.) IN THE LIMFJORD, DENMARK,
Aarhus Univ. (Denmark). Botanical Inst.
J. E. Lyngby, and H. Brix.
Aquatic Botany, Vol. 14, No. 1, p 59-74, September, 1982. 7 Fig, 3 Tab, 40 Ref.

Descriptors: *Eelgrass, *Heavy metals, *Seasonal variation, *Limfjord, *Denmark, Cadmium, Copper, Lead, Zinc, Fjords, Sediments, Coastal waters, Plant growth.

The seasonal variation of cadmium, copper, lead, zinc and ash content in above and below-ground parts of eelgrass (Zostera marina L.) was studied at three locations in the Limfjord, Denmark. Heavy metal concentrations in eelgrass from the three locations differed significantly, and reflected either the concentrations in the sediment (Cu, Pb, Zn) or the concentrations in the ambient water (Cd). Above-ground parts of eelgrass contained significantly higher concentrations of cadmium, copper and zinc than below-ground parts, while no significant difference was observed for lead. Ash content in above-ground parts of eelgrass showed a significant seasonal variation with lowest ash content in spring. A general seasonal variation pattern of heavy metal concentrations in above and below-ground parts of eelgrass was observed. Maximum concentrations were encountered in late winter-early spring and minimum concentrations in the autumn. This seasonal variation pattern of heavy metals can be explained by the growth dynamics of eelgrass. (Author's abstract)
W85-01080

SEAGRASS-SEDIMENT DYNAMICS OF A FLOOD-TIDAL DELTA IN RHODE ISLAND (U.S.A.),
Rhode Island Univ., Kingston. Dept. of Botany.
M. M. Harlin, B. Thorne-Miller, and J. C. Boothroyd.
Aquatic Botany, Vol. 14, No. 2, p 127-138, October, 1982. 5 Fig, 3 Tab, 8 Ref. NOAA grant NA79AA-D-00096.

Descriptors: *Rhode Island, *Deltas, *Seagrasses, *Sediments, Flood-tidal deltas, Eelgrass, Coastal waters, Water currents, Diatoms, Sediment accumulation, Vegetation.

Interactions between seagrasses and sediment dynamics were examined on a flood-tidal delta of a coastal lagoon in southern Rhode Island from 1978 to 1980. Serial aerial photographs combined with

visits showed that Zostera marina L. appeared a stable portion of the delta in the springs of 8 through 1980 and also on a new, incipient e during 1980. The population of an annual n of Z. marina increased rapidly from June (100 nts/sq m) to late July and early August (1000 nts/sq m), after which it rapidly decreased. In etated plots in both areas current measurements to zero near the substrate, while in experimen- y denuded plots (64 sq m) they simultaneously ched 8 cm/s in the stable and 14 cm/s in the table portion of the tidal delta. At the margin of lobe in August 1980 the sediment accreted 2.5 in vegetated plots and eroded 1.5 cm in denud- plots. On the stable site short frames (0.25 sq m) truding 5 cm from the sediment surface pre- ted sediment removal and prolonged plant life, these frames set at the margin of a lobe either le no difference or increased the rate of plant ial and subsequent plant loss. Rooted plants oped dense red algal mats. Where Z. marina had n removed in the stable area, Ruppia maritima appeared. Benthic diatoms quickly covered all uded areas. This work shows that, even as an emeral, Z. marina can encourage sediment ac- nulation by slowing water current on a moder- energy tidal delta; but the degree to which this tor becomes important depends upon the densi- of the plant bed. (Author's abstract)
5-01081

E OF REPROCESSING EFFLUENT RA- ONUCLIDES IN THE GEOCHRONOLOGY RECENT SEDIMENTS,
mmission of the European Communities, Ispra ly). Joint Research Centre.
A. Stanners, and S. R. Aston.
emical Geology, Vol. 44, No. 1/3, p 19-32, y, 1984. 6 Fig, 4 Tab, 17 Ref.

scriptors: *Radioactive tracers, *Estuarine envi- nment, *Sedimentation, Sediment transport, ochronology, Radionuclides, Fuel reprocessing, dioactive wastes, Fate of pollutants, Particle e.

scharges into the northeast Irish Sea from the ndscale reprocessing plant provide a useful op- rtunity to study the transport and geochrono- y of sediments in this area. Reprocessing waste lionuclides in association with estuarine sedi- nts have provided a means for understanding e short term (15 yr) history of a dynamic intertid- l environment. Present studies are geographical- limited to coastal and estuarine environments se to significant outfalls of nuclear waste. The plication of a simple model to predict activity- pth profiles from the data on the radionuclide ste discharges of the Pu and Cs isotopes, has abled estimates to be made of apparent diffusion efficients, net sedimentation rates and lag times. is has shown that redistribution processes for Cs d Pu within a sediment column are small. Net dimentation rates varied between 16 and 71 mm/ and lag times between 0 and .75 yr. The Cs-134/ -137 and Pu-238/Pu-239+240 ratios were espe- lly important tools for carrying out this analysis. ie sensitivity of these interpretations is restricted the accuracy with which the activity profiles e defined and the unavailability of discharge data ore detailed than the annual averages. A transect ken through tidal channel, intertidal bank and lt marsh areas indicates that large activity vari- ions on the surface are found. Ratio profiles ow that grain size influences exist, but that activ- profiles also vary due to decay of the shorter ved radionuclides. These decay induced vari- ions can be related to particular sub-environ- ents having different rates of sediment accumula- on and which have exposed on the surface, sedi- ents related to different deposition events. Baker-IVI)
/85-01098

ATTERNS OF RECENT SEDIMENT ACCU- IULATION IN CHESAPEAKE BAY (VIRGIN- A-MARYLAND, U.S.A.) TRIBUTARIES,
ohns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
. S. Brush.
hemical Geology, Vol. 44, No. 1/3, p 227-242, lay, 1984. 5 Fig, 5 Tab, 30 Ref.

Descriptors: *Sedimentation rates, *Land use, *Chesapeake Bay, Virginia, Maryland, Environmental effects, Bays, Estuaries.

Mean rates of sediment accumulation based on pollen geochronology for different periods of land use in 39 cores collected in 20 tributaries of the Chesapeake Bay and the general pattern of sediment accumulation in the tributaries are described. Drainage areas of six of the tributaries extend from the Coastal Plain into the Piedmont and four are restricted to the Coastal Plain. Rates are highly variable, but higher in the upper parts of the tributaries and lower at the mouths. During the period of early agriculture, when less than 20% of the land was under cultivation, the average rate of sediment accumulation was 0.19 cm/yr. Later, when land under cultivation reached 40-50%, rates almost doubled averaging 0.34 cm/yr. There are no differences in post-settlement mass accumulation rates during periods of different land use or in different stretches of the tributaries. (Baker-IVI)
W85-01105

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

REFERENCE PLANT FOR HIGH TEMPERATURE ELECTRODIALYSIS DESALTING OF SEAWATER,
Ionics, Inc., Watertown, MA.
E. J. Parsi, T. A. Prato, and T. A. Susa.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 195841, Price codes: A08 in paper copy, A01 in microfiche. Completion Report, July 1983. 89 p, 28 Tab, 30 Exhibits. Contract/Grant No. 14-34-0001-7525.

Descriptors: High Temperature Electrodialysis, *Electrodialysis, Pilot plants, Membranes, *Desalination, Feasibility studies, Ion exchange membranes, Seawater.

The objectives of this project was to establish the feasibility of High Temperature Electrodialysis (HTED) in a seawater desalting reference plant. The goal was to increase the energy efficiency and economics of seawater desalting over conventional electrodialysis by operating at temperatures ranging up to 140 degrees F, using improved membranes, and incorporating innovations in the membrane stack and process design. A 30,000 GPD reference plant (expandable to 50,000 GPD) was designed, built and installed at the Wrightsville Beach Test Facility. Field testing was halted by the shutdown of the facility at the end of March, 1983, however, the abbreviated field test demonstrated the efficacy of most of the novel features, and an energy consumption of 40 KWH/Kgal was projected at 4 GFD, 130 degrees F, and 50% water recovery.
W85-00608

ELECTROCHEMICAL APPROACH TO THE PREVENTION OF BIOFOULING PHENOMENA,
Texas A and M Univ., College Station. Dept. of Chemistry.
J. O'M. Bockris, H. P. Dhar, and L. R. Langham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202613, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, August 1983. 40 p, 14 Fig, 2 Tab, 20 Ref.

Descriptors: Bacteria, *Electrochemistry, *Fouling, *Biofouling, *Bacterial fouling, Vibrio, Pseudomona, Aeromonas.

A novel electrochemical anti-biofouling method has been developed. The method is based on the bactericidal action of H202 generated in situ on the electrode surface from the dissolved oxygen present in the electrolyte. It has been tested in 3% saline solution and in sea water using bacteria Vibrio Anguillarum, Pseudomona atlantica, Pseudomona stutzeri and Aeromonas hydrophilia. In a thin, electrochemical cell bacteria were observed to lose motility when potential, in the range where H202 is expected to generate, was applied. In the beaker type cell, applications of steady state potentials decreased bacterial concentrations on cathode and anode by ca. 100-300 times. Potentials in the form of pulses were also effective but increasing length of off pulses was less satisfactory. Current densities were within 20-30 micro-A.cm to the minus 2nd power, and the cell potential was ca. 1.8 V. In the recirculatory flow conditions, in general, results were similar to those obtained under the stationary state conditions. Due to the generation of H202 on the surface, bacteria become inactivated before they can settle down on the surface. In addition to the generation of H202 the electrode surface becomes slightly more alkaline. The calculated pH at the cathode surface at the highest negative potential in 9.5 which is within the borderline for the formation of Mg (OH) 2 and CaC03. No precipitates were detected on the electrode surface.
W85-00863

3B. Water Yield Improvement

SURFACE MINE LAKES: AN IMPORTANT WATER RESOURCE FOR IOWA,
Iowa State Water Resources Research Inst., Ames.
L. M. Antosch.
Proceedings of the Iowa Academy of Science, Vol. 91, No. 2, p 67-69, 1984. 2 Fig, 2 Tab, 19 Ref.

Descriptors: *Iowa, *Surface mine lakes, *Selective withdrawal, *Recreation, Dewatering, Process water, Municipal water, Powerplants, Irrigation.

A survey, in 1981, revealed that Iowa had 1,215 active surface mines. Of the active and abandoned surface mines, 625 had water withdrawal permits from the Iowa Natural Resources Council. Most of these surface mines are located in the interior river valleys where the natural water table causes them to fill with water. The majority of the withdrawal permits were for dewatering and/or processing water but several were for other beneficial uses such as power production, municipal water supply, or irrigation. Several of the surface mines are also used for outdoor recreational activities. This usage, for water supply and recreation, indicates the value of surface mine lakes as a water resource for the people of Iowa. (Collier-IVI)
W85-00812

3C. Use Of Water Of Impaired Quality

BERMUDAGRASS GROWN WITH MUNICIPAL WASTEWATER,
Arizona Agricultural Experiment Station, Tucson. Dept. of Plant Sciences.
A. D. Day, J. R. Wilson, and F. R. Katterman.
BioCycle, Vol. 25, No. 4, p 38-39, May-June, 1984. 1 Tab, 8 Ref.

Descriptors: *Water reuse, *Irrigation, *Bermudagrass, *Land disposal, Semiarid lands, Fertilizers, Nitrogen, Potassium, Phosphorus, Water supply, Grasses, Municipal wastes, Forage, Crop yield.

The effects of eight irrigation and fertilizer treatments were investigated on the growth and yield of Bermudagrass and the ability of Bermudagrass to use the plant nutrients in municipal wastewater and the plant nutrients in commercial inorganic fertilizer was studied. All irrigation and fertilizer treatments produced Bermudagrass with similar plant heights, which suggested that all treatments stimulated vegetative growth to a similar degree. Only the higher amounts of N, P,and K found in municipal wastewater were effective in the production of more and longer stolons and higher above-ground dry weight from Bermudagrass than were produced when the crop received well water and recommended amounts of N, P, and K. Therefore, treated municipal wastewater can be used effectively as a potential source of irrigation water

and plant nutrients in the commercial production of forage from Bermudagrass in the semiarid areas of the world. (Baker-IVI)
W85-00680

SALINITY AND UNIFORMITY OF WATER INFILTRATION AS FACTORS IN YIELD AND ECONOMICALLY OPTIMAL WATER APPLICATION,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
E. Feinerman, K. C. Knapp, and J. Letey.
Soil Science Society of America Journal, Vol. 48, No. 3, p 477-481, May-June, 1984. 6 Fig, 7 Ref. California Water Quality Control Board contract 2-043-300-0.

Descriptors: *Salinity, *Infiltration, *Irrigation efficiency, *Costs, Crop yield, Corn, Application rates, Impaired water quality, Irrigation water, Infiltration.

The effects of irrigation water salinity and uniformity of infiltered water on average crop yields, economically optimal water applications, and profits are analyzed for steady-state and transient salinity conditions. Input data specific for corn (Zea mays L.) are used in the analysis to illustrate results. Except at very low water application levels, decreasing uniformity of infiltered water results in decreasing yield at a given water application rate and at all levels of water salinity under both steady-state and transient conditions. Profit-maximizing water applications increase under conditions of increased irrigation water salinity, decreased uniformity of infiltered water, and decreased water price; whereas profits decrease with increased salt concentrations and decreased infiltered water uniformity. Economically optimal water applications and profit can vary by factors of three or more depending on water prices, salt concentrations, and uniformity of infiltered water. Therefore accurate determination of these variables is important for decision making at the farm level. (Author's abstract)
W85-00750

3D. Conservation In Domestic and Municipal Use

URBAN WATER PLAN, (CUMBERLAND CO., N.J.).
Cumberland County Planning Board, Bridgeton, NJ.
For primary bibliographic entry see Field 6D.
W85-00825

3E. Conservation In Industry

RURAL WATER PLAN, (CUMBERLAND CO., N.J.).
Lloyd (T.) Associates, Philadelphia, PA.
For primary bibliographic entry see Field 6D.
W85-00824

3F. Conservation In Agriculture

DRAINAGE OF A TROPAQUALF BEFORE AND AFTER WATER EXTRACTION BY A CROP,
Philippines Univ. at Los Banos.
For primary bibliographic entry see Field 2G.
W85-00754

INNOVATION, CONSERVATION TO KEEP OGALLALA FROM RUNNING DRY,
D. Gardner.
Irrigation Age, Vol. 18, No. 3, p 6-7 and 20, November, 1983.

Descripors: *Water conservation, *Irrigation, *Kansas, *Ogallala Aquifer, Water use, Planning, Water management, Irrigation efficiency, Conservation tillage.

Irrigators are active in western Kansas with the promise that their help will enable land users to survive the next couple decades. The work done by the Gigot family on the Ogallala Aquifer is reviewed. Water conservation is the Gigots' number one priority. However, this means more than using less water to irrigate the corn. The individual plan per irrigation circle starts with conservation tillage to retain as much natural moisture as possible, careful selection and utilization of chemicals, and water considerations. Sprinkler irrigators are assessed a higher rate for the irrigated land despite the fact that they use the water more efficiently than furrow irrigators. This practice has encouraged inefficiency of water use and it is suggested that the situation should be reversed. Another area of concern that breeds inefficiency is the requirement that to prove out your permit you have to use within two acre-feet per year of what you applied for or you'll be cut back. The third area of concern is water metering. (Baker-IVI)
W85-01036

SECOND WATER SUPPLY THROUGH CONSERVATION: THE KENDRICK PROJECT.
Irrigation Age, Vol. 18, No. 3, p 16-17, November, 1983.

Descriptors: *Water conservation, *Irrigation, *Water need, *Kendrick Project, *Casper, *Wyoming, Water Use, Water demand, Municipal water supply, Water supply development.

Municipal water needs may be solved for Casper, Wyoming until the year 2000 through the agreement signed by the major and the board of public utilities. Casper will annually receive up to 7,000 acre-feet of water from the Bureau of Reclamation's Kendrick Project. That is water that will be saved by improvements to the district's water distribution system. The improvements will be paid for by the city. The Kendrick Project provides a second water supply. The city gets its municipal water. The district gets an improved, more efficient irrigation distribution system and its repayment obligations paid. And Reclamation gets added revenues for faster payment of the federal government's investment in the project. (Baker-IVI)
W85-01037

SPRINKLER SYSTEM CHOICES: CENTER PIVOT OR,
C. Krauter.
Irrigation Age, Vol. 18, No. 5, p 16-17 and 45, January, 1984. 2 Fig.

Descriptors: *Irrigation practices, *Planning, *Center pivot irrigation, Agriculture, Design criteria, Decision making, Sprinkler irrigation, Pivot irrigation.

The development of the center pivot sprinkler over the past 20 years was a significant advance in the state of irrigation technology. The pivot has solved problems of topography, economics, labor and deficient water supplies. The machine is continually moving into the driest area without reversing direction or retracing its track. The pivot point makes both the alignment and water supply fairly simple. Unfortunately the circular path also produces the physical and biological limitations on the use of the center pivot. The critical factors are the daily water requirement of the crop that the pivot must supply and the infiltration rate of the soil. Problems begin to arise in hot, arid climates with high pH, desert type soil. The straight line sprinkler is undoubtedly a more complex and certainly a more expensive method of irrigation but the fact remains that limitations on the use of a center pivot are soil and plant problems while the straight line system limits are essentially engineering difficulties. (Baker-IVI)
W85-01039

ACTUAL AND POTENTIAL YIELD FOR RAINFED AND IRRIGATED WHEAT IN CHINA,
California Univ., Los Angeles. Dept. of Geography.
W. H. Terjung, H.-Y. Ji, J. T. Hayes, P. A. O'Rourke, and P. E. Todhunter.
Agricultural and Forest Meteorology, Vol. 31, No. 1, p 1-23, February, 1984. 8 Fig, 5 Tab, 44 Ref.

Descriptors: *Water consumption, *Irrigation, *Crop yield, *China, *Korea, *Wheat, Model studies, Computers, Water conservation, Simulation, Rainfall.

The winter wheat seasonal yield and irrigation water consumption pattern of China and Korea has been simulated and examined for single and multiple cropping with the aid of a parametric water use and yield model, (YIELD). This application has shown the model's ability to delineate areas of high and low yield and production efficiencies. Analyses of this nature could provide a key to the location of optimum yield conditions for the world's basic food crops. In this study a network of 241 stations provided the seasonal climatic input, consisting of data averaged over approximately a 20 year period. Among the results, highest annual yields under full irrigation occurred in the Yangtze River area, Yunnan-Szechwan-eastern Tibet, Korea and the northeast, and the upper Huang Ho River. Lowest yields were calculated for the north western interior. High annual yields exceeded 5-6,000 kg/ha. Under rainfed only conditions, the management efficiency of wheat production was higher in many regions than cases with full irrigation. In order to achieve optimum crop yields, about 400 mm of irrigation water was needed in the northwest, contrasted with nonrequired in the south and east of China. A sensitivity analysis was applied to determine the degree of error introduced by faulty, uncertain, or missing environmental input data for the stations utilized in this study. (Baker-IVI)
W85-01057

ASSESSING SOLAR ENERGY AND WATER USE EFFICIENCIES IN WINTER WHEAT: A CASE STUDY,
Kansas Agricultural Experiment Station, Manhattan. Evapotranspiration Lab.
G. Asrar, L. E. Hipps, and E. T. Kanemasu.
Agricultural and Forest Meteorology, Vol. 31, No. 1, p 47-58, February, 1984. 2 Fig, 5 Tab, 19 Ref. NASA contract NAS 9-16457.

Descriptors: *Water use efficiency, *Wheat, *Solar radiation, Crop yield, Water use, Plant growth, Management, Water conservation, Planting density.

Water-use and photosynthetic efficiencies of two cultivars of winter wheat planted at three different densities were examined during different stages of crop development throughout a growing season. Water-use efficiencies of all planting densities of the two cultivars varied from vegetative growth to booting stage and decreased thereafter due to crop maturity, leaf drop, and increased evaporation from the soil surface. High water use efficiencies in medium and heavy planting densities of both cultivars were attributed to full canopy cover and reduced evaporation from the soil surface. The cv. Centurk was more efficient than Newton in using the available soil moisture for total dry phytomass production by 14%, 18%, and 4%, as well as grain yield production by 20%, 2%, and 13% for light, medium and heavy planting densities, respectively. The radiation extinction coefficients for both cultivars increased with an increase in planting density, thus providing more energy for efficient use of available moisture in these treatments. The average seasonal photosynthetic efficiency was similar for each cultivar, but improved as planting density increased. Thus both water use and photosynthetic efficiencies of winter wheat, as defined, vary throughout the growing season due to management practices, weather parameters and physiological characteristics of the crop. (Baker-IVI)
W85-01058

COMPARATIVE STUDY OF FOUR AUTOMATIC IRRIGATION DEVICES APPLIED TO

TRICKLE IRRIGATION OF MAIZE
JDE COMPARATIVE DE QUATRE DISPO-
FS D'IRRIGATION AUTOMATIQUE: AP-
CATION AU MAIS IRRRIGUE EN LOCA-
C),
Centre d'Etudes Nucleaires de Cadarache,
-Paul-les-Durance (France). Dept. de Biolo-

outonnet, J. Wery, and A. Bossy.
cultural Meteorology, Vol. 24, No. 4, p 275-
August, 1981. 10 Fig, 3 Tab, 12 Ref.

criptors: *Irrigation engineering, *Corn, *Au-
ation, Plant growth, Tensiometer, Trickle irri-
on, Crop yield, Evapotranspiration.

plots, each 1000 sq m, were under cultivation
corn. These plots were used to compare four
matic irrigation methods. In three of the four
ods the irrigation schedule depends on gauges
iometers or electrical resistance probes) insert-
the cropped soil. The fourth method used a
A evaporation pan. The fifth plot was irrigat-
accordance with mean potential evapotran-
ation. Soil water uptake and plant growth were
investigated. The results indicated that tensi-
ter scheduling saved 30% of the irrigation
er without any significant decrease in yield.
vever, with the commercial electrical resist-
probes, the watering was not well suited to
plant needs and lead to a 25% decrease in
d. (Baker-IVI)
5-01061

RIGATION SCHEDULING - A VALID
TION WITH MICROPROCESSOR-BASED
NTROLS,
rgia Univ., Athens. Dept. of Agricultural Eco-
ics.
D. McLendon, S. J. Thomson, and J. L.
sness.
ricultural Engineering, Vol. 64, No. 9, p 12-14,
tember, 1983. 3 Fig.

criptors: *Irrigation scheduling, *Automation,
icroprocessors, Tensiometers, Remote control,
asuring instruments, Monitoring, Sensors, Soil
er suction.

development of microprocessor technology
greatly expanded the options in implementing
omated control systems for irrigation schedul-
. More efficient water use and reduced energy
uirements can be obtained when the appropriate
trol algorithm combined with in field sensors is
d to operate the irrigation system. Three 30-cm
g tensiometers with magnetically coupled
tches were used for field tests designed to
aluate the performance of on-off switching ten-
meters and solid-state sensors. The microproces-
circuitry used to analyze the data from the soil
ter suction sensors performed flawlessly. Pres-
e transducers can be fitted to tensiometers and
erfaced to a microprocessor-based controller to
oduce an accurate, continuous readout of soil
ter suction. The magnetically coupled switch on
tensiometer provides on-off controls within 4
of the setting. Solid state sensors can be used to
n on irrigation systems but are probably not
iable for turning them off. This would not
esent a problem in field application systems
here time clocks are used to apply a fixed amount
water. (Baker-IVI)
85-01076

EEP CULTIVATION AND GYPSUM AS PO-
ENTIAL SOLUTIONS TO SLOW WATER
ENETRATION,
J. Singer, J. R. Munn, Jr, and W. E. Wildman.
lifonia Agriculture, Vol. 38, No. 7-8, p 16-18,
ly-August, 1984. 3 Tab.

escriptors: *Water penetration, *Gypsum, *Culti-
ation, Phosphogypsum, Tillage, Water penetra-
on, Soil properties, Soil surface, Irrigation effects,
filtration.

he case of slow infiltration of irrigation water in a
une orchard north of Marysville in Yuba County
as investigated with the hope of determining
hether deep tillage, or gypsum, or both, would reduce the problem. In one set of experiments, surface soil water content was higher in the deep tillage (trench) plots because of the mixing of moist subsoil during excavation. Neither gypsum nor trenching treatment improved water intake after the first irrigation. Decreased 24 hr infiltration rates indicate that both the surface crust and increased subsoil density were reestablished by the time the second set of measurements was made. The final trial study indicates that benefits are derived from surface application of gypsum in promoting cumulative infiltration and in maintaining high infiltration rates. Phosphogypsum was applied at 5 tons per acre and improved water penetration. Phosphogypsum adds salts to the soil solution as irrigation water enters the soil thereby promoting aggregate stability. It is effective only if it remains on the soil surface before irrigation. Deep tillage is required to break up established compaction pans and significantly improves water penetration, but this treatment is short lived if there is continual heavy machine traffic over the soil. (Baker-IVI)
W85-01093

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

ECOLOGY OF A LAND DRAINAGE CHANNEL - II; BIOLOGY, CHEMISTRY AND SUBMERGED WEED CONTROL,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
E. J. P. Marshall.
Water Research, Vol. 18, No. 7, p 817-825, 1984. 6 Fig, 3 Tab, 24 Ref, 1 Append.

Descriptors: *Wales, *Drainage ditches, *Aquatic weed control, Diquate, Herbicides, Macrophytes, Chemical properties, Ecology, Invertebrates, Algae, Saline water, Chlorophyll a, Hardness, Aquatic plants.

Shallow land drainage channels lying behind a seawall built in 1967 near the village of Goldcliff, Wales contain moderately hard oligohaline eutrophic water. Mean chloride concentration was 355 mg/l; seawater appeared to be a major influence on the composition of the flora and fauna. Plant cover was estimated in 1974 from quadrants and in 1975 from strips. Five study lengths were dominated by the angiosperms Myriophyllum spicatum and Potamogeton pectinatus. Extensive lengths of channel margin were covered by Phragmites australis. Cover of Lemna spp. was determined and the presence of filamentous algal species was noted. Estimates of amounts of micro-algae were made by measuring chlorophyll a concentration. The herbicide diquat was applied to three sites in mid and later summer of 1975 to control submerged plants. The herbicide had dissipated to 20% of its initial concentration of 1.0 mg/l between 4 and 10 days, and was < 0.001 mg/l between 17 and 21 days after spraying. M. spicatum and P. pectinatus were eliminated, though slow rates of decomposition were noted at two sites. L. minor, L. trisulca, Elodea canadensis, Juncus actiflorus, and Azolla filiculoides were also killed. P. amphibium, found at one site was resistant to diquat and M. spicatum regrew at one site. L. minor and the algae Cladophora sp. were only controlled for a short time. There were no coincident effects amongst the macroinvertebrates. (Collier-IVI)
W85-00555

INVENTORY AND ANALYSES OF INFORMATION FOR FLOOD PLAIN MANAGEMENT IN NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
D. G. Emerson, and J. D. Wald.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Open-File Report 84-053, 1983. 201 p, 2 Fig, 2 Tab, 155 Ref.

Descriptors: Flood data, *Flood plain management, *Flood hazard information, *North Dakota.

Governmental units that have been identified as having flood hazard areas but do not have detailed base flood information are required to use the 'best available data' to regulate new development or expansion of existing development in flood prone areas. Information for flood plain management has been identified for 95 governmental units in North Dakota and includes the determination of what data are available regarding flood hazards, hydraulics, and hydrology, and a review of these data to determine their adequacy for use in flood plain management. (USGS)
W85-00617

STORM WATER DETENTION/RETENTION: A NEW SOLUTION,
Advanced Drainage Systems, Inc., Columbus, OH.
J. B. Goddard.
Public Works, Vol. 115, No. 6, p 82-83, June, 1984. 3 Fig, 2 Tab.

Descriptors: *Storm runoff, *Drainage, *North Myrtle Beach, *South Carolina, Design criteria, Runoff management, Water storage, Runoff, Storms, Erosion control, Saline water intrusion.

The management of storm water in rapidly developing areas has become a major concern in many communities. Without adequate storm water facilities, the runoff rate following storms may create substantial erosion and increase the possibility of downstream flooding. City ordinances are currently being or have recently been established in many communities to regulate the disposal of future development projects. Government agencies who regulate the preservation of sensitive coastal areas, the South Carolina Coastal Council, the Army Corps of Engineers, and the city engineer, studied various solutions that had been applied in similar situations in other communities to solve a problem being experienced in North Myrtle Beach, South Carolina. The solution appears to be the installation of a perforated drainage pipe at a number of locations to deal with storm water disposal and storage. Storm water is temporarily stored and then released and cleaned as it percolates into sandy soils. The pipe is installed in trenches and surrounded by a gravel backfill, which in turn is lined with a filler fabric to prevent sand or soil seepage into the stone bed. The system is particularly suited to coarse, sandy soil types. In coastal areas this method can also help negate the effects of salt water intrusion into aquifers. Use of the perforated pipe system in North Myrtle Beach has been successful and allows for conventional building and site planning. (Baker-IVI)
W85-00737

DOWNSTREAM EFFECTS OF RESERVOIR RELEASES TO THE POTOMAC RIVER FROM LUKE, MARYLAND, TO WASHINGTON, D.C.,
Geological Survey, Towson, MD. Water Resources Div.
T. J. Trombley.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 82-4062, August 1982. 35 p, 15 Fig, 12 Tab, 3 Ref.

Descriptors: *Dispersion, *District of Columbia, *Potomac River, Bank storage, Base flow, *Computer models, Diffusion, *Reservoir releases, Routing, Streamflow, Low flow, Reach (streams), Wave velocity, Maryland, Unit response, Flow losses, Channel storage.

A digital computer flow-routing model was developed for the Potomac River in order to determine the downstream effects of flow releases from the Bloomington and Savage River Reservoirs. Both reservoirs are located above Luke, Maryland approximately 230 miles upstream from Washington, D. C. The downstream effects of reservoir releases were determined by using the unit-response method of flow routing implemented by a diffusion analogy. Results are in the form of unit response coefficients which are used to route flows down-

stream from Luke. A 24-hour sustained reservoir release input at Luke will result in 35 percent of the flow arriving at Washington, D.C., during the 4th day after the beginning of the release, followed by 61 percent and 4 percent arriving on the 5th and 6th days, respectively. For a 7-day sustained reservoir release, 47 percent of the flow will arrive during the 1st week, and 53 percent will arrive the 2d week. Two methods were used to estimate the amount of water that goes into channel storage between Luke and Washington, D.C., during sustained reservoir releases. Analysis of the flow-routing results indicates channel storage is equivalent to the volume of water releases over a 3.7-day period. Using channel geometry relationships, that volume is equal to 3.2 days' release. (USGS)
W85-00836

GREAT LAKES RESEARCH: PAST, PRESENT AND FUTURE,
Amsterdam Univ., (Netherlands). Vakgroep Aquatische Oecologie.
W. R. Swain.
Journal of Great Lakes Research, Vol. 10, No. 2, p 99-105, 1984. 4 Ref.

Descriptors: *Water resources development, *Reviews, *Great Lakes, Planning, Ecosystems, Water management, Diversion.

In studying at the Silver Jubilee Meeting of the International Association for Great Lakes Research the past 25 years of research conducted on the Great Lakes, it becomes apparent that research topics are cyclical in nature, occurring frequently as a result of crisis situations. In view of the potential for anticipated crises, a preview is given of research projects to come for this area. The question of diversions and consumptive withdrawals of water from the Great Lakes is expected to be a big topic of study in the near future as a result of increased water shortages in agricultural production areas across the United States. (Baker-IVI)
W85-00916

STEP-FUNCTIONAL CHANGE IN ANNUAL PEAK FLOW ILLUSTRATED FOR THE ISHIKARI RIVER AT HASHIMOTO-CHO, HOKKAIDO,
Risby, Bury St. Edmunds (England).
G. H. Dury, and N. Kohchi.
Japanese Journal of Limnology, Vol. 43, No. 3, p 147-156, 1982. 6 Fig, 3 Tab, 19 Ref.

Descriptors: *Flood control, *Prediction, Measuring, Probability distribution, Ishikari River, Wabash River, Forecasting, Flow, Floods.

The application of a particular method for measuring abrupt changes in magnitude between successive portions of a series was studied. The method tests for abrupt changes in magnitude between successive portions of the series. If a test produced positive results, then it identified a step function in the regime concerned. The method has been successfully applied to climatic and climate-related series of several kinds, not only those of streamflow, but also those of annual and monthly precipitation. The method also amplifies probability analysis as it is usually practiced. For the Ishikari River, step functional testing identified blocks of years, with average block length being 5 years, when annual floods ran generally above, generally below, or generally close to the series mean. Parallel testing for the Wabash River identified runs of either high or low values, with average length of these runs being between 4 and 5 years. Separate Gumbel graphs can be drawn for the high flow and low flow regimes, and also for the regime close to the mean. While long term forecasting is not affected by these results, they do suggest great fluctuations in the flood hazard measurements, in short term considerations. (Baker-IVI)
W85-00928

NILE: DESCRIPTION, HYDROLOGY, CONTROL AND UTILISATION,
Arab Authority for Agricultural Investment and Development, Khartoum (Sudan). Implementation Div.
For primary bibliographic entry see Field 2H.
W85-01024

MINERAL NUTRIENT DEMANDS OF THE WATER HYACINTH (EICHHORNIA CRASSIPES (MART.) SOLMS), IN THE WHITE NILE,
Khartoum Univ. (Sudan). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W85-01032

RANCHER TAKES BULL BY HORNS; BUILDS POWER PLANT AND CONVERTS TO PIVOTS,
D. Gardner.
Irrigation Age, Vol. 18, No. 2, p 6-7, October, 1983. 1 Fig.

Descriptors: *Water resources development, *Hydroelectric plants, *Center pivot irrigation, Ranching, Cattle, Pivots, Irrigation, Idaho, Pole Creek.

Flood irrigation has been replaced by five center pivots watering 922 acres of orchard grass, brome and clover. Energy to operate the pivots comes from a 50 kw hydroelectric plant. Total cost of the project was $400,000. Expanding the cattle operation on the land should pay for the system in several years. All the pivots are pressure-regulated at 15 psi. Four pivots operated in 1982. The other went on line this year. The largest covers 317 acres. Two pivots irrigate 212 acres each, one waters 110 acres, and the final pivot, 71 acres. The system is designed to use 5.5 gpm per irrigated acre and 2,700 gpm for power generation. The project uses considerably less water than previously, assuring a continuous flow of water into Pole Creek. (Baker-IVI)
W85-01035

SECOND WATER SUPPLY THROUGH CONSERVATION: THE KENDRICK PROJECT.
For primary bibliographic entry see Field 3F.
W85-01037

137-CS AND 210-PB TRANSPORT AND GEOCHRONOLOGIES IN URBANIZED RESERVOIRS WITH RAPIDLY INCREASING SEDIMENTATION RATES,
Case Western Reserve Univ., Cleveland, OH. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2J.
W85-01099

4B. Groundwater Management

GROUND-WATER SUPPLY POTENTIAL AND PROCEDURES FOR WELL-SITE SELECTION, UPPER CAPE FEAR RIVER BASIN,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-00584

SUMMARY OF GROUND-WATER PUMPAGE IN THE CENTRAL VALLEY, CALIFORNIA, 1961-77,
Geological Survey, Sacramento, CA. Water Resources Div.
J. Diamond, and A. K. Williamson.
Available from OFSS, USGS, Box 25426, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4037, 1983. 70 p, 11 Fig, 2 Tab, 19 Ref, 4 Append.

Descriptors: *Pumpage, *Groundwater, Hydrologic data collections, Groundwater irrigation, Statistical models, *California, *San Joaquin Valley, *Sacramento Valley, Central Valley Plant-efficiency tests.

In the Central Valley of California, a great agricultural economy has been developed in a semiarid environment. This economy is supported by imported surface water and 9 to 15 million acre-feet per year of ground water. Estimates of groundwater pumpage computed from power consumption have been compiled and summarized. Under ideal conditions, the accuracy of the methods used is about 3 percent. This level of accuracy is not sustained over the entire study area. When pumpage for the entire area is mapped, the estimates seem to be consistent areally and through time. A multiple linear-regression model was used to synthesize data for the years 1961 through 1977, when power data were not available. The model used a relation between ground-water pumpage and climatic indexes to develop a full suite of pumpage data to be used as input to a digital ground-water model, one of the products of the Central Valley Aquifer Project. Statistical analysis of well-perforation data from drillers' logs and water-temperature data was used to determine the percentage of pumpage that was withdrawn from each of two horizontal layers. (USGS)
W85-00591

SUBSURFACE STORAGE OF FRESHWATER IN SOUTH FLORIDA: A DIGITAL MODEL ANALYSIS OF RECOVERABILITY,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. L. Merritt.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 83-536, 1983. 73 p, 20 Fig, 1 Tab, 26 Ref.

Descriptors: *Injection wells, Underground storage, *Computer models, *Mathematical models, *Model studies, *Florida, Cyclic injection, *Solute transport, Freshwater injection.

As part of a feasibility study of cyclic freshwater injection, digital models were implemented to analyze the relation of recovery efficiency to various hydrogeologic conditions which could prevail in brackish aquifers and to various management regimes. The analyses implemented an approach in which the control for sensitivity testing was a hypothetical aquifer representative of potential injection zones in south Florida, and parameter variations in sensitivity tests represented possible variations in aquifer conditions in the area. The permeability of the aquifer determined whether buoyancy stratification could reduce recovery efficiency. The range of permeability leading to buoyancy stratification became lower as resident fluid salinity increased. Thus, recovery efficiency was optimized by both low permeability and low resident fluid density. High levels of simulated hydrodynamic dispersion led to the lowest estimates of recovery efficiency. Advection by regional flow within the artesian injection zone could significantly affect recovery efficiency, depending upon the storage period, the volume injected, and site-specific hydraulic characteristics. Recovery efficiency was unrelated to the rate of injection or withdrawal or to the degree of penetration of permeable layers, and improved with successive cycles of injection and recovery. (USGS)
W85-00601

GROUND-WATER DATA FOR MICHIGAN-1982,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-00615

PUBLIC-SUPPLY PUMPAGE IN WISCONSIN, BY AQUIFER,
Geological Survey, Madison, WI. Water Resources Div.
C. L. Lawrence, B. R. Ellefson, and R. D. Cotter.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Open-File Report 83-931, February, 1984. 40 p, 5 Fig, 5 Tab, 1 Ref.

Descriptors: *Aquifers, *Water use, Groundwater, *Pumpage, Wells, Bedrock, *Wisconsin, Sand-and-gravel aquifer, Silurian dolomite aquifer, *Sandstone aquifer, Precambrian aquifer, Lithology.

The amounts and distribution of the pumpage of ground water for public supplies among four aquifers in Wisconsin are summarized. The data

or 1979. The proportions would be similar for equent years. Of the water pumped for public lies, 95 percent comes from two major fers, the sand and gravel, and the standstone. er amounts of water come from the Silurian mite, which exists only in a narrow band in rn Wisconsin, and from the Precambrian, h is the generally low-yielding basement rock nding beneath the entire state. Protection of e aquifers from contamination is essential to future well being of the State and its residents. GS)
-00618

V METHOD FOR THE INVESTIGATION BACTERIAL OCCURRENCE IN GROUND-TER-BEARING SANDY SEDIMENTS (EIN UES VERFAHREN ZUR UNTERSUCHUNG R BAKTERIELLEN BESIEDLUNG GRUND-SSERFUEHRENDER SANDIGER SEDI-NTE),
-Planck-Inst. fuer Limnologie, Schlitz (Germa-F.R.). Limnologische Flussstation.
primary bibliographic entry see Field 5A.
-00768

OUNDWATER: A SURVEY OF CONTAMI-TION POTENTIAL IN THE FOX VALLEY GION,
consin Univ.-Oshkosh.
primary bibliographic entry see Field 5B.
-00830

ALUATION OF THE SAN DIEGUITO, SAN JO, AND SAN PASQUAL HYDROLOGIC BAREAS FOR RECLAIMED WATER USE, N DIEGO COUNTY, CALIFORNIA,
ological Survey, Sacramento, CA. Water Re-rces Div.
primary bibliographic entry see Field 5D.
-00839

JECTION OF TREATED WASTEWATER R GROUND-WATER RECHARGE IN THE LO ALTO BAYLANDS, CALIFORNIA, HY-AULIC AND CHEMICAL INTERACTIONS--ELIMINARY REPORT,
ological Survey, Sacramento, CA. Water Re-rces Div.
primary bibliographic entry see Field 5G.
-00840

FECTS OF RECHARGE FROM DRAINAGE ELLS ON QUALITY OF WATER IN THE ORIDAN AQUIFER IN THE ORLANDO EA, CENTRAL FLORIDA,
ological Survey, Tallahassee, FL. Water Re-rces Div.
primary bibliographic entry see Field 5G.
-00843

TIMATES OF VERTICAL HYDRAULIC NDUCTIVITY AND REGIONAL GROUND-ATER FLOW RATES IN ROCKS OF JURAS-C AND CRETACEOUS AGE, SAN JUAN SIN, NEW MEXICO AND COLORADO,
ological Survey, Albuquerque, NM. Water Re-rces Div.
primary bibliographic entry see Field 2F.
-00844

FECTS OF PUMPAGE, IRRIGATION TURN, AND REGIONAL GROUND-WATER OW ON THE WATER QUALITY AT AIAWA WATER TUNNEL, OAHU, HAWAII,
ological Survey, Honolulu, HI. Water Re-rces Div.
primary bibliographic entry see Field 5G.
-00850

MULATED CHANGES IN GROUND-WATER EVELS RELATED TO PROPOSED DEVEL-PMENT OF FEDERAL COAL LEASES, SAN UAN BASIN, NEW MEXICO,
ological Survey, Albuquerque, NM. Water Re-rces Div.

For primary bibliographic entry see Field 4C.
W85-00858

GROUND WATER IN THE GREATER ATLANTA REGION, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-00866

4C. Effects On Water Of Man's Non-Water Activities

EFFECTS OF URBANIZATION ON THE MAGNITUDE AND FREQUENCY OF FLOODS ON SMALL STREAMS IN TENNESSEE - BASIC DATA REPORT NO. 3,
Geological Survey, Nashville, TN. Water Resources Div.
C. H. Robbins.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Open-File Report 84-242, 1984. 32 p, 1 Fig, 21 Tab, 1 Ref.

Descriptors: *Urbanization, Basic data, *Rainfall, *Discharge, *Floods, *Tennessee, *Data collection.

Rainfall and discharge data collected at 21 urban hydrology sites in Tennessee from July 1977 to September 1983 are summarized. These rainfall-runoff data will be used to calibrate a U.S. Geological Survey Rainfall-Runoff Model. The results of the model calibrations will then be used to develop reliable methods for determining the magnitude and frequency of floods on small streams in Tennessee where urbanization is a factor. (USGS)
W85-00619

RELATION BETWEEN TROPICAL RIVERS AND THE TERRESTRIAL ENVIRONMENT AND THE EFFECT ON BOTH OF HUMAN INTERFERENCE (TROPISCHE FLUSSE IN IHREN BEZIEHUNGEN ZUR TERRESTRISCHEN UMGEBUNG UND IM HINBLICK AUF MENSCHLICHE EINGRIFFE),
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
For primary bibliographic entry see Field 6G.
W85-00775

WETLANDS OF THE NEW JERSEY PINELANDS: VALUES, FUNCTIONS, IMPACTS AND A PROPOSED BUFFER DELINEATION MODEL,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
For primary bibliographic entry see Field 6G.
W85-00813

AQUATIC ECOLOGY OF THE NEW JERSEY PINELANDS,
Lloyd (T.) Associates, Philadelphia, PA.
For primary bibliographic entry see Field 6G.
W85-00814

ASSESSMENT OF CUMULATIVE IMPACTS OF COAL MINING ON THE HYDROLOGY IN PART OF THE POWDER RIVER STRUCTURAL BASIN, WYOMING--A PROGRESS REPORT,
Geological Survey, Cheyenne, WY. Water Resources Div.
P. R. Jordan, R. M. Bloyd, and P. B. Daddow.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4235, 1984. 25 p, 10 Fig, 2 Tab, 7 Ref.

Descriptors: *Coal mines, Hydrology, Surface water, *Simulation, Hydrographs, Caballo Creek, Drainage basins, Streamflow, Model studies, *Wyoming, *Powder River Basin, Duration curves, Mining, Water pollution sources.

The U.S. Geological Survey and the Wyoming Department of Environmental Quality are involved in a cooperative effort to assess the probable cumulative impacts of coal mining on the hydrology of a part of the Powder River Structural Basin in Wyoming. It was assumed that the principal impacts on the ground-water system due to mining will occur in the relatively shallow aquifers which can be grouped into three homogeneous aquifers, namely, the Wyodak coal, the overburden, and the under burden. Emphasis of this report is on the results of analysis of surface-water resources in the Caballo Creek drainage. A surface-water model of the Caballo Creek drainage was developed using the Hydrological Simulation Program-Fortran model to help assess the impacts of mining activities on streamflow. The Caballo Creek drainage was divided into 10 land segments and 6 stream reaches in the modeling process. Three simulation runs show little, if any, change in streamflow between pre- and post-mining conditions and very little change between pre-mining and during-mining conditions. The principal reason for the absence of change is the high infiltration rate used in the model for all three conditions. (USGS)
W85-00847

GROUND-WATER HYDROLOGY BEFORE, DURING, AND AFTER COAL STRIP MINING OF A SMALL WATERSHED IN COSHOCTON COUNTY, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-00857

SIMULATED CHANGES IN GROUND-WATER LEVELS RELATED TO PROPOSED DEVELOPMENT OF FEDERAL COAL LEASES, SAN JUAN BASIN, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
P. F. Frenzel.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, Colo. 80225. USGS Open-File Report 83-949, 1983. 63 p, 20 Fig, 2 Pl, 4 Tab, 8 Ref.

Descriptors: *Groundwater, *Hydraulic Models, *Drawdown, *Coal, San Juan Basin, *New Mexico.

The effects of coal-related ground-water withdrawals on potentiometric surfaces of aquifers in the San Juan Basin, New Mexico, were estimated. A previously published steady-state finite-difference digital model was converted to a transient-state model by changing boundary conditions and adding storage coefficients. No calibration of the transient-state model was attempted. Predicted drawdowns with a minimum amount of coal development combined with other kinds of development were as great as 2,000 feet. As much as 300 feet of additional drawdown were simulated for the maximum amount of coal development. Drawdowns near pumping wells are not predicted. (USGS)
W85-00858

4D. Watershed Protection

EFFECT OF POND STORAGE ON THE HYDROLOGIC AND NUTRIENT OUTPUT OF A FORESTED WATERSHED IN NORTHERN VERMONT,
Johnson State Coll., VT.
For primary bibliographic entry see Field 5A.
W85-00612

USE OF RAINFALL-SIMULATOR DATA IN PRECIPITATION-RUNOFF MODELING STUDIES,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-00837

EFFECT OF THE PROPOSED COOPER RIVER REDIVERSION ON SEDIMENTATION IN CHARLESTON HARBOR, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
G. G. Patterson.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4198, 1983. 65 p, 8 Fig, 10 Tab, 33 Ref, 2 Append.

Descriptors: *Estuaries, *Sedimentation, *Sediment control, *Silting, *Dredging, *Diversion, *South Carolina, Harbors, Navigation, Bank erosion, Sedimentation rates, Suspended solids, Sediment yield, Channel improvement, Fluvial sediments, Shoals, Marshes, Diatoms, *Charleston Harbor, *Rediversion, Santee-Cooper diversion project.

The rates of sedimentation and of resultant maintenance dredging in Charleston Harbor increased dramatically in the 1940s, following two major modifications to the harbor. One modification, the Santee-Cooper diversion project, caused a twenty-fold increase in freshwater inflow to the harbor. The other modification was deepening of the navigation channels in the harbor from 30 to 35 feet below mean low water. After field and model studies indicated that the diversion was the major cause of the increase in the sedimentation rate, plans were made to redivert most of the Santee River water back to its former channel. This report documents a review of existing data and literature that was made to evaluate rediversion as a means of reducing the rate of maintenance dredging. The postrediversion decrease in the rate of maintenance dredging can be estimated only within broad limits because some important questions lack reliable answers. Analysis of available information indicates that rediversion will eventually reduce the rate of maintenance dredging by about 40 to 75 percent. The reduction in the rate of maintenance dredging may be delayed for a decade or more by the gradual removal of accumulated sediment and may be partially offset by the effects of future channel deepening. (USGS)
W85-00846

SLUMPINGS OF THE VALLEYS ENCOMPASSING IDUKKI RESERVOIR, CENTRAL KERALA, INDIA,
Centre for Earth Science Studies, Trivandrum (India).
K. Saseendran, P. K. Rajan, D. Salim, and K. K. Ramachandran.
Current Science, Vol. 53, No. 2, p 80-83, January, 1984. 5 Fig, 8 Ref.

Descriptors: *Slumping, *Watershed management, *Idukki Reservoir, *India, Soil erosion, Siltation, Forest watersheds, Reservoir capacity, Landslides, Valleys.

The effect of valley slumping was studied in one of the biggest reservoirs in western Ghats, the reservoir of the Idukki Hydroelectric Project. Slumping of valleys encompassing a reservoir could result in: degradation of slopes involving erosion of soil; siltation of reservoir due to accumulation of sediments derived from slides resulting in loss of storage capacity; and progressive degradation and ultimate destruction of forest cover along the slope. The nature of valley slumping was assessed by studying 200 valley slumpings encompassing the Idukki reservoir, using aerial photographs, field checks and actual field measurements. Siltation from the valley slumps is not so alarming as to affect the storage capacity of the reservoir. It has affected the degradation of slopes causing erosion of precious soil, which, if not checked, would result in ultimate destruction of the rich forest of the catchment area. Slides may be prevented by reducing the activating forces, by increasing the forces resisting the movement or by avoiding or eliminating the slide itself. Afforestation and proper management of existing forests help to stabilize the valley. (Moore-IVI)
W85-00961

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

INVESTIGATION OF TRACE METALS BY STRIPPING VOLTAMMETRY IN THE EFFLUENT OF BATHINDA THERMAL POWER STATION,
Seth G.N. Khalsa Coll., Sri Ganganagar (India). Post-Graduate Dept. of Chemistry.
B. Singh, and S. Pathak.
International Journal of Environmental Studies, Vol. 22, No. 3-4, p 289-294, 1984. 6 Fig, 10 Ref.

Descriptors: *Trace metals, *Anodic stripping voltammetry, *India, *Sirhand Canal, *Bathinda thermal power station, Polarographic analysis, Zinc, Cadmium, Lead, Copper, Pollutant identification.

An evaluation of differential pulse anodic stripping voltammetry (DPASV) was carried out on the effluent of the Bathinda thermal power station on the Sirhand Canal in northern India. Using a Sargent Welch model 4001 polarograph, Zn, Cd, Pb and Cu were characterized by their respective peak potential values. For this purpose pH and ionic strength were simulated. The trace concentration of the metals in the water sample is determined by the standard addition method. The concentrations of Zn, Cd, Pb and Cu were 461.8 ppb, 0.2 ppb, 2.6 ppb and 2.3 ppb, respectively. There are no standards for trace metals in the aquatic environment in India; the metals were within the permissible limits as given in the World Health Organization standards of water criteria. (Collier-IVI)
W85-00511

DETERMINATION OF ULTRA TRACE CONCENTRATIONS OF NITRITE IN POLLUTED WATERS AND SOIL,
Ravishankar Univ., Raipur (India). Dept. of Chemistry.
A. Chaube, A. K. Baveja, and V. K. Gupta.
Talanta, Vol. 31, No. 5, p 391-393, May, 1984. 5 Tab, 14 Ref.

Descriptors: *Nitrites, *Pollutant identification, *Soil contamination, Extraction, Spectrophotometry, Diazotization.

An extraction method for determining nitrite in water was 30% more sensitive than the standard spectrophotometric method. The nitrate is used to diazotize o-nitroaniline. The o-nitrophenyldiazonium chloride formed is coupled with N-(1-naphthyl)ethylenediamine dihydrochloride in acid medium to give a red-violet dye (absorption maxima at 545 nm) which is stable and extractable into isoamyl alcohol. The color system obeyed Beer's law in the range 2.5-15 micro g of nitrite per 25 ml of initial aqueous sample for the direct procedure, and 2.5-15 micro g/100 ml of sample when the extraction system was used. Water samples from the river Kharoon and soil samples were analyzed by the standard method and by the proposed method: correlation of the two methods was 0.986 and 0.99 for the river and for the soil samples respectively. The extraction method is advantageous because it lowers the detection limit by the concentration effect. (Collier-IVI)
W85-00547

CHLORINATED PHENOLICS OF BLEACHED KRAFT MILL ORIGIN; AN OLFACTORY EVALUATION,
Pulp and Paper Research Inst. of Canada, Pointe Claire (Quebec).
T. G. Kovacs, R. H. Voss, and A. Wong.
Water Research, Vol. 18, No. 7, p 911-916, 1984. 2 Fig, 4 Tab, 23 Ref.

Descriptors: *Chlorinated phenolics, *Kraft mills, *Pulp wastes, *Odors, Organoleptic properties, Odor thresholds, Triangle test, Effluents, Chlorinated hydrocarbons.

Biologically treated effluent samples from 9 Canadian bleached softwood kraft mills were analyzed for chlorinated phenolics content. Considerable variation exists in the discharge of individual and total phenolics between mills. Odor thresholds were determined for selected chlorinated phenolics and for a synthetic mixture of these compounds at concentrations typical of a biologically-treated bleached kraft mill effluent (BKME). The triangle test was used for sensory threshold evaluations; panelists were presented with three samples and told that two of them were identical and one was different. The odor contribution of the individual chlorinated phenolics in the BKME samples was quantified by determining the odor unit (OU) contribution of each compound. The total OU for the synthetic mixture was 4.95. On the basis of additivity of odor units for chlorinated phenolics, the odor threshold for the synthetic solution was 20%. The actual odor threshold for the synthetic mixture was 17%. If the chlorinated phenolics were the only contributors to BKME odor, then the expected odor threshold of a typical BKME would be 23% (based on total OU = 4.30). The odor thresholds determined for the nine BKME ranged from 0.002 to 0.15%. The chlorinated phenolics studied are not the major odorous compounds present in BKME, and thus are not expected to contribute an off-odor to recipient waters. (Collier-IVI)
W85-00559

ORGANOCHLORINE CONTAMINATION OF THE DUTCH DELTA REGION AS 'WATCHED' BY MUSSELS,
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
E. K. Duursma, J. Nieuwenhuize, and J. M. van Liere.
Water Science and Technology, Vol. 16, No. 3/4, p 619-622, 1984. 1 Fig, 5 Ref.

Descriptors: *Organochlorines, *Bioindicators, *Mussels, *Netherlands, *Sediment contamination, Deltas, Estuarine environments, Pollution indicators, Pesticides, DDD, Polychlorinated biphenyls, Dieldrin.

The distribution of organochlorines in the Delta region was determined by mussels for 1980 and 1981. For 5-CB, 6-CB, PCB and p,p'-DDD a significant correlation was noted between their concentrations in mussels on a fat basis and the conservative property of the water, the chlorinity. This correlation was equally significant for dieldrin and p,p'-DDE for 1980 and 1981 values combined, but not if calculated for a single half-year period. Mussels thus appear to be relatively good recorders for these organochlorine contaminants. The non-significant correlation for alpha and gamma HCH in mussels with chlorinity was explained by possible contamination from agricultural sources through polder-water discharges. Other organochlorines originated primarily from the Rhine, Meuse and Scheldt rivers. Organochlorine concentrations in mussels and in deposited or particulate sedimentary material showed rather constant relations with concentrations in solution. The distribution of PCB's at least between the two phases of mussels and water is for the whole Delta region in a form of equilibrium. This is also the case between the phases of sediment and water of the Nieuwe Maas-Nieuwe Merwede estuary, but not of the Eastern and Western Scheldt area. (Baker-IVI)
W85-00571

EFFECT OF POND STORAGE ON THE HYDROLOGIC AND NUTRIENT OUTPUT OF A FORESTED WATERSHED IN NORTHERN VERMONT,
Johnson State Coll., VT.
C. H. Racine, P. J. Marchand, and L. L. Butler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 195833, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, Univ. of Vermont, Burlington, February 1983. 35 p, 8 Fig, 6 Tab, 7 Ref, 1 Append. Project No. OWRT A-042-VT (1).

iptors: *Ponds, *Nutrients, *Forest water- Acidity, Surface runoff, Nutrient removal, logic data, Forest hydrology, *Vermont, storage, Water analysis, Chemical analysis.

dy of the chemical nutrient and hydrologic ior of a forested pond watershed and adja- stream watershed was performed between 980 and September 1982. The purpose was to nine how pond surface water storage influ- watershed outputs relative to forest-stream stems in which residence time differs signifi- . Hydrologic output from the two water- was monitored daily by V-notch weirs. n water samples were collected weekly along evational gradient. Precipitation was meas- and rain water was sampled. Water samples analyzed for pH, calcium, magnesium, potas- sodium and alkalinity; nitrate and sulfate measured occassionally. The pond watershed ted a relatively stable and constant discharge ter without the high peak flows and very low experienced in the stream watershed. Dis- l nutrient concentrations in the stream water h watersheds varied between .4 and .5 mg/l esium, and .15 to .31 mg/l potassium. pH varied between 6.2 and 6.6. Alkalinity were between 50 and 100 micro-equivalent lutrient concentrations and pH from Devil's stream watershed were generally higher that from Big Muddy Pond Watershed. n water nutrient concentrations decreased ncreasing elevation (1100 to 1500 ft.) in this shed. Over twice as much calcium was lost the stream watershed (1.07 Kgm/ha) than the pond watershed (.44 Kgm/ha) during a y summer period.
00612

ER-QUALITY RECORDS FOR SELECTED ERVOIRS IN TEXAS, 1976-77 WATER RS,
gical Survey, Austin, TX. Water Resources

. Flugrath, and E. S. Chitwood.
Department of Water Resources, Austin, rt 271, September 1982. 189 p, 20 Fig, 96 Tab, f.

riptors: *Water quality data, *Reservoirs, ical analyses, Temperature, Dissolved en, Specific conductance, Hydrogen ion con- ation, *Data collection, *Texas.

U.S. Geological Survey, in cooperation with Federal, and local agencies, has made com- ensive water-quality surveys of selected reser- in Texas periodically since October 1961. ng the 1970 water year, the program was nded to include periodic sampling of many reservoirs in the State where water-quality ys were not being made. Water-quality data cted before October 1975 have been published eleased previously. This report contains the ts of water-quality surveys of 19 reservoirs hemical analyses of samples collected periodi- from 53 reservoirs. (USGS)
00621

ER QUALITY OF BELTON LAKE, CEN- L TEXAS,
ogical Survey, Austin, TX. Water Resources

. Mendieta, and D. L. Pate.
s Department of Water Resources, Austin, ort 281, October 1983. 60 p, 17 Fig, 19 Tab, 11

riptors: *Water quality, Surface water, *Res- ir, Thermal stratification, Dissolved oxygen, olved solids, Iron, Manganese, Nitrogen, sphorus, Chloride, Sulfate, Hardness, Pesti- , Sediment, Water transparency, *Texas, on Lake.

concentrations of dissolved solids, chloride, sulfate in Belton Lake in central Texas usually age about 240 milligrams per liter, 40 milli- ns per liter, and 30 milligrams per liter, respec- y. The water is usually hard or very hard. centrations are usually minimum during later summer and early fall after periods of sustained high inflow from the Leon River. Thermal stratification in the lake begins to develop in late February or early March and usually persists until September or October. The water usually is stratified into three fairly distinct layers by early June. Thermal stratification and seasonal variations of inflow result in stratification of principal dissolved constituents; dissolved oxygen, iron and manganese; and total phosphorus and inorganic nitrogen. (USGS)
W85-00622

METAL AND TRANSURANIC RECORDS IN MUSSEL SHELLS, BYSSAL THREADS AND TISSUES,
Scripps Institution of Oceanography, La Jolla, CA.
M. Koide, D. S. Lee, and E. D. Goldberg.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 6, p 679-695, December, 1982. 1 Fig, 12 Tab, 13 Ref.

Descriptors: *Mussels, *Shells, *Byssal threads, *Monitoring, *Heavy metals, *Transuranic elements, Copper, Cadmium, Zinc, Lead, Silver, Nickel, Plutonium, Radioactive wastes.

Bivalve shells offer several advantages over tissues for the monitoring of heavy metal pollutants in the marine environment. They are easier to handle and to store. The problem of whether to depurate the animals before analysis is avoided. The shells appear to be more sensitive to environmental heavy metals levels over the long term than do the soft parts. Of the substances examined (Cd, Cu, Zn, Pb, Ag, Ni, Pu-238 and Pu-239 + 240) only Pb and Pu displayed a strong covariance between soft tissue and shell concentrations. There were strong correlations between metals in the shell but not in the soft tissues in general. The byssal threads, because of their enrichment of transuranic elements and of their ease in handling, may be useful in monitoring these metals. A very weak discharge of Pu-238 to marine waters adjacent to a nuclear reactor was detected in the byssal threads of mussels. (Author's abstract)
W85-00666

SIMPLIFIED LIQUID-LIQUID EXTRACTION METHOD FOR ANALYSIS OF TRIHALOMETHANES IN DRINKING WATER,
Florida International Univ., Miami. Drinking Water Quality Research Center.
M. F. Mehran, R. A. Slifker, and W. J. Cooper.
Journal of Chromatographic Science, Vol. 22, No. 6, p 241-243, June, 1984. 4 Tab, 17 Ref.

Descriptors: *Trihalomethanes, *Pollutant identification, *Extraction, *Gas chromatography, *Drinking water, Chloroform, Bromodichloromethane, Chlorodibromomethane, Bromoform.

Chlorine, widely used as a disinfectant for drinking water, is known to interact with precursors to yield trihalomethanes. Trihalomethanes of major public health interest include chloroform, bromodichloromethane, chlorodibromomethane, and bromoform. A rapid, simple method for determination of trihalomethanes in water involves liquid-liquid extraction by vigorous agitation of a pentane:water mixture, followed by gas chromatographic analysis of the pentane extract. The method employs methanolic trihalomethane standards and is directly applicable to aqueous samples. All four trihalomethanes can be quantified at concentrations required by proposed regulations when adequate precautions are taken to ensure pure solvents and high quality distilled purged water. The detection limit in this method is about 0.1 micro g/l with a coefficient of variation + or - 2% through the concentration range of 14 to 160 micro g/l. (Moore-IVI)
W85-00697

SAMPLING FOR ORGANIC CONTAMINANTS IN GROUNDWATER,
Illinois State Water Survey Div., Champaign.
J. P. Gibb, and M. J. Barcelona.
Journal of the American Water Works Association, Vol. 76, No. 5, p 48-51, May, 1984. 1 Fig, 18 Ref.

Descriptors: *Water analysis, *Sampling, *Organic compounds, *Groundwater, Water quality control, Monitoring, Monitoring wells, Sample preservation, Water sampling.

Samples taken for analyzing of groundwater quality can be altered by certain materials used in the construction of monitoring wells and even by the containers used to collect the samples. Similar problems can occur with samples taken from distribution systems. For organic sampling, the first step is the clear understanding of the goals of the sampling or monitoring project. The materials used for well construction, the pumps and the sampling devices should be compatible with the goals of the program and consistent with the desired limits of accuracy and precision for detecting the chemical constituents of interest. A clear understanding of the hydrogeology and suspected chemical contaminants is also needed to be successful. The possible alteration of the chemistry of water samples caused by an inappropriate sampling mechanism or by contact with the well casing or sample delivery tubing should be considered. Pumping rates and times must be sufficient to purge the well of stagnant water without inducing excessive migration of water toward the well. Careful consideration must be given to the pumping mechanisms in the well, the type of treatment the water undergoes before it enters the distribution system, and the kinds of piping contained in the distribution system. All these factors may change the chemical quality of water prior to use by the consumer. (Baker-IVI)
W85-00701

NEW METHOD FOR THE INVESTIGATION OF BACTERIAL OCCURRENCE IN GROUNDWATER-BEARING SANDY SEDIMENTS (EIN NEUES VERFAHREN ZUR UNTERSUCHUNG DER BAKTERIELLEN BESIEDLUNG GRUNDWASSERFUEHRENDER SANDIGER SEDIMENTE),
Max-Planck-Inst. fuer Limnologie, Schlitz (Germany, F.R.). Limnologische Flussstation.
J. Marxsen.
Archiv fur Hydrobiologie, Vol. 95, No. 1/4, p 221-233, October, 1982. 2 Fig, 4 Tab, 26 Ref.

Descriptors: *Groundwater, *Bacteria, Water quality control, Percolation, Sand, Sediments, Biomass, Aufwuchs, Interstitial bacteria.

The quantitative measurement of bacterial biomass is a problem in ecological studies of the groundwater of sandy sediments. Containers of stainless steel nets containing sterilized sand were placed in a pumping tube at 4.0 m depth in groundwater bearing sediments, in an effort to study the quantity of bacteria in the sandy fraction of these sediment layers. The sterilized sand ranged from 0.40 to 0.80 mm in grain size. Rather stable populations had developed by three months after the start of the experiment. At this time the bacterial biomass amounted to 0.21 to 0.32% of the total organic matter. The interstitial bacteria amount to less than 1% of the total number of bacteria in the investigated substrate. An entire group of rods and large bacteria, such as are found in pumped groundwater, were present in the 'aufwuchs' of sand particles. (Baker-IVI)
W85-00768

CADMIUM AND OTHER HEAVY METAL CONCENTRATIONS IN SELECTED BIOTA FROM COCKBURN SOUND, WESTERN AUSTRALIA,
Environchem, Orelia (Australia).
V. Talbot, and A. Chegwidden.
Australian Journal of Marine and Freshwater Research, Vol. 33, No. 5, p 779-788, 1982. 1 Fig, 7 Tab, 9 Ref.

Descriptors: *Trace metals, *Cadmium, *Mussels, *Oysters, *Cockburn Sound, *Australia, Industrial wastes, Chromium, Copper, Iron, Manganese, Lead, Zinc, Heavy metals, Bioindicators, Water analysis.

Concentrations of some heavy metals in Mytilus edulis, Ostrea angasi, Portunus pelagicus, Chaetopterus variopedatus, Posidonia sp., and their epiphytes and Ulva lactuca from Cockburn Sound, Western Australia, are reported. The highest concentrations of Cd, Cr and Pb in M. edulis and Cd and Zn in O. angasi were found in those animals taken from the area near the industrial effluent discharge points. Elevated concentrations of some metals were found in the hepatopancreas of Portunus pelagicus and in C. variopedatus and U. lactuca. Data collected revealed the heavy metals to have resulted from industrial effluent discharges. Of the biota examined, only C. variopedatus and U. lactuca showed potential as trace metal indicators. (Baker-IVI)
W85-00781

SPECIATION OF IRON, COPPER AND ZINC IN THE HAWKESBURY RIVER,
Sydney Univ. (Australia). Dept. of Inorganic Chemistry.
A. J. Pik, J. M. Eckert, and K. L. Williams.
Australian Journal of Marine and Freshwater Research, Vol. 33, No. 6, p 971-977, 1982. 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Hawkesbury River, *New South Wales, *Australia, *Iron, *Copper, *Zinc, *Speciation, *Metals, Membrane filters, Ion exchange, Dissolved metals, Particulate metals, Coprecipitation, X-ray fluorescence spectrometry, Salinity.

A method for the determination of dissolved and particulate metals at microgram per liter levels in water was tested in surface waters of the Hawkesbury River estuary in New South Wales, Australia, in 1978 and 1979. Using a combination of membrane filtration, ion exchange, coprecipitation and thin-film X-ray fluorescence spectrometry, data was obtained on the chemical speciation of iron, copper and zinc in water ranging in salinity from 0 to 30%. The samples were filtered under suction through Nucleopore polycarbonate membrane filters of 0.4 micro m pore size. Iron, the principal trace metal, was found mainly (> 90%) in the particulate form. The dissolved (filterable) iron fraction was largely non-ion-exchangeable (colloidal) in the freshwater region and ion-exchangeable in saline waters (as hydrated ions or metal complexes that dissociate on the chelating resin column). Copper and zinc, by contrast, were almost entirely filterable over the whole salinity range, copper being 50-100% in the non-ion-exchangeable fraction, and zinc, 70-100% ion-exchangeable. Concentrations of cobalt, nickel, cadmium, and lead were below the detection limits of the methods for these metals (0.2, 0.2, 0.1, and, 1.6 micro g/l, respectively). (Collier-IVI)
W85-00786

INFLUENCE OF POLLUTION ON THE HARPACTICOID COPEPODS OF TWO NORTH SEA ESTUARIES,
Ghent Rijksuniversiteit (Belgium). Lab. voor Morfologie and Systematiek.
For primary bibliographic entry see Field 5C.
W85-00795

OPTICAL PROPERTIES AND REFLECTANCE SPECTRA OF 3 SHALLOW LAKES OBTAINED FROM A SPECTROPHOTOMETRIC STUDY,
Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Science Centre.
R. J. Davies-Colley.
New Zealand Journal of Medicine and Freshwater Research, Vol. 17, No. 4, p 445-459, 1983. 8 Fig, 2 Tab, 32 Ref.

Descriptors: *New Zealand, *Lake Ngaroto, *Lake Rotoroa, *Lake Hakanoa, *Spectral analysis, *Optical properties, Scattering, Absorption, Color, Spectrophotometry.

Most of the apparent absorbance of a natural water sample in the visible spectrum as detected by a spectrophotometer results from scattering of light by suspended particles out of the path of the collimated beam. An integrating sphere (a diffuse reflectance accessory (DRA)) may be employed to collect light scattered through a wide angular range from the collimated beam in the spectrophotometer. This method was applied to water samples obtained in 1982 from Lakes Ngaroto, Rotoroa, and Hakanoa in the Waikato Basin (New Zealand). Measurement of absorbances both in the normal spectrophotometric configuration and with the DRA allowed determination of the wavelength (lambda) dependence of scattering and estimation of the scattering coefficient b(lambda) as well as the absorption coefficient, a(lambda). Filtered samples from the 3 lake waters exhibited absorption spectra which were featureless except for an exponential rise in a(lambda) towards shorter wavelengths, evidently caused by the presence of dissolved/colloidal organic matter (yellow substance). The absorption spectra of particulate materials exhibited structure caused by superposition of the in vivo absorption spectra of algal photosynthetic pigments and the exponential absorption spectra of yellow substance chemically adsorbed by mineral particles. Light scattering was apparently a more important contributor to total attenuation of a light beam than was light absorption. The calculated chromaticity coordinates for synthesized reflectance spectra showed the 3 lakes to be dominantly yellow-colored, having a rather low degree of spectral purity which results in a brownish appearance. (Collier-IVI)
W85-00808

BEDEN BROOK INTENSIVE STREAM SURVEY, SPRING/SUMMER, 1982: INTENSIVE SURVEY NO. 823404,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
J. T. Reading, and B. A. Kurtz.
Report, June 1983. 4 fig, 7 Tab, 7 Ref, 3 Append.

Descriptors: *Streams, *Surveys, *Biological sampling, *Chemical analysis, Tributaries, Water quality, Water quality standards, Nutrients, Wastewater treatment, Phosphorus, Watersheds, Wastewater facilities, Macroinvertebrates, *New Jersey, Beden Brook.

During the spring and summer of 1982, the New Jersey Bureau of Monitoring and Data Management conducted an intensive stream survey of Beden Brook to collect background nutrient information on the Beden Brook watershed prior to completion of the Hopewell Borough Sewage Treatment Plant. The data will be used to evaluate the necessity of advanced wastewater treatment for nutrient removal at the Hopewell Borough Plant. This report evaluates the water quality data obtained during the 1982 survey. Biological and chemical sampling was conducted on four mainstream and two tributary stations (Rock Brook and Pike Run). The results indicated that both Beden Brook and Pike Run were of generally good water quality. However, nutrient levels in lower Rock Brook and lower Beden Brook were significantly elevated due to the New Jersey Neuropsychiatric Institute Sewage Treatment Plant discharge. The State Water Quality Standard for total phosphorus (0.10 mg/l) was violated in both streams during low flow conditions. Maximum values recorded were 0.25 mg/l in Beden Brook and 2.51 mg/l in Rock Brook. Beden Brook, a tributary to the Lower Millstone River, flows through Mercer and Somerset counties in central New Jersey. (Fazio-Omniplan)
W85-00817

INTENSIVE SURVEY: MANASQUAN ESTUARY, MAY-SEPTEMBER 1978,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
J. Brzozowski, P. Olsen, and S. Hullings.
Report, July 1979. 54 p, 7 Fig, 5 Tab, 15 Ref, 3 Append.

Descriptors: *Surveys, *Estuaries, *River basins, *Cholorophyll a, *Bacteria, *Phytoplankton, *Chemical analysis, Basins, Rivers, Tidal rivers, Hydrogen ion concentration, Dissolved oxygen, Nutrients, Coliforms, Streptococcus, Water quality, Estuarine environment, Primary productivity, *New Jersey, Manasquan River estuary.

An intensive chemical and biological survey was conducted on the lower Manasquan River and estuary from May 25 through September 28, 1978. The objectives were to describe the present water quality in the freshwater tidal Manasquan River and estuary, estimate current levels of primary production, describe and analyze present phytoplankton community and population dynamics, and correlate present nutrient loadings with observed phytoplankton community dynamics. Data will be used in the assessment of the various reservoir and wastewater treatment facilities plans being proposed for this basin. Chemical and phytoplankton grab samples were taken weekly at eight stations from Squankum to the Manasquan Inlet. Bacterial quality in the river and estuary was substandard. Dissolved oxygen levels were generally satisfactory although the 5.0 mg/l standard was violated twice at Squankum and once at the upper estuary at station 3. Nitrate nitrogen and total kjeldahl nitrogen loadings at Squankum were estimated at 279 lbs/day and 1023 lbs/day, respectively. Chlorophyll A concentrations greater than 100 mg/cu m were measured in the upper estuary and a phenomenally high value of 680 mg/cu m was recorded at station 3. Bloom species in the Manasquan River were primarily those with euryhaline or mesohaline tolerances. Basin morphology and a lack of tidal flushing contribute the nuisance conditions by allowing accumulations of nutrients. (Fazio-Omniplan)
W85-00818

MEASUREMENT OF THE REAERATION COEFFICIENTS OF THE NORTH FORK LICKING RIVER AT UTICA, OHIO, BY RADIOACTIVE TRACERS,
Geological Survey, Columbus, OH. Water Resources Div.
J. Hren.
Available from the OFSS, USGS, Box 26425, Fed. Ctr., Denver, CO 80255. USGS Water-Resources Investigations Report 83-4192, 1983. 15 p, 7 Fig, 5 Tab, 10 Ref.

Descriptors: *Radioactive tracers, Traveltime, Dye concentrations, *Reaeration coefficients, *Hydrocarbon tracers, *Ohio, Licking County, North Ford Licking River.

Reaeration coefficients of the North Fork Licking River at Utica, Ohio were measured by the radioactive-tracer method. The tests were conducted on a 2.1-mile reach on September 23 and October 7, 1981, during low-flow conditions. Krypton-85 gas and tritium were the radioactive tracers. Rhodamine-WT dye also was used as a tracer. The reaeration coefficients determined on September 23 were 3.09/day (subreach 1-2) and 3.32/day (subreach 2-3). On October 7, the values were 2.04/day and 2.23/day. (USGS)
W85-00853

ACID PRECIPITATION- AN ANNOTATED BIBLIOGRAPHY.
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 10C.
W85-00864

DETOXIFICATION/TOXIFICATION OF CADMIUM IN SCORPIONFISH (SCORPAENA GUTTATA): ACUTE EXPOSURE,
Southern California Coastal Water Research Project Authority, Long Beach.
D. A. Brown, S. M. Bay, J. F. Alfafara, G. P. Hershelman, and K. D. Rosenthal.
Aquatic Toxicology, Vol. 5, No. 2, p 93-107, May, 1984. 1 Fig, 5 Tab, 28 Ref. NOAA grant NA82RAD00003.

Descriptors: *Cadmium, *Scorpionfish, *Water pollution effects, *Toxicity, Detoxification, Metallothionein, Fish.

There is a need to develop assays for assessing the degree of toxicity resulting from sublethal exposures to contaminants in the environment, since there may be no clear outward signs of toxicity in

l organisms. There is also a need to develop inant-specific assays of toxicity since orga- ıay be exposed to many contaminants. The xposure of scorpionfish to near lethal Cd rations produced detoxification/toxifica- ofiles which were different for each tissue. ncentrations of Cd in the metallothionein- ing pool (detoxified) of each tissue were in the order: liver > intestine > gills > Concentrations of ENZ pool cadmium (po- or toxicity) had the inverse ranking: kidney > intestine > liver. These detoxification/ tion profiles differ markedly from the con- tern and may be useful in diagnosing acute es in fish sampled directly from the field. IVI)
0878

S OF AQUEOUS ALUMINUM IN ACIDI- CATCHMENTS OF CENTRAL ONTAR- METHODOLOGICAL ANALYSIS,
) Ministry of the Environment, Rexdale. Resources Branch.
LaZerte.
an Journal of Fisheries and Aquatic Scienc- . 41, No. 5, p 766-776, May, 1984. 10 Fig, 2 5 Ref.

ptors: *Metal speciation, *Aluminum, *On- *Acidic waters, Streams, Lakes, Acidity, studies, Snowmelt.

nethods (dialysis or computational) for the ion of Al in freshwaters are described, com- and critically evaluated. Both the dialysis mputational methods of estimating inoganic neric Al are consistent and well correlated ach other. The general pattern of Al specia- bserved during spring snowmelt in the Mus- Haliburton region of central Ontario agrees ith previous observations in the Adirondack n of New York, in the Laurentians of c, and in Norway. The results are relevant interpretation of observed field toxicity and ating laboratory studies to the field. The cal model provided may be useful in estimat- e potentially toxic Al fraction in colored, aters of central Ontario. The model predicts nic monomeric aluminum in waters using rganic carbon and the aluminum measured hort extraction without dialysis. (Baker-IVI)
00893

HOD FOR THE ANALYSIS OF TOTAL OGEN IN NATURAL WATERS,
ll Univ., Montreal (Quebec). Dept. of Biol-

ff, and E. Bentzen.
dian Journal of Fisheries and Aquatic Scienc- ol. 41, No. 5, p 815-819, May, 1984. 4 Tab, 12

riptors: *Oxidation, *Nitrogen, *Water analy- atural waters, Persulfate, Sulfates.

thod is presented which combines persulfate tion with subsequent analysis of the nitrate ıced with the more standard salicylate od of total nitrogen analysis. The oxidation solid potassium persulfate as opposed to the nonly used liquid preparation of oxidant, thus nating the possibility of changes in oxidation tial with aging of the solution. The combined od is simple, reproducible, and economical, ring only standard apparatus, a spectrophoto- r, a pressure cooker or autoclave, and hot- s and is useful for routine measurement of gen in the field. The method is linear to 1000 o g N/L, with the range extendable by chang- he sample size. The variability is lowest be- n 100 and 1000 micro g N/L. The method has used successfully for determining total nitro- as well as dissolved nitrogen on filtered sam- and nitrate on nonoxidized samples. (Baker-

-00896

TAVIRUS SURVIVAL IN CONVENTIONAL- TREATED DRINKING WATER,
Ottawa Univ. (Ontario). Dept. of Microbilogy and Immunology.
S. A. Sattar, R. A. Raphael, and V. S. Springthorpe.
Canadian Journal of Microbiology, Vol. 30, p 653-656, May, 1984. 1 Fig, 2 Tab, 20 Ref. Ontario Ministry of Health grant CHS-R46.

Descriptors: *Drinking water, *Viruses, *Rotavirus, Potable water, Water treatment, Water analysis, Public health, Chlorine, Water temperature.

Samples of conventionally treated drinking water collected either as effuent (PE) at a treatment plant or out of a tap (TW) in the lab were seeded with simian rotavirus SA-11, which closely resembles rotavirus of human origin. There was nearly a 1 log-10 loss in the titer of the virus when it was suspended in distilled water prior to its addition to samples of PE. Samples of PE contained 0.75 mg/L of free and 0.89 mg/L of total chlorine. There was a 15- to 18-fold reduction in these amounts by the time the treated water was collected at TW in the lab. Addition of TPB alone to PE to a final concentration of 1:1000 reduced the free and total chlorine by about 66%. When EBSS was used instead, the reduction in chlorine values in PE amounted to about 20%. In long-term survival studies of rotavirus SA-11 it was determined that at 20 degrees C it took 64 days to reduce the virus titer by 2 log-10, whereas, at 4 degrees C, the virus titer dropped by only 0.7 log-10 during the same period. The initial TW pH of 8.3 remained essentially the same when it was incubated for 64 days at 4 degrees C. There was a slight drop in the pH value of the water sample after 64 days at 20 degrees C. As would be expected, the freshly collected sample of TW at the start of the experiment had very low levels of aerobic bacteria (2 CFU/mL). After 64 days this count increased by 10- and 50-fold at 4 and 20 degrees C, respectively. (Baker-IVI)
W85-00897

COMPARISON OF THE MICROTOX AND DAPHNIA TEST FOR THE EVALUATION OF INDUSTRIAL EFFLUENTS (COMPARAISON DES TESTS MICROTOX ET DAPHNIE POUR L'EVALUATION DE LA TOXICITE AIGUE D'EFFLENTS INDUSTRIELS),
Centre des Sciences de l'Environment, Metz (France). Lab. de Toxicologie.
P. Vasseur, J. F. Ferard, J. Vial, and G. Larbaigt.
Environmental Pollution (Series A), Vol. 34, No. 3, p 225-235, June, 1984. 4 Tab, 9 Ref.

Descriptors: *Toxicity, *Effluents, *Microtox test, *Daphnia, Industrial wastewater, Photobacterium, Bioluminescence.

The luminescent marine bacterial test (Microtox test) has been compared with the 'Daphnia' test for controlling the toxicity of industrial effluents. The criterion which has been chosen to quantitate toxicity is the determination of the effective concentration of the effluent which reduces 50% of the bioluminescence (EC50) or which inhibits 50% of the mobility of Daphnia (IC50). The toxicity screening of 39 samples indicates that the results of the two tests are in good agreement for 86% of the toxic wastewaters. This study shows that the sensitivity of bacteria (Photobacterium phosphoreum) and invertebrates (Daphnia magna) is related to the comparison of effluents and to the kind of products which are synthesized and released by the industrial sites. The reproducibility of the results is of the same order of magnitude in the two tests: the mean values of the EC50(Microtox) and IC50(Daphnia) have been assessed with a coefficient of variation between 3% and 30%. Since it is rapid, simple and cheap, the Microtox test appears to be a more convenient method than the Daphnia test for the survey of toxic emissions and to be well suited to the toxicity screening of industrial effluents. (Author's abstract)
W85-00907

BENTHIC MACROINVERTEBRATES AS INDICATORS OF ENVIRONMENTAL DEGRADATION IN THE SOUTHERN NEARSHORE ZONE OF THE CENTRAL BASIN OF LAKE ERIE,
Heidelberg Coll., Tiffin, OH. Water Quality Lab.
K. A. Krieger.
Journal of Great Lakes Research, Vol. 10, No. 2, p 197-209, 1984. 2 Fig, 8 Tab, 43 Ref. EPA grant R005350012, EPA contract 68-01-5857.

Descriptors: *Invertebrates, *Lake Erie, *Bioindicators, Great Lakes, Harbors, Water pollution effects, Population dynamics, Species diversity.

Benthic macroinvertebrates of the central basin of Lake Erie were samples using a Ponar grab in the summers of 1978 and 1979 along a 155 km reach of the nearshore zone in Ohio at depths of less than 20 m. A comparison of the species assemblages with those in other areas of the Great Lakes indicates moderate organic enrichment in the general area outside of harbors. There was evidence of a gradient of decreasing pollution in an offshore direction. The harbors are severely degraded, as reflected by the almost complete absence of all but the most pollution tolerant species. The abundance and relative contribution of oligochaetes as well as the oligochaete trophic condition index showed significant differences between the harbors and the rest of the nearshore zone. The relative contribution of Limnodrilus hoffmeisteeri and the trophic condition index when applied to midge species failed to demonstrate a difference in the extent of pollution between the harbors and open areas. The distributions of individual midge species within the most tolerant group revealed strong differences. Conditions outside of the harbors generally appear to be an extension of those prevailing in the western basin in the 1960's and reflect somewhat greater organic enrichment than was apparent in the 1960's in the deeper, more offshore areas of the central basin. (Baker-IVI)
W85-00926

MEASUREMENT OF THE REDOX POTENTIAL IN GROUNDWATER (REDOX-MESSUNGEN IM GRUNDWASSER(II)),
W. Kass.
Deutsche Gewasserkindliche Mitteilungen, Vol 28, No. 1, p 25-27, February, 1984. 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Redox potential, *Groundwater, *Measuring instruments, Electrodes, Chemical properties.

The redox condition of groundwater can be measured with the so-called redox potential; however, redox balance is easily disturbed, since there is little buffering of the system. A reference was found in the literature to a redox electrode with a polishable pin; such a device could not be found on the market, so one was custom made. In the summer of 1983, redox potential was measured in groundwater at five sites in the Breisgau area, Federal Republic of Germany. The experiments had a standard deviation of 5.9 to 19.5 mV, showing an improvement in reproducibility through use of the new electrode. The redox electrode must be stored in distilled water and must have its platinum pin polished every day before use. (Gish-IVI)
W85-00972

SEQUENTIAL SAMPLING: A COST-EFFECTIVE APPROACH FOR MONITORING BENTHIC MACROINVERTEBRATES IN ENVIRONMENTAL IMPACT ASSESSMENTS,
California Univ., Berkeley. Div. of Entomology and Parasitology.
For primary bibliographic entry see Field 6G.
W85-00975

MONITORING TOTAL SUSPENDED SOLIDS BY USING NEPHELOMETRY,
Corps of Engineers, Baltimore, MD. Baltimore District.
H. G. Earhart.
Environmental Management, Vol. 8, No. 1, p 81-86, January, 1984. 4 Fig, 16 Ref.

Descriptors: *Nephelometry, *Suspended solids, *Monitoring, Correlation curves, Turbidity, Dredging, Sediments, Chesapeake Bay.

Correlation curves were developed relating nephelometric turbidity units (NTU) with total suspended solids (TSS) for diked upland dredged material placement site effluents of three US Army Corps of Engineers (COE) maintenance dredging projects in the Chesapeake Bay, Maryland. The procedure was developed in an effort to ensure compliance with Maryland's 400 milligrams per liter (mg/l) TSS standard for COE dredging projects. Samples of the sediments to be dredged were collected and analyzed, correlating turbidity readings with TSS determined by standard gravimetric techniques. The correlation curves were provided to the COE inspectors to measure the effluent with a turbidity meter and to extract a TSS concentration from the correlation curve. Samples collected and analyzed after initiation of the dredging indicated that the correlation curves were an overestimate of the actual TSS concentrations of the effluent discharges. The procedures, endorsed by the State of Maryland, provided immediate on-site TSS analysis eliminating the previously encountered delays in obtaining gravimetric analysis of effluent discharges and potential contract management problems. (Author's abstract)
W85-00976

ERRORS IN PH MEASUREMENT WITH COLORIMETRIC INDICATORS IN LOW ALKALINITY WATERS,
Maine Univ. at Orono. Dept. of Zoology.
T. A. Haines, J. J. Akielaszek, S. A. Norton, and R. B. Davis.
Hydrobiologia, Vol. 107, No. 1, p 57-61, October, 1983. 5 Fig, 8 Ref.

Descriptors: *Colorimetry, *Hydrogen ion concentration, Water chemistry, Lakes, Electrometry, Ionic strength, Buffering, Alkalinity.

A series of laboratory and field studies were conducted to evaluate the reliability of colorimetric pH indicators in dilute, acidic surface waters in New England. Laboratory studies consisted of comparing colorimetric and electrometric pH results in synthetic solutions with a range of ionic strength and buffering capacity. Field studies involved simultaneous colorimetric and electrometric pH determinations in 52 New England lakes with differing water chemistry. Colorimetric indicators deviated from electrometric pH results at low alkalinities and near the end of their operating range. They agreed with electrometric values, within 0.2 unit at alkalinities of 20 micro eq/l and greater, or near the center of their operating range. Changing ionic strength without changing buffering capacity did not affect results. When indicators were selected that bracketed sample pH, colorimetric determinations of pH in New England lakes agreed well with electrometric determinations. (Author's abstract)
W85-00992

COMPARISON OF LEAD AND ZINC SEDIMENT PROFILES FROM CORES TAKEN BY DIVER AND A GRAVITY CORER,
Trent Univ., Peterborough (Ontario). Freshwater Science Programme.
H. E. Evans, and D. C. Lasenby.
Hydrobiologia, Vol. 108, No. 2, p 165-169, 1984. 1 Fig, 1 Tab, 36 Ref.

Descriptors: *Sampling, *Metals, *Lake sediments, Lakes, Sediments, Zinc, Lead, Measuring instruments, Coon Lake, Canada.

The zinc and lead concentrations were compared in several pairs of sediment cores obtained with a modified K-B corer and by Scuba diver from Coon Lake, Canada. A slow approach to and penetration of the sediments was employed for both coring devices. In each core the concentration of Zn decreases gradually with depth. In fact, for both coring methods, an analysis of variance revealed significant differences in Zn concentration between depths within each core and between the various diameters. Paired T-tests were performed for each core-pair of the same i.d., comparing the K-B corer and diver core results at each depth. In 4 of the 5 comparisons there was no significant difference in the Zn concentrations at each depth. The Zn concentrations measured on the K-B cores are both higher and lower than those measured on the diver cores. Whereas the Zn concentrations in each core decline gradually with depth, the Pb concentrations decrease rapidly to background concentrations at about 5-7 cm. Even so, the background Pb concentrations are reached at about the same depth of both the K-B and diver cores. No evidence was found to reject the hypothesis that in soft, recent sediments, slow impact K-B cores are comparable to diver cores with respect to Zn and Pb profiles, for the 3 core tube diameters investigated. (Baker-IVI)
W85-01011

MEASUREMENT OF TRITIUM IN NATURAL WATER,
M. Li.
Oceanologia et Limnologia Sinica, Vol. 14, No. 6, p 571-576, November, 1983. 3 Fig, 4 Tab.

Descriptors: *Water analysis, *Tritium, Surface water, Natural waters, Scintillation, Triton X-100.

A detergent scintillation liquid mixture applied to measure low specific activity of tritium in natural water was studied. Comparison of the Triton X-100 scintillation liquid mixture with the dioxane-based scintillation liquid allowed the determination of a better fomula for Triton X-100 scintillation liquid mixture. The mixture possesses the quality of high water content, high efficiency and low background in measuring tritium in water. Chemiluminescence of the Triton X-100 scintillation liquid mixture can be totally deexcited in short time. It can be employed at ambient temperatures of 11-28 degrees C. (Baker-IVI)
W85-01050

DETERMINATION OF DIESEL FUEL AS CONTAMINATION IN WATER (DIE BESTIMMUNG VON DIESELOL ALS VERUNREINIGUNG IM WASSER),
H. Binder, and L. Weis.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17, No. 1, p 20-22, February, 1984. 1 Fig, 5 Ref.

Descriptors: *Fuel, *Pollutant identification, Gas chromatography, Extraction, Hydrocarbons.

Adding methanol and Tween 80 and using an Ultraturrax for dispersion leads to homogenous and stable diesel-water-mixtures. The addition of tetradecen as an internal standard and the use of extraction cartridges for separating the hydrocarbons leads to quantitative determination by gas chromatography in the range of 40 ppb to 20 ppm diesel fuel or domestic fuel oil with recovery of 98.9 + or - 5.0%. (Author's abatract)
W85-01056

SIMULTANEOUS SPECTROPHOTOMETRIC DETERMINATION OF HUMIC ACID AND IRON IN WATER,
Melbourne Univ., Parkville (Australia). Marine Chemistry Lab.
P. D. Carpenter, and J. D. Smith.
Analytica Chimica Acta, Vol. 159, p 299-308, May, 1984. 5 Fig, 4 Tab, 31 Ref.

Descriptors: *Spectrophotometry, *Humic acid, *Iron, Natural waters, Organic matter, Fulvic acid.

Humic substances constitute the bulk of organic matter in natural fresh waters. Iron is stabilized in solution by humic acid. A simple and rapid method is described for the determination of humic acid and iron in solution. Two absorbance measurements are required, one on an untreated sample aliquot, and the other on an aliquot treated to enhance iron absorptivity. The method requires sample volumes of less than 15 ml and is sensitive enough for direct application to most natural waters. Limits of detection for each component vary with concentration of the other, but 0.01 mg/l for humic acid and 0.04 micro M for iron can be achieved. The procedure determines fulvic and humic acids, as both have similar absorption spectra and reactions with iron. Waters from six streams in northeast Victoria, Australia, were analyzed for iron and humic acid. Independent calibration graphs gave results 6-40% higher for iron and 6-29% higher for humic acid, than the results obtained with the recommended procedure (Moore-IVI)
W85-01077

DETERMINATION OF ALDICARB, ALDICARB OXIME, AND ALDICARB NITRILE IN WATER BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY,
Florida Univ., Gainesville. Dept. of Chemistry
M. L. Trehy, R. A. Yost, and J. J. McCreary.
Analytical Chemistry, Vol. 56, No. 8, p 1281-1285, July, 1984. 4 Fig, 2 Tab, 18 Ref.

Descriptors: *Gas chromatography, *Mass spectrometry, *Aldicarb, *Aldicarb oxime, *Aldicarb nitrile, Pollutant identification, Carbamate pesticides, Groundwater pollution, Fate of pollutants, Microorganisms, Anaerobic conditions, Pesticide residues.

The carbamate pesticide aldicarb is extensively used in agriculture and has been detected in groundwaters in agricultural areas. The use of a short capillary column coupled to a mass spectrometer facilitates the analysis of the thermally labile carbamate pesticide and two of its degradation products, aldicarb oxime and aldicarb nitrile. Methane and isobutane chemical ionization reagent gases are evaluated. The limits of detection for aldicarb, aldicarb oxime, and aldicarb nitrile are 0.3 ng, 1.2 ng, and 0.15 ng, respectively. Experiments on the fate of aldecarb in anaerobic groundwaters indicate that aldicarb slowly hydrolyzes to aldicarb oxime in sterile anaerobic groundwater at pH 8.2. In the presence of a high concentration of anaerobic microorganisms, aldicarb rapidly degrades to aldicarb nitrile. The use of gas chromatography/mass spectrometry with short capillary columns permits analysis for thermally labile pesticides and offers the advantage of confirmation of identity and rapid analysis. Up to six samples per hour can be analyzed for aldicarb by this technique. (Moore-IVI)
W85-01078

CHANGES IN BLUEGILL ACTIVITY AS A MONITOR OF ACUTE BENZENE EXPOSURE,
Air Force Aerospace Medical Research Lab., Wright-Patterson AFB, OH.
J. W. Fisher, R. W. Dilego, and L. M. Paulos.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 1, p 26-32, July, 1984. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Bioindicators, *Bluegills, *Benzene, Industrial wastes, Fuels, Oil spills, Fish behavior, Water pollution effects, Salmon, Fish, Toxicity, Monitoring.

The acute sensitivity of bluegill (Lepomis macrochirus) to benzene was investigated using a newly developed automated activity monitor. Two days in the acclimation chambers were followed by three days of control activity data collection from 1200-1500 hours. Benzene reached maximum concentrations in the testing chambers within 60 to 75 min and after exposure the concentration decreased to well under 1.0 mg/l within two hours. No benzene was detected 24 hr postexposure. Toxicity was similar among various species of teleosts. Six salmon species had 96 hr median tolerance limits ranging from 11.7 to 14.7 mg/L. Gasterosteus aculeatus and Cottus cognatus had 96 hr TLM values of 24.8 and 15.4 mg/L, respectively. Benzene 96 hr TLM values for Lepomis macrochirus, Pimephales promelas, Carassium auratus, and Poecilia reiculata ranged from 22.5 to 36.6 mg/L. The use of fish behavior as an indirect means to assess water quality appears to be sensitive and responsive. Clues regarding ecological death may be derived from observing sublethal effects on behavior. (Baker-IVI)
W85-01088

RRESTRIALITY IN THE CYPRINODONTID H RIVULUS MARMORATUS: POTENTIAL LITY IN H2S AND OTHER BIOASSAYS,
rleston Coll., SC. Grice Marine Biological

C. Abel.
etin of Environmental Contamination and icology, Vol. 33, No. 1, p 33-39, July, 1984. 1 1 Tab, 23 Ref. EPA grant R805469 01.

criptors: *Bioindicators, *Fish behavior, *Bioy, *Terrestriality, *Hydrogen sulfide, Industriastes, Water quality, Monitoring.

suitability of the euryhaline cyrpinodontid Rias marmoratus as a bioassay fish is considered. fish inhabits mangrove forests, swamps, and ons of Florida and several Caribbean islands. concentration of hydrogen sulfide that elicited sitive response in 50% of the fish was 123.6 Sixteen of the 20 fish that responded positiveimped onto the platform. No positive responses e recorded from either the normoxic or hyc control. There was a significant positive elation between duration of emergence and rogen sulfide concentration. These findings onstrate the ability of Rivulus marmoratus to ct and avoid water contaminated with hydrosulfide. Sublethal responses reported for freshr fishes are more sensitive, but there is a th of euryhaline species suitable for such ys, so more comprehensive testing of the leapresponse of this species is warranted. (Baker-

5-01089

. Sources Of Pollution

OD EFFECTS ON THE TRANSPORT OF AVY METALS,
versity Coll. of Wales, Aberystwyth. Dept. of graphy.
. Bradley.
rnational Journal of Environmental Studies, 22, No. 3-4, p 225-230, 1984. 3 Fig, 2 Tab, 16

criptors: *River sediments, *Heavy metals, liment transport, *Floods, *River Ystwyth, les, Path of pollutants, Lead, Copper, Cadmi- Manganese, Iron, Sediment contamination, odplains.

effect of river flooding on sediment quality studied in the River Ystwyth in Wales, a river rely contaminated by base metal mining in the teenth century. Samples were collected during od on 14 January 1983. Concentrations of Pb, Cd, and Mn were determined for the extracts g an atomic absorption spectrophotometer a SP9 graphite furnace. Concentrations of Pb, and Cd on the sediment are lowest just after flood peak, and rise on the falling limb as ment concentrations decline. It appears that source areas are activated at higher discharges naterial from the upper channel sides, from dplains, and as washload contribute to the sused load. The delivery times of sediments from ous parts of the catchment to the monitoring may have influenced the composition of the ple. Historic mining resulted in the dissemina- of contaminated materials throughout the hment, particularly to floodplain domains, and e contaminated sediments are supplied by nont sources throughout the catchment. The ease which metals can be removed from sediment ences their bioavailability. (Baker-IVI)
5-00510

RBIDITY IN THE WESTERN BASIN OF E ERIE,
ironmental Protection Agency, Narragansett,

Paul, R. Kasprzyk, and W. Lick.
nal of Geophysical Research, Vol. 87, No. C8, 779-5784, July, 1982. 9 Fig, 1 Tab, 15 Ref.

criptors: *Turbidity, *Lake Erie, *Sediment , *Shear stress, Oregon, Ohio, Detroit River, mee River, Wave action, Suspended solids, Suspended sediments, Fate of pollutants, Path of pollutants.

The Western Basin of Lake Erie is shallow with an average depth of 7 m and is separated from the rest of the Lake by an underwater ridge and a series of islands. The major source of sediments into the Basin are the Detroit and Maumee Rivers which are annually responsible for 1,800,000 metric tons and 1,200,000 metric tons, respectively. Turbidity data from the Oregon, Ohio municipal water intake in the Basin for the years of 1976 through 1979 were examined. A relatively simple formula for the turbidity (T) as a function of bottom shear stress due to wave action (S) and sediment loading from the Maumee River (L) was developed where $T = C1 + C2F(S) + C3F(S)I(L) + C4D(L)$: F(S) is an entrainment function dependent upon the bottom shear stress, I(L) and D(L) are both functions of L, and C1, C2, C3, and C4 are constants. Excellent agreement was found between the observed and calculated turbidities for all years examined. The results demonstrate that turbidity is directly related to wave action and the resulting bottom stress, sediments from the Maumee River significantly contribute to the amount of entrainable sediment near the Oregon intake, the transport of suspended solids from the Maumee River to the Oregon intake is a significant factor in causing high turbidity, and there is reasonable equality between turbidity in NTU units and suspended sediment concentration in units of milligrams per liter. (Collier-IVI)
W85-00512

COMPOSITION OF PRECIPITATION IN REMOTE AREAS OF THE WORLD,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2K.
W85-00514

CHEMICAL ANALYSIS OF CLOUD WATER COLLECTED OVER HAWAII,
National Oceanic and Atmospheric Administration, Boulder, CO. Office of Weather Research and Modification.
For primary bibliographic entry see Field 2K.
W85-00515

SNOW CHEMISTRY ON JAMES ROSS ISLAND (ANTARCTIC PENINSULA),
Instituto Antartico Argentino, Buenos Aires.
For primary bibliographic entry see Field 2C.
W85-00519

CHEMISTRY OF WESTERN ATLANTIC PRECIPITATION AT THE MID-ATLANTIC COAST AND ON BERMUDA,
Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 2K.
W85-00520

PARTITIONING OF HEAVY METALS (MN, FE, AS, CD, PB, CU, ZN, CO AND NI) INTO SELECTIVE CHEMICAL FRACTIONS IN SEDIMENT CORES FROM LAKE BIWA (IN JAPANESE),
Okayama Univ., Kurashiki (Japan). Inst. for Agricultural and Biological Sciences.
S. Nakashima.
Japanese Journal of Limnology, Vol. 43, No. 2, p 67-80, April, 1982. 11 Fig, 28 Ref.

Descriptors: *Heavy metals, *Lake Biwa, *Japan, *Sediments, Fate of pollutants, Manganese, Iron, Arsenic, Cadmium, Lead, Copper, Zinc, Cobalt, Nickel.

In order to investigate the mechanism of metal accumulation in the bottom sediment of Lake Biwa, two 22 cm long sediment cores from the center (about 90 m in water depth) of the northern part of the lake were sliced into 2 cm sections and analyzed for Mn, Fe, As, Cd, Pb, Cu, Zn, Co and Ni. Partitioning of these heavy metals into mineral and organic fractions was determined with selective chemical leaching techniques for core samples. The total contents of heavy metals in the sediment core samples were classified into two groups on the basis of vertical distribution: (1) Manganese, As, and to a lesser degree Cd, Pb, Cu and Zn were concentrated in the upper 2 cm of the core. (2) Iron, Co and Ni showed no vertical gradient. Manganese and Cd were enriched in both the exchangeable and hydrous Fe/Mn oxide fractions in the upper 2 cm layer of the core samples. Arsenic, Pb, Cu and Zn were concentrated in the hydrous Fe/Mn oxide fractions in the surface sediment layer. The heavy metal contents of sulfide, organic and silicate fractions were relatively constant regardless of depth. The remarkable enrichment of Mn and As in the oxidized upper layer of the sediment is assumed to be mainly due to upward migration of dissolved Mn and As from the deeper, reduced sediment layers and to reprecipitation in the thin oxidized surface layer. High concentrations of Cd, Pb, Cu and Zn in the upper 2 cm are presumably due mainly to upward migration in addition to human activities. These results suggest that hydrous Fe/Mn oxides play an important role in the sedimentation and surface enrichment of heavy metals in the sediment of Lake Biwa. (Author's abstract)
W85-00527

DISSOLVED ORGANIC CARBON AS A CONTROLLING FACTOR IN OXYGEN CONSUMPTION IN NATURAL AND MAN-MADE WATERS,
Tokyo Univ. of Agriculture and Technology (Japan). Faculty of Agriculture.
M. Seto, S. Nishida, and M. Yamamoto.
Japanese Journal of Limnology, Vol. 43, No. 2, p 96-101, April, 1982. 3 Fig, 1 Tab, 13 Ref.

Descriptors: *Japan, *Organic carbon, *Oxygen requirements, *Dissolved oxygen, *Respiration, Microbial respiration, Hydrogen ion concentration, Heterotrophic bacteria, Nitrates, Actiivated sludge, Coke oven liquor, Hot springs, Fate of pollutants, Pollution effects.

The rate of oxygen (O2) consumption, and thus the concentration of dissolved oxygen (DO), is controlled heavily by environmental factors other than temperature. Dissolved organic carbon (DOC) is the most important factor that controls O2 consumption in the waters from several sites in central Japan. The rate of oxygen (O2) consumption, Y (mg O2/l/hr), as well as the amount of dissolved organic carbon (DOC), X (mg C/l), in a sample water showed almost no variation in the middle period of aerobic incubation at 25 degrees C. The rates Y in this period were highly correlated with the amount X ($Y = 3290\ X$ to the 1.50 power); correlation coefficient (r, 0.970) among the forty-six sample waters from various sources including rivers, ponds, ground waters, activated sludges and others. Correlation coefficient (r) between the rate Y and both the concentration of hydrogen ion and the number of heterotrophic bacteria was as low as 0.135 or 0.690, respectively. The coefficient, r, between the rate Y and the amount of NO3(-)-N or particulate organic carbon (POC) was fairly high at 0.791 or 0.828, respectively. Assuming that DOC is the respiratory substrate for the aquatic microbes, the turnover rate of DOC per hour was calculated to be the highest of 0.0194 (retention time t, 51.6 hrs) in the activated sludge which had been decomposing coke-oven liquors, and the lowest of 0.00093 (t, 1075 hrs) in a hot spring. Almost the same amount of DOC respired by microbes was supplied into DOC from POC through the liquefaction by exoenzyme and/or autolysis of the microbial bodies. (Collier-IVI)
W85-00530

CHEMICAL CHANGES OF SNOW COVER BY MELTING,
Hokkaido Univ., Sapporo (Japan). Lab. of Fundamental Research.
For primary bibliographic entry see Field 2K.
W85-00531

CHARACTERISTICS OF HEAVY METALS IN THE BOTTOM MUD OF MINING AND URBAN RIVERS (IN JAPANESE),
Takasaki Coll. of Economics, Gumma (Japan).
F. Tada, H. Doi, N. Kawaguchi, J. Suzuku, and S. Suzuki.
Japanese Journal of Limnology, Vol. 43, No. 4, p 225-229, October, 1982. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Heavy metals, *Mud, *Sediments, *Mine wastes, *Urban areas, Fractionation, Cadmium, Zinc, Copper, Lead, Path of pollutants, Organic matter, Clay, Industrial wastewater, Municipal wastewater.

In order to separate the different forms of heavy metals contained in bottom mud of urban and mining rivers, fractionation of metals by chemical extractants was carried out. Heavy metals were fractionated by successive extraction with 2N CH3COONH4, 0.1 M-EDTA and 0.5 N-HCl, and by decomposition with HNO3-H2O2. The latticeheld metals, which were separated by HNO3-H2O2 decomposition, were 70-80% of the total in the bottom mud receiving wastewater from mining industry, suggesting that most of these metals were composed of ore minerals. On the other hand, the fraction of HNO3-H2O2 was only 20-30% in urban rivers receiving industrial or municipal waste water. The major fractions of the heavy metals were separated with 2N CH3COONH4 or 0.1 M-EDTA. It was suggested that large parts of Cd, Zn, and Cu in the mud of urban rivers bind weakly with clay or organic matter and Pb binds more strongly with organic matter. (Author's abstract)
W85-00533

COMPLEXING CAPACITY OF RIVER WATER (IN JAPANESE),
Hirosaki Univ. (Japan). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2H.
W85-00538

MONITORING HERBICIDE RESIDUES IN SPRINGFLOW AFTER AN OPERATIONAL APPLICATION OF HEXAZINONE,
Southeastern Forest Experiment Station, Asheville, NC. Coweeta Hydrologic Lab.
D. G. Neary.
Southern Journal of Applied Forestry, Vol. 17, No. 4, p 217-223, November 1983. 4 Fig, 1 Tab, 17 Ref.

Descriptors: *Pesticide residues, *Hexazinone, *Springs, *Tennessee, Fate of pollutants, Forest management, Groundwater pollution, Triazine pesticides, Water pollution sources, Herbicides.

Hexazinone, a symetrical triazine herbicide, shows promise to be a cost-effective tool in pine regeneration. Parts of two forested watersheds in central Tennessee were aerially treated with 15 lb/ac of hexazinone pellets (10% active ingredient) to remove hardwood competition prior to establishing loblolly pine (Pinus taeda L.). Both treated watersheds and a control were monitored to determine if hexazinone residues were entering groundwater and appearing in springflow. Seven months of monitoring included two intensively sampled periods during application and the first storm. No detectable residues of hexazinone or its two primary metabolites were measured in samples from the Coleman Hollow watershed in which hexazinone was applied up to 66 ft. from the monitoring point in 1981. Springflow samples from a spring monitoring site 1000 m from the portion of the Lost Creek watershed treated in 1980 were also clear of herbicide residues. A delayed subsurface movement of detectable amounts of hexazinone did not occur through the cherty loam soils of Coleman Hollow within the first seven months after application. (Collier-IVI)
W85-00546

POND SEDIMENTS AS HISTORICAL RECORD OF HEAVY METALS FALLOUT,
Facultes Universitaires Notre-Dame de la Paix, Namur (Belgium). Lab. of Analytical Chemistry and Mass Spectrometry.
M. Thomas, D. Petit, and L. Lamberts.
Water, Air, and Soil Pollution, Vol. 23, No. 1, p 51-59, July, 1984. 3 Fig, 2 Tab, 26 Ref.

Descriptors: *Belgium, *Heavy metals, *Pond sediments, *Fallout, Sediment contamination, Isotope studies, Cesium radioisotopes, Aluminum, Copper, Lead, Zinc, Arsenic, Cadmium, Water pollution sources.

Sediment cores from a rural pond in Southern Belgium were dated as a function of depth by the Pb-210 geochronological method for the past 100 yr. Local industrial or domestic sources of contamination can be considered as negligible and natural background is constant. The sediments provide a good reservoir for estimating atmospheric fluxes of heavy metal pollutants. The results have been checked with Cs-137 analysis for the last 30 yr. Sedimentation rate calculated from the Cs-137 profile is based on the presence of a horizon at the onset of nuclear testing, which started in 1954, with a maximum between 1963-1964. Cs-137 activity increases in the sediment layers from about 1950 on the Pb-210 time scale basis indicating a good agreement between the dating methods. Mineralogical composition is very constant along the sediment cores indicating mechanical erosion of local outcrops as bulk sediment origin. The concentrations of Al, Cu, Pb, Zn, Cd, and As have been determined and enrichment factors normalized to Al value were calculated. Copper is mainly of natural origin, and As is influenced by local agricultural use. The anthropogenic source of Pb, Zn, and Cd is clearly provided by atmospheric fallout which is supported by comparison with atmospheric fluxes for wet and dry deposition at nearby sampling sites. Zn and Cd concentrations show decreases corresponding to the recent slowing down of industrial activity in Europe. Pb is the only element at a constant level for the most recent layers of sediment due to the combustion of leaded gasoline in automobiles. (Collier-IVI)
W85-00548

ONONDAGA LAKE AND THE DYNAMICS OF CHLORIDE IN THE OSWEGO RIVER,
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W85-00549

FREQUENCY DISTRIBUTIONS OF WATER QUALITY VARIABLES; RELATIONSHIPS BETWEEN MEAN AND MAXIMUM VALUES,
Uppsala Univ. (Sweden). Limnologiska Institutionen.
U. Heyman, S.-O. Ryding, and C. Forsberg.
Water Research, Vol. 18, No. 7, p 787-794, 1984. 3 Fig, 4 Tab, 17 Ref.

Descriptors: *Sweden, *Water quality, *Lakes, Probability, Chemical oxygen demand, Turbidity, Color, Hydrogen ion concentration, Nitrogen, Phosphorous, Suspended solids, Transparency, Chlorophyll a, Conductivity, Mathematical studies, Statistical analysis.

Frequency distributions of water quality variables have been analyzed by using about 950 samples from 25 Swedish meso- to hypertrophic lakes. By expressing all values as relative to their means, data from all the lakes could be pooled to datasets based on about 950 values for each variable. The distributions of COD, conductivity, pH and color were symmetrical with very high frequencies around 100% of the mean. The variables of total-N, total-P, suspended solids and Secchi disk transparency followed more skew distributions, while turbidity, chlorophyll a and molybdate reactive phosphorous (MRP) were markedly skewed. The inorganic nitrogen fractions had their highest frequency at or just above zero percent of the mean. Three probability density functions (pdf) namely beta, gamma and log normal distributions were fitted to the pooled data. There were two variables, color and conductivity, which did not fit to any of the pdf's but for the rest the null hypothesis could not be rejected at the 99.5% level. Frequency distributions for each lake demonstrated that for most variables one or two lakes showed distributions deviating from the pooled data pdf. There were no discernible trends among lakes and the numbe rejections seemed to be randomly distributed. (C lier-IVI)
W85-00553

MODEL FOR THE MOVEMENT OF SEWA EFFLUENT, ACCORDING TO SEA STATE, A BAY SITUATION,
Saint Andrews Univ. (Scotland). Dept. of I chemistry and Microbiology.
D. Thirkell, and R. Keatch.
Water Research, Vol. 18, No. 7, p 917-920, 198 Fig, 1 Tab, 8 Ref.

Descriptors: *Saint Andrews Bay, *Scotland, * fluents, *Path of pollutants, Bays, Model stud Wind, Water currents, Bacteria, Public hea Swimming, Storms.

A model system to describe the movement sewage effluent according to sea state within a l situation was tested by following dye movem under simulated conditions on a scale model of Andrews Bay (Scotland) and by following fl movements in the bay under different sea st conditions. It is possible to select parameters ba on wind conditions and current strengths to pos late the flow of sewage effluent within a l situation. The coliform:Group D streptococci ra in water samples collected near the water's ec adjacent to the sewage outfall decreased with creasing roughness of the sea. This would be pected in view of the differential in survival ra between these two types of bacteria; the low counts are obtained alongshore under calm con tions and the highest counts under storm con tions. This is noteworthy since maximum rec ational use is made of the water under calm conditions and public health hazards of bathing sewage polluted waters are thus diminished. (C lier-IVI)
W85-00560

ORGANOCHLORINE CONTAMINATION THE DUTCH DELTA REGION AS 'WATCHE BY MUSSELS,
Delta Inst. for Hydrobiological Research, Yerse (Netherlands).
For primary bibliographic entry see Field 5A.
W85-00571

INTERACTION BETWEEN GROUNDWATI AND SURFACE WATER REGIMES AN MINING-INDUCED ACID MINE DRAINAG IN THE STOCKETT-SAND COULEE CO/ FIELD,
Montana Coll. of Mineral Science and Techno gy, Butte.
T. J. Osborne, J. J. Donovan, and J. L. Sonderegger.
Montana Water Resources Research Cent Report No. 138, Bozeman, June 1983. 215 p, 9 F 4 Tab, 25 Ref, 5 Append. Project No. OWRT 129-MONT (1), Contract/Grant No. 14-34-00 1128, 14-34-0001-2128.

Descriptors: *Coal mine water, *Acid mine wat *Mine drainage, Water pollution sources, *Su face-groundwater relationships, Infiltration, H drogeology, Water types, Flyash, *Montana, Inf tration control, Acid neutralization, Madison aq fer, Kootenai aquifer.

Abandoned underground coal mines in the Stoc ett and Sand Coulele, Montana, region have be discharging acid water for many years, causi severe pollution of Sand Coulee Creek and trib taries, and groundwater resources. A two-year i vestigation of the hydrogeology of the Sa Coulee Creek basin was conducted to formula acid mine drainage mitigation techniques based hydrologic systems controls and decentralized ne tralization. Periodic field inventories in 1980- located at least 17 acid discharge points flowi either perennially or ephemerally. The measure total rate of acid discharge ranged from 1 to 3.3 ft/sec. Most acid discharges were of very po quality with field pH ranging from 2.2 to 5. acidity from 108 to 6002 mg/l as CaCo3 a

ecific conductance from 1038 to 15,966 microsie-
ns per centimeter. Water types were mostly
rous-aluminum sulfate with dissolved iron con-
ntrations from 12 to 1065 mg/l. Acid water
mprises roughly 60-90% of the baseflow of Sand
ulee Creek. Most baseflow is lost to evapotran-
ration and subsurface seepage. Most alluvial
undwater is polluted and has not been utilized
residents for many years. Vertical groundwater
dients are primarily downward, and mine drain-
e water reaches lower bedrock aquifers through
eam seepage, alluvial groundwater leakage and
ll bore leakage. Proposed mitigation techniques
luded infiltration control through cultivation of
ter consumptive crops and grain recropping in
harge areas, vertical connector wells or hori-
ntal wells to dewater the Kootenai aquifer over-
ng the old coal mines, injection and neutraliza-
n of acid water in the Madison limestone, and
all-scale neutralization pits using flyash and al-
ine Kootenai groundwater.
5-00583

**LORIDE CONCENTRATIONS IN THE
ASTAL MARGIN OF THE FLORIDAN AQ-
FER, SOUTHWEST FLORIDA,**
ological Survey, Tallahassee, FL. Water Re-
rces Div.
r primary bibliographic entry see Field 2F.
5-00585

**STRIBUTION OF CHLORIDE CONCEN-
ATIONS IN THE PRINCIPAL AQUIFERS
THE NEW JERSEY COASTAL PLAIN, 1977-
1,**
ological Survey, Trenton, NJ. Water Resources
.
L. Schaefer.
ailable from OFSS, USGS, Box 25425, Fed.
. Denver, CO 80225. USGS Water-Resources
estigations Report 83-4061, 1983. 56 p, 18 Fig, 9
, 22 Ref.

scriptors: *Salinewater intrusion, *Salinewater
roachment, *Chlorides, Atlantic Coastal Plain,
ew Jersey, Atlantic Ocean, Groundwater, Salin-
Groundwater movement, Groundwater with-
wals, Hydraulic gradient, Water wells, Ground-
er recharge, Water quality, Hydrogeology.

e U.S. Geological Survey maintains a saltwater
nitoring network in New Jersey to document
evaluate the movement of saline water into
hwater aquifers that serve as sources of water
ply. Areas in the Coastal Plain with existing or
ential saltwater intrusion are delineated. Data
lected through 1981 indicate that freshwater
ifers in parts of seven Coastal-Plain counties are
taminated by saline water. Encroachment of
water into freshwater aquifers in the Sayreville
a of Middlesex County and in the lower penin-
a of Cape May County has been reported for
ut 40 years and is now more extensive. Several
er areas are experiencing limited saltwater in-
sion. These include the Keyport-Union Beach
a in Monmouth County, areas along the Dela-
re estuary in Gloucester and Salem Counties,
at Point Pleasant Beach and Seaside Heights in
can County. The continuing updip movement of
ne water in the Potomac-Raritan-Magothy aq-
r system is also threatening existing freshwater
plies in the interior areas of Gloucester and
em Counties. Saltwater intrusion has resulted
n extensive ground-water withdrawals. The re-
ant freshwater head declines have caused re-
sals in the natural hydraulic gradients that
mit inland movement of saline water from adja-
t saltwater bodies. (USGS)
5-00596

**DROLOGY OF AREA 38, WESTERN
GION, INTERIOR COAL PROVINCE, IOWA
D MISSOURI,**
ological Survey, Iowa City, IA. Water Re-
rces Div.
G. Detroy, and J. Skelton.
GS Water-Resources Investigations Open File
ort 82-1014, 1983. 85 p, 50 Fig, 26 Tab, 60 Ref.

scriptors: *Iowa, *Missouri, *Coal mining, Hy-
logy, *Water quality, *Hydrologic data, *Acid
mine drainage, Rivers, Aquifers, Groundwater, Flow, Land reclamation, *Surface mining, *Coal hydrology, Chariton River, Cedar Creek, Water data sources, Groundwater quality.

General information characterizing hydrologic conditions in mined and potential mine areas has been compiled in response to the Surface Mining Control and reclamation Act of 1977. Presentation is in the form of a brief text with an accompanying map, chart, graph, or other illustration for each of a series of water-resources-related topics. Coal has been mined for 130 years in Area 38, production peaking in 1917; however, large reserves remain. Measurements of specific conductance, dissolved solids, pH, alkalinity, sulfate, iron, manganese, trace metals and other constitutents are available for surface water at 35 stations operated between 1978 and 1981 expressly for the collection of water-quality data upstream and downstream from coalmining areas. A cumulative impact of coal mining on the mineralization of surface water is evident from water-quality data for stations downstream from mining activities. Streams in Area 38 have slightly alkaline water providing the capability to neutralize acid-mine drainage to some extent. Average sulfate concentrations were larger for stations upstream from mining than for stations downstream of mining. Streams at a few stations in Area 38, located downstream of coal mining, exceeded acid-mine-drainage criteria at one time or another. (USGS)
W85-00597

DEVELOPMENT OF A MODEL TO PREDICT THE ADSORPTION OF LEAD FROM SOLUTION ON A NATURAL STREAMBED SEDIMENT,
Geological Survey, Menlo Park, CA. Water Resources Div.
D. W. Brown, and J. D. Hem.
Available from Supt. of Documents, GPO, Washington, D.C. 20402. USGS Water Supply Paper 2187, 1984. 35 p, 20 Fig, 6 Tab, 27 Ref.

Descriptors: *Absorption, *Cation absorption, *Lead, Sorption, Metals, Silts, Sediments, Geochemistry, Ions, Chemical reactions, Chemical properties, *Heavy metals, Path of pollutants, *Cation exchange, *Ion exchange, Surfaces, Trace elements, Water chemistry, Cations, Water pollution, Gasoline, Water qualtiy, Water pollution sources, *Electrical double-layer, Lead absorption, Surface chemistry.

The extensive use of lead antiknock additives in gasoline has made lead perhaps the most widely distributed toxic heavy metal in the urban environment and has greatly increased its availability for solution in natural waters. It is important for this reason to know whether its introduction into surface and ground waters by rainfall and runoff will make it available for solution or whether chemical processes, adsorption by mineral surfaces in particular, will place a safe upper limit on its solubility. A model based on electrical double-layer theory has been developed which appears to be capable of characterizing the adsorptive behavior of a natural fine-grained sediment containing mostly quartz and feldspar. This variable surface charge-variable surface potential (VSC-VSP) model differs from others in being capable of evaluating more closely the effect of total metal ion activity on the pH-dependent change in electrical potential at the solid surface. The model was tested using 0.0001 molar solutions of lead and a silt-size fraction of sediment from the bed of Colma Creek, a small stream in urban northern San Mateo County, California. The average deviation of measured percent adsorption and values calculated from the model was 6.6 adsorption percent from pH 2.0 to pH 7.0. (USGS)
W85-00604

EVALUATION OF TRENDS IN THE ACIDITY OF PRECIPITATION AND THE RELATED ACIDIFICATION OF SURFACE WATER IN NORTH AMERICA,
Geological Survey, Lakewood, CO. Water Resources Div.
J. T. Turk.
Available from Supt. of Documents, GPO, Washington, D.C. 20402. USGS Water-Supply Paper 2249, 1983. 18 p, 4 Fig, 2 Tab, 72 Ref.

Descriptors: Acidity, *Acid rain, Timing, *Temporal distribution, *Spatial distribution, North America, Precipitation, Surface water, Acidification, United States, Canada.

The acidity of precipitation in the northeastern United States has increased, probably as a result of anthropogenic emissions. Increases in New England and New York occurred primarily before the mid-1950's. Since the mid-1960's there has been no significant change in the acidity of precipitation in this region; however, nitrate concentrations may have increased and sulfate concentrations have decreased. The inadequacy of the historical data base and the effect of climatic variation make ambiguous the assignment of time periods for changes in acidity of precipitation in the midwestern and southeastern United States. Acidity of precipitation in the western United States is primarily the result of emissions from localized sources. Because these sources are established metropolitan areas, no time periods can be assigned to this acidification. Acidification of surface water generally has occurred in time frames compatible with the hypothesis that acidification of precipitation is the cause of the surface-water acidification; however, there are few examples of complementary data. Trends in surface-water acidification in Pennsylvania, New Jersey, North Carolina, the extreme northwestern United States, and the Central Rocky Mountains support the hypothesis that precipitation recently has been acidified in these regions. (USGS)
W85-00605

METHOD FOR RELATING SUSPENDED-CHEMICAL CONCENTRATIONS TO SUSPENDED-SEDIMENT PARTICLE-SIZE CLASSES IN STORM-WATER RUNOFF,
Geological Survey, Portland, OR. Water Resources Div.
J. F. Rinella, and S. W. McKenzie.
USGS Water Resources Investigations 82-39, 1982. 43 p, 9 Fig, 7 Tab, 6 Ref.

Descriptors: *Water quality, *Sediments, *Chemical analysis, *Storm runoff, *Sediment transport, Settling basins, Particle size, Suspended chemicals, Chemical transport, Chemical partitioning, Sediment fall diameters.

A method has been developed to relate suspended-chemical concentrations (associated with suspended sediments) in storm-water runoff to suspended-sediment particle-size classes. These classes are based on settling velocities in quiescent native water. This method requires processing 20 liters of water having a suspended-sediment concentration greater than 500 milligrams per liter. However, samples with suspended-sediment concentrations as low as 250 milligrams per liter may be analyzed, if sample volumes are increased to 50 liters. The time required for one person to separate suspended sediments into particle-size classes ranges from 6 to 14 hours. This report outlines procedures for processing metal, nutrient, and organic samples. (USGS)
W85-00614

BRIEF STATEMENT ON THE HYDROLOGY OF THE SAMPIT RIVER AREA NEAR GEORGETOWN, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
J. M. Cahill.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Open-File Report 84-243, 1984. 13 p, 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Oil refinery, *Groundwater pollution, *Oil spills, Water pollution sources, *South Carolina, Sampit River.

The Carolina Refining and Distributing Company is planning to locate an oil-refining plant near Georgetown, South Carolina. To aid in the preparation of an environmental impact statement, a description of the stratigraphy, ground-water re-

sources, and an assessment of possible seismic activity that may occur in the Winyah Bay vicinity has been prepared. Additional data will be required to quantitatively evaluate the impact of an oil spill on the shallow aquifer in the area. (USGS)
W85-00620

INCREASES IN FISH MERCURY LEVELS IN LAKES FLOODED BY THE CHURCHILL RIVER DIVERSION, NORTHERN MANITOBA,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
R. A. Bodaly, R. E. Hecky, and R. J. P. Fudge.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 4, p 682-691, April, 1984. 1 Fig, 4 Tab, 40 Ref.

Descriptors: *Mercury, *Flooding, *Fish, *Churchill River Diversion, *Manitoba, Southern Indian Lake, Rat Lake, Notigi Lake, Wuskwatim Lake, Water pollution sources, Dam effects, Reservoirs, Pike, Whitefish, Walleye, Heavy metals, Soil contamination, Postimpoundment.

Reservoir creation has often been inferred as a cause of elevated fish mercury concentrations. Increases in fish muscle mercury levels, occurring coincidentally with flooding, are documented for three lakes affected by the Churchill River diversion for which pre- and post-impoundment data were available. For example, northern pike (Esox lucius) and walleye (Stizostedion vitreum vitreum) muscle mercury levels from Southern Indian Lake, which was increased in surface area by 21% by flooding in 1976, increased from baseline values of 0.2-0.3 micro g/g prior to flooding to 0.5-1.0 micro g/g in 1978-82. Muscle mercury levels from predatory species (northern pike and walleye) from all 10 lakes tested in the Churchill, Rat, and Burntwood valleys flooded by the Churchill diversion are near to or exceed the current export marketing limit of 1.0 micro g/g. Because mercury levels in fish from nearby unflooded lakes have not shown recent increases, atmospheric fallout of the metal does not appear to be the cause of the problem. Also, there are no known industrial sources of mercury in the area and no agricultural activity. Postimpoundment mercury levels in predatory fish appeared to be related to the flooded terrestrial area compared with pre-impoundment lake area. They were highest (1.15-2.90 micro g/g) in Rat and Notigi lakes, which were increased in surface area by 282%, lower (0.60-1.53 micro g/g) in lakes immediately below Notigi Reservoir, increased in surface area by 31-37%, and lowest (0.45-1.03 micro g/g) in Southern Indian and Wuskwatim lakes, increased in surface area by 13-21%. Fish mercury levels responded quickly to impoundment, increasing noticeably within 2-3 yr. Declines in mercury concentrations had not, in general, taken place within 5-8 yr of impoundment, with the exception of lake whitefish (Coregonus clupaeformis) from Southern Indian Lake. It is hypothesized that observed fish mercury level increases were due to the bacterial methylation of naturally occurring mercury found in flooded soils. (Author's abstract)
W85-00640

COMPARISON OF PRECIPITATION AND LAND RUNOFF AS SOURCES OF ESTUARINE NITROGEN,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
D. L. Correll, and D. Ford.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 1, p 45-56, July, 1982. 8 Fig, 3 Tab, 16 Ref. NSF Grant No. DEB-79-11563, EPA Grant No. R804536.

Descriptors: *Water pollution sources, *Nitrogen, *Estuaries, *Precipitation, *Runoff, Air pollution, Fallout, Agriculture, Fertilizers, Ammonia, Amines, Nitrates, Chesapeake Bay, Atlantic Coastal Plain.

Seasonal and year to year variation of bulk precipitation as a source of total N, nitrate and ammonia is reported for a 7 year period at the Rhode River, a subestuary of Chesapeake Bay. These values are placed in perspective by comparison with analogous nitrogen loading due to watershed discharges. A significant amount of the variance in nitrogen area yield loading due to precipitation can be explained by covariance in rainfall volume. Variation in the amount of spring rain would account for 50% of the variation in spring nitrate area loadings. Average area loading rates for nitrate, ammonia, TKN and total N were all highest in the spring followed by the summer. Nitrate precipitation area loadings were almost twice those for ammonia. Dissolved ammonia was only determined for 3.5 years but usually accounted for about one third to one half of the TKN in bulk precipitation. Trend analyses of the pH of bulk precipitation have indicated a general decline in pH from 1974 to 1980, particularly in spring and summer seasonal data. While year to year variations were important, in an average year about the same amount of readily available nitrogen entered the system via precipitation as entered in land runoff and, during the summer and fall, precipitation was the largest source. (Baker-IVI)
W85-00649

BIOGEOCHEMICAL FATE AND TOXICITY OF MERCURY IN CONTROLLED EXPERIMENTAL ECOSYSTEMS,
Skidaway Inst. of Oceanography, Savannah, GA.
G. T. Wallace, Jr., D. L. Seibert, S. M. Holzknecht, and W. H. Thomas.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 2, p 151-182, August, 1982. 9 Fig, 4 Tab, 54 Ref. NSF grants IDO73-09762, OCE-76-22717, OCE-77-27551, IDO-73-09758 and OCE-76-22139.

Descriptors: *Mercury, *Fate of pollutants, *Toxicity, *Organic matter, Geochemistry, Particulates, Colloids, Phytoplankton, Biodegradation, Primary productivity, Sorption.

The affinity of mercury for organic matter was the most important parameter governing its chemical speciation, transport and toxicity in Controlled Experimental Ecosystems (CEEs) of the Controlled Ecosystem Pollution Experiment (CEPEX) deployed in Saanich Inlet, B.C., Canada. Particulate, colloidal and high molecular weight dissolved forms of mercury accounted for about 90% of the total mercury present in the water column. Bioassays indicated that organic matter in the above size classes had an important influence on the toxicity of mercury to phytoplankton. Sorption of mercury to particulate organic matter in the CEEs could be described by either Freundlich or linear adsorption isotherms. An observed depth-dependent increase in mercury content of particulate matter was attributed to selective biological degradation of non-mercury-binding organic components of the particles during settling. The high affinity of mercury for settling particulate organic matter led to rapid removal of mercury from CEEs. Removal rates could be described as first order and were a function of primary production rates. Deviations of measured half-removal times from those predicted by an empirically formulated relationship between primary production and mercury half-removal times could be related successfully to the influence of other occasionally significant biological parameters such as zooplankton grazing activity. (Author's abstract)
W85-00651

STRUCTURE AND CHEMISTRY OF SEDIMENTS IN BELFAST LOUGH, A SEMI-ENCLOSED MARINE BAY,
Department of Agriculture for Northern Ireland, Coleraine. Fisheries Research Lab.
J. G. Parker.
Estuarine, Coastal and Shelf Science, Vol. 15, No. 4, p 373-384, October, 1982. 4 Fig, 5 Tab, 27 Ref.

Descriptors: *Fate of pollutants, *Sediment contamination, *Belfast Lough, *Northern Ireland, Marine environment, Heavy metals, Organic matter, Sand, Silt, Grain size, Docks.

In a study of the benthic environment of Belfast Lough the structure of the subtidal sediment was examined along with its content of organic matter and selected metals (Cr, Mn, Ni, Cu, Zn, Pb). A wide range of sediment types occurred within the lough but the mean grain sizes for individual sa lay predominantly within the size classes of fi sand, very fine sand and silt. The content of orga ic matter and metals in the sediments show strong positive correlations with each other a with the content of silt/clay. Both organic matt and metals decreased in concentration in a se wards direction. The content of organic matter l generally within the range of 1-5% which is no mally associated with shelf sediments, but cons tuted up to 12% of the sediment in the docks are Likewise, metals were usually within the ran reported within other nearshore coastal waters the U.K., but sediments in the docks area and inn lough were enriched with several metals. Clust analysis identified four major subdivisions in t lough which were distinctly different in their co tents of silt/clay, organic matter and metals. (A thor's abstract)
W85-00654

NUTRIENT EXCHANGE ACROSS THE SED MENT-WATER INTERFACE IN THE POT MAC RIVER ESTUARY,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2L.
W85-00655

RADIOCAESIUM AND 210PB IN CLYDE SE LOCH SEDIMENTS,
Glasgow Univ. (Scotland). Dept. of Chemistr
D. S. Swan, M. S. Baxter, I. G. McKinley, and W Jack.
Estuarine, Coastal and Shelf Science, Vol. 15, N 5, p 515-536, November, 1982. 9 Fig, 6 Tab, Ref.

Descriptors: *Cesium radioisotopes, *Lead radic sotopes, *Radium radioisotopes, *Clyde sea loch *Scotland, *Sediment deposition, Sediment co tamination, Water pollution sources, Radioactiv wastes, Fuel reprocessing, Cobalt radioisotope Radioactive tracers, Submarines.

An attempt was made to apply the Pb-210 metho to assessment of sedimentation rates within th Clyde sea lochs in western Scotland. Sedimentar radiocesium, notably the fraction originating effluents from the Windscale nuclear fuel repro essing plant, was also used to test core chronol gies. Pb-210, Ra-226, Cs-137 and Cs-134 were an lyzed in short sediment cores. The radiocesiu nuclide concentrations in Clyde sediments provid information on (a) enrichment factors onto partic late matter, (b) surficial mixing coefficients and (sedimentation rates. Rates of 6, 3.5, 15 and 15 mm yr were found for Loch Goil Station 1, Loch Go Station 2, Gareloch and Holyloch sites, respectiv ly. Sequential analyses of Loch Goil sediment imply a radiocesium concentration factor of x24 for transfer from the water column to particulate The radiocesium residence time in coastal wate of ca. 950 years reflects the importance of scaveng ing by the high nearshore particulate flux. Pb-21 levels in sediments are controlled, in the unsup ported fraction, by a major input sorbed on catch ment particulates and, in the supported componen by Ra-226 activities occasionally perturbed by ur usually high surface values probably of planktoni origin. In Holyloch, detectable levels of Cs-13 and Co-60 are attributed to the discharge of pr mary coolant from nuclear submarine reactor (Moore-IVI)
W85-00659

URBAN GROUNDWATER AS A POSSIBL NUTRIENT SOURCE FOR AN ESTUARIN BENTHIC ALGAL BLOOM,
Commonwealth Scientific and Industrial Researc Organization, Floreat Park (Australia). Div. o Land Resources Management.
P. L. Sewell.
Estuarine, Coastal and Shelf Science, Vol. 15, No 5, p 569-576, November, 1982. 2 Fig, 2 Tab, 6 Ref

Descriptors: *Peel Inlet, *Australia, *Estuarine en vironment, *Eutrophication, *Urban groundwater Groundwater pollution, Water pollution sources

ogen, Phosphorus, Wastewater pollution, ic tanks, Groundwater movement.

Peel Inlet in Western Australia was used to y the cause of eutrophic conditions in an estu- In addition to large quantities of nitrogen and phorus (at low concentrations) entering the from rivers and drains from agricultural areas, rban contribution via groundwater was identi- The average nitrogen concentrations of urban ndwater under an area serviced with septic systems was 12 parts/1,000,000. Because of nature of the soils, very few groundwater les contained appreciable phosphorus concen- ns. However, one area close to the inlet had -confined groundwaters with nitrogen and phorus concentrations as high as 100 and 0.4 /1,000,000 respectively. An obsolete dumping for human excreta was also identified near the n area, and this is suspected of having contrib- to very high concentrations of nitrogen and phorus in groundwater which may have al- y reached the estuary and caused excessive growth. Groundwater contours showed the ntial for groundwater movement from part of rban area and also from the obsolete dumping (Author's abstract)
-00662

IAVIOUR OF BORON, CALCIUM AND GNESIUM IN A POLLUTED ESTUARY,
onal Inst. of Oceanography, Panaji (India).
. Narvekar, M. D. Zingde, and V. N. Kamat
l.
arine, Coastal and Shelf Science, Vol. 16, No. 9-16, January, 1983. 5 Fig, 17 Ref.

criptors: *Fate of pollutants, *Boron, *Calci- *Magnesium, *Estuarine environment, bika River estuary, *India, Chlorinity, Indus- wastes, Suspended solids, Clay, Seawater.

avior of industrially added boron in the well d Ambika river estuary of South Gujarat, has been studied along with that of calcium magnesium. The ratios of Ca:Cl and Mg:Cl at ing chlorinities were always within the normal es found in river water at one end and sea- r at the other end. B:Cl exceeded the river r end limit at the ebb tide at an upstream on. Percentage addition or removal of boron, um and magnesium was calculated using the ept of the theoretical dilution line. The exter- nput raised the boron concentration by 263% e vicinity of the industrial discharge. A corre- n coefficient of -0.82 between chlorinity and entage addition or removal of boron supports heory of boron incorporation in sediments in nts proportional to salinity. Inverse relation- between percentage addition or removal of n and suspended solids was observed. Behav- f calcium and magnesium was in line with the cement of Ca(2+) ions occupying the majori- f ion-exchange sites in riverine clays by 2+), Na(+) and K(+) during their first en- ter with seawater. (Author's abstract)
-00668

MUSSEL WATCH: 1977-1978 RESULTS ON CE METALS AND RADIONUCLIDES,
ps Institution of Oceanography, La Jolla, CA.
. Goldberg, M. Koide, V. Hodge, A. R.
al, and J. Martin.
arine, Coastal and Shelf Science, Vol. 16, No. 69-93, January, 1983. 5 Fig, 2 Tab, 15 Ref.

criptors: *Monitoring, *Mussels, *Trace is, *Radionuclides, Silver, Copper, Zinc, Cad- n, Nickel, Lead, Plutonium, Americium, Up- ng, Water pollution sources, Urban areas.

U.S. Mussel Watch Program began in 1976 the overall aim of providing stategies for tant monitoring in coastal waters. Results for eriod 1976-1978 are presented for trace metals artificial radionuclides in bivalves. The sub- es analysed included Ag, Cu, Zn, Cd, Ni, Pb, 38, Pu-239+240 and Am-241. The concentra- of these substances in the bivalves may reflect elling processes, anthropogenic inputs or natu- evels. Off the California coast, mussels show markedly elevated Pu and Cd concentrations in coastal areas adjacent to the most intensive upwelling zones. Elevated levels of Pb, for example, are found in organisms living adjacent to highly urbanized places. The general patterns of distribution repeat themselves year after year at a given site. Annual monitoring activities may not be necessary and a frequency of sampling of several years may be more appropriate to identify pollution problems. National baselines for Pb in the west coast mussels of 1.0 parts/1,000,000 and for Ag in east coast mussels of 0.05 parts/1,000,000 are suggested. Certain processes could only be identified where a collecting program involved a number of geographic locations and a time period of greater than 1 year. Without a systematic national survey, elevated Cd and Pu concentrations in mussels might have been interpreted as a consequence of localized anthropogenic sources rather than of a coastal physical phenomenon such as upwelling. (Moore-IVI)
W85-00669

GROUNDWATER SUPPLY SURVEY,
Environmental Protection Agency, Cincinnati, OH.
For primary bibliographic entry see Field 5F.
W85-00702

CHRYSOTILE ASBESTOS IN CALIFORNIA SURFACE WATERS: FROM UPSTREAM RIVERS THROUGH WATER TREATMENT,
California Inst. of Tech., Pasadena. Dept. of Engineering Science.
R. C. Bales, D. D. Newkirk, and S. B. Hayward.
Journal of American Water Works Association, Vol. 76, No. 5, p 66-74, May, 1984. 10 Fig, 6 Tab, 29 Ref.

Descriptors: *Chrysotile, *Asbestos, *California, *Fate of pollutants, Water pollution sources, Weathering, Serpentine, Surface waters, Reservoirs, Water treatment, Coagulation, Filtration, California Aqueduct.

As a result of the natural weathering of serpentine rock, chrysotile asbestos fibers are found in some surface waters originating in the western slopes of the Sierra Nevada and in the coastal mountains of California. Deposits in California yield short fibers, 90% of which are from 0.1 to 3.0 micro m long. Concentrations of chrysotile asbestos fibers in surface waters are estimated from a mass-balance model that takes into consideration natural weathering and removal of fibers by coagulation in reservoirs. Fiber concentrations range from 10 to the 8th/L in waters from the western slope of the Sierra Nevada foothills in the central part of the state of 10 to the 10th/L in rivers in the northwest part of the state. Fiber concentrations increase approximately fourfold as water passes through the California Aquiduct. Fiber removals of from 90 to 99.8% were observed in reservoirs with detention times of from 0.5 to 3 years. Removal of submicron-sized fibers in water treatment plants also ranged from 90 to 99.8%, depending on the degree of coagulation prior to filtration. Higher removals, > or = 99.9%, were observed in only a few cases, which represent enhanced coagulation before or during filtration. (Moore-IVI)
W85-00704

WATER POLLUTION CONTROL FOR UNDERGROUND COAL GASIFICATION,
Wyoming Univ., Laramie. Dept. of Civil Engineering.
M. J. Humenick.
Journal of Energy Engineering, Vol. 110, No. 2, p 100-112, June, 1984. 1 Fig, 5 Tab, 22 Ref.

Descriptors: *Coal gasification, *Groundwater pollution, Water pollution sources, Fate of pollutants, Water quality, Wastewater treatment, Adsorption, Ion exchange, Precipitation, Dilution, Dispersion, Monitoring.

Water pollution arising from underground gasification of coal is one of the important considerations in the eventual commercialization of the process. Because many coal seams which are amenable to in situ gasification are also ground-water aquifers, contaminants may be released to these groundwaters during and after gasification. When product gas is processed above ground for use, wastewater streams are generated which are too polluted to be discharged. Contaminants released to groundwater are both organic and inorganic materials. Inorganic material is principally released by ash leaching, while the organic materials arise from condensed gases and pyrolysis of surrounding coal by hot gases. Pollutants tend to decrease with time and distance from the burn cavities. Mechanisms which tend to reduce the groundwater contaminants are adsorption and ion exchange on the surrounding strata, precipitation reactions, dilution and dispersion by groundwater flow, and biological conversion reactions. Groundwater monitoring at some field test sites have indicated a return to baseline water quality; at other sites the contamination has persisted with time. Polluted water generated by above-ground processing of product gas is similar by not identical to the wastewaters generated by aboveground gasification processes. Guidance for treatment of these wastewaters for reuse or discharge is available from work performed on above-ground gasification wastewaters. (Moore-IVI)
W85-00717

PROBABILITY MODEL OF STREAM QUALITY DUE TO RUNOFF,
Manhattan Coll., Bronx, NY. Environmental Engineering and Science Graduate Program.
D. M. Di Toro.
Journal of Environmental Engineering, Vol. 110, No. 3, p 607-628, June, 1984. 11 Fig, 4 Tab, 16 Ref, 2 Append.

Descriptors: *Runoff, *Water quality, *Streamflow, Model studies, Probability distribution, Path of pollutants, Dilution, Rapid Creek, Dakota.

Probabilistic water quality analysis starts with classical, deterministic, water quality models of fate of pollutants and overlays probability theory in such a way that the probability distribution of the relevant concentrations are computed. An effective approximate method has been found for computing the exceedence probability of a downstream concentration that results from simple dilution and lognormal concentrations and flows. The exact equations which include the possibility of concentration flow cross correlation are also derived and numerically evaluated. The formulas are checked using simulations and verified using runoff and stream data from Rapid Creek, South Dakota. These demonstrate both the applicability and power of the methodology in the evaluation of the impact of runoff on the water quality of streams. (Baker-IVI)
W85-00718

COPPER TRANSPORT ALONG A SIERRA NEVADA STREAM,
Geological Survey, Menlo Park, CA.
J. S. Kuwabara, H. V. Leland, and K. E. Bencala.
Journal of Environmental Engineering, Vol. 110, No. 3, p 646-655, June, 1984. 2 Fig, 1 Tab, 27 Ref.

Descriptors: *Path of pollutants, *Streamflow, *Copper, California, Sierra Nevada, Mountain streams, Solute transport, Model studies.

A 3-component model is used to describe transport of a reactive solute, Cu, along a California mountain stream. The fact that measured, calculated and fitted parameter values for this model were well within the range of published values determined in the laboratory and that a dispersion coefficient calculated using an empirical equation formulated from other studies provides a good fit to the conservative model, suggests that this stream is not atypical and that this approach may be generally useful in studying solute transport in streams. This indicates that consideration of nonhydrologic mechanisms (both biological and chemical) in addition to conventionally examined physical transport processes such as advection and dispersion, may be important in describing transport of reactive solutes in streams. The model is not to be predictive

for all streams subjected to a reactive metal pollutant or even for this stream under very different environmental conditions. Indeed, the degree of importance of nonconservative processes varies with time and location. Effects of physical parameters on Cu uptake rates are not quantified in this model. This approach can be of value as a tool to identify the relative importance of interdependent hydrologic, chemical and biological processes in solute transport of reactive constituents. (Baker-IVI)
W85-00719

ORGANIC POLLUTANT SORPTION IN AQUATIC SYSTEMS,
Environmental Research Lab., Athens, GA.
S. W. Karickhoff.
Journal of Hydraulic Engineering, Vol. 110, No. 6, p 707-735, June, 1984. 5 Fig, 2 Tab, 64 Ref.

Descriptors: *Sorption, *Fate of pollutants, *Organic compounds, Aquatic environment, Particulates, Sediments, Aquatic soils, Organic carbon.

An understanding of sorption processes is an important key to describing pollutant fate in an aquatic system because sorption may alter significantly physical transport and chemical reactivity of pollutants. The sorption of uncharged organic chemicals to natural aquatic sorbents is dominated by 'hydrophobic interactions.' For composite particulates (i.e., sediments/soils), organic matter is the primary sorbing constituent. Sorption partition coefficients, indexed to organic carbon (Koc), are relatively invariant for natural sorbents. Koc's can be estimated from other physical properties of pollutants (aqueous solubility or octanol/water partition coefficients). Hydrophilic contributions to sorption tend to occur with one or both of the following conditions: (1) High sorbate polarity; and (2) low organic carbon content of the sorbent, especially with coincident high clay content. Although a priori estimation techniques comparable to hydrophobic sorption are not presently available, hydrophilic contributions relative to Koc can be estimated based upon chemical class and sorbent composition. Although sorption to sediment or soils is frequently viewed as a rapid process in environmental modeling, true sorption equilibrium may require weeks to months to achieve, with pollutant uptake and release kinetics highly dependent on molecular size, sorbent cohesive properties, and solids concentration. (Author's abstract)
W85-00726

CHLORINE TOLERANT BACTERIA IN A WATER DISTRIBUTION SYSTEM,
Monroe County Dept. of Health, Rochester, NY.
T. F. Clark.
Public Works, Vol 115, No. 6, p 65-67, June, 1984. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Water pollution sources, *Bacteria, *Brockport, *New York, *Water conveyance, Drinking water, Public health, Coliforms, Water pressure, Water distribution, Fire departments.

The Brockport, New York water treatment plant is located on the shores of Lake Ontario. During September and October of 1983 Brockport as well as the adjacent towns experienced incidents of coliform bacteria in the distribution systems. Water departments in all the affected municipalities had hypochlorinated and flushed numerous districts in an effort to expel the bacteria but all efforts were unsuccessful. It was determined that a 200 ft length of 14 in diameter line had been installed as a bypass line beneath the Lake Ontario Parkway during the early 1950s. The valves were in a closed position, thus entraping 1,600 gallons of water. The water taken from the bypass line was quite black, with an odor very similar to that of hydrogen sulfide. Bacterial analyses showed the presence of bacteria identical to those found contaminating other parts of the system. The presence of the bacteria originally had occurred in the furthest reaches of Hamlin's water district. A fire training drill ten days previous to the initial coliform detection was conducted in the furthest reaches of the Hamlin/Kendall Water District. Due to the action of four pumping units, which were connected to 8-in and 10-in water lines, velocities within the mains reached 10 fps. System pressures were reduced from the normal 210 psi range, down to 50 psi. The accelerated flow from the district meter to the site of the drill would have served to sweep up sediments, deposits, and bacterial slimes. The heavy demand exerted by the drill would have seeded the district with bacteria from the bypass line as well. (Baker-IVI)
W85-00734

POLYCYCLIC AROMATIC HYDROCARBONS IN RAINWATER,
Institut d'Hygiene et d'Epidemiologie, Brussels (Belgium).
D. Quaghebeur, E. De Wulf, M. C. Ravelingien, and G. Janssens.
Science of the Total Environment, Vol. 32, No. 1, p 35-54, December, 1983. 10 Fig, 5 Tab, 12 Ref.

Descriptors: *Rain, *Water pollution sources, *Polycyclic aromatic hydrocarbons, *Belgium, Hydrocarbons, Aromatic compounds, Organic carbon, Wind, Heating systems.

A study on polycyclic aromatic hydrocarbons (PAH) in rainwater was carried out over periods of at least one year at two locations in Belgium with different environments. Maximum amounts and concentrations of PAH were reached during the winter period, mainly due to household heating. This influence was also reflected in the relative proportions of the six PAH measured. For comparable periods the amounts of PAH were almost proportional to the quantity of rain. With the available data, and as most of the rainfall is coming from the same wind direction, it was not feasible to localize possible pollution sources based upon the distribution of PAH over the different windsectors, nor was it possible to identify significant differences for both sampling locations due to their different surroundings, indicating that the rain plays an important role in the transport and distribution of pollutants over a wide area. Between about 100 and 170 micro g/sq m PAH and 2 to 3 g/sq m of total organic carbon content (TOC) per year were deposited by the rain, corresponding to mean concentrations of about 140 ng/l of PAH and 2.9 mg/l of TOC. (Author's abstract)
W85-00741

FATE OF OIL DISPERSANTS IN AQUATIC ENVIRONMENT,
National Water Research Inst., Burlington (Ontario).
D. Liu.
Science of the Total Environment, Vol. 32, No. 1, p 93-98, December, 1983. 3 Fig, 8 Ref.

Descriptors: *Oil dispersants, *Fate of pollutants, Cleanup operations, Oil spills, Bacteria, Aquatic environment, Biodegradation, Organic compounds.

Chemical oil dispersants have been used throughout most of the world to combat oil spills. However, their fate in aquatic environment remains uncertain. This study was conducted to investigate the persistence of five oil dispersants in the aquatic environment. The results indicate that petroleum utilizing bacteria possess high potential for the biodegradation of oil dispersants. The order of biodegradability for the five oil dispersants was as follows: Magnus 101 > BP1100X > BP1100 > Linco No. 4 > Corexit 8666. From the results of this study and a review of the literature data, it can be concluded that treatment of oil spills with chemical dispersants is unlikely to cause any build-up of organic contaminants in the aquatic environment. (Author's abstract)
W85-00742

FATE OF HEAVY METALS IN STORMWATER RUNOFF FROM HIGHWAY BRIDGES,
University of Central Florida, Orlando. Dept. of Civil Engineering and Environmental Science.
Y. A. Yousef, M. P. Wanielista, T. Hvitved-Jacobsen, and H. H. Harper.
Science of the Total Environment, Vol. 33, p 233-244, February, 1984. 3 Fig, 7 Tab, 11 Ref.

Descriptors: *Storm water, *Runoff, *Highway, Florida, Scupper drains, Drainage, Metals, Heavy metals, Percolation, Overland flow, Water pollution control.

Pollutants associated with runoff water from highway bridges located in Central Florida were characterized and quantified. These pollutants are directly discharged through scupper drains to adjacent water bodies and flood plains or detained in ponds before being released to lakes and streams. Runoff water contains heavy metals such as lead, zinc, copper, chromium, iron, nickel and cadmium which concentrate in adjacent soils and biota. Most of the heavy metals released to a lake were concentrated by bottom sediments. On a mass balance basis which estimated the average distribution of heavy metals per unit area between the dissolved fraction, suspended fraction and bottom sediments, most of the heavy metals were associated with the bottom sediments, typically 95-98% of the total. High concentrations of heavy metals in submerged plants and benthic organisms were detected. When highways pass over water bodies, especially land locked impoundments where the effects of heavy metal pollution are more localized and high traffic volumes are encountered, it is recommended that the use of scupper drains in new construction be limited as much as is feasibly possible. Runoff from the bridge surface should be directed off the bridge surface toward either side so that the runoff will experience the maximum overland flow to encourage percolation and removal of heavy metals before reaching the receiving body. (Baker-IVI)
W85-00746

EFFECT OF HIGHWAY RUNOFF ON LAKE WATER QUALITY,
Norsk Treteknisk Inst., Oslo.
E. Gjessing, E. Lygren, L. Berglind, T. Gulbrandsen, and R. Skaane.
Science of the Total Environment, Vol. 33, p 245-257, February, 1984. 5 Fig, 9 Tab, 5 Ref.

Descriptors: *Highways, *Runoff, *Water pollution sources, *Oslo, *Norway, Snowmelt, Storm water, Lead, Cadmium, Zinc, Polycyclic aromatic hydrocarbons, Organic compounds, Hydrocarbons.

A small lake close to a main highway in the Oslo area has been studied with regard to water quality. The contribution of pollutants from the surrounding area, from the local atmosphere, and directly from the pavement has been studied and related to the quality of the lake water and the outflowing water. PAH's, heavy metals, and several other quality parameters are evaluated. Studies of lead, cadmium, zinc, and PAH in sediments and bottom organisms are included. The water analyses, including most relevant drinking water parameters, suggest that the contributary brooks to a relatively moderate extent are affected by inorganic highway traffic pollutants, whereas organic pollutants and suspended matter are noticeably high; the washout water from the pavement is rich in inorganic and organic pollutants and suspended matter; the lake acts as a sink most of the year for important pollutants; and the water is significantly affected by chlorides from the road salt. The snow analyses show that during the winter a considerable amount of the pollutants are deposited within 5 m of the road side; that the pollutants are also transported a considerable distance through the air, being traced in the snow even at a distance of 300 m from the highway; and that the concentrations of the inorganic micropollutants in the snow on the lake are more than 10 times higher than in the lake water itself. The sediment analyses show a significant effect on the heavy metal concentration in the upper 2 cm of the sediments, and that these are distributed all over the lake, with a possible maximum in the deeper parts; and that the enrichment of Pb, Zn, and Cd relative to normal is 2-4 fold. The adsorption studies indicate that an essential part of the PAH's in the drainage water from highway pavement is retained in the soil surface layer. In general the results suggest that important pollutants probably are strongly related to the par

e matter (dust) which is transported through mosphere over long distances. (Baker-IVI)
0747

OF PHOSPHORUS AND NITROGEN IN S RECEIVING HIGHWAY RUNOFF,
rg Universitetscenter (Denmark). Dept. of Engineering.
itved-Jacobsen, Y. A. Yousef, M. P.
lista, and D. B. Pearce.
e of the Total Environment, Vol. 33, p 259-ebruary, 1984. 10 Fig, 3 Tab, 11 Ref.

ptors: *Phosphorus, *Nitrogen, *Highways, ff, *Ponds, Water pollution sources, Water , Nutrients, Fate of pollutants, Water qual-trol.

te of phosphorus and nitrogen was investi-in detention/retention ponds receiving high-runoff. Investigations comprising loading, and isolation chamber studies have been out in a 1.2 ha shallow pond located in Florida. Transformation and exchange or nutrients across the water sediment inter-ave been determined. About 99% of the total of phosphorus during 7 years has accumulat-the sediments. Furthermore, 85-90% of the itrogen input has been removed probably by fication. Also, in situ experiments demon-the importance of the sediment as a sink for hosphorus and nitrogen. Even though the is subjected to high areal loading of both horus and nitrogen a high water and sedi-quality is obtained as a result of good nutrient al efficiencies. Maintenance of a permanent ed sediment layer of some depth is a key Therefore, a shallow pond with sediments ated by inorganic matter, providing good n conditions at the water sediment interface, o be important parts of future quality design a for these ponds. (Baker-IVI)
0748

UENCE OF SURFACE RUNOFF ON THE RO-INVERTEBRATE FAUNA OF AN N STREAM,
esex Polytechnic, London (England).
E. Shutes.
e of the Total Environment, Vol. 33, p 271-ebruary, 1984. 5 Fig, 1 Tab, 16 Ref.

iptors: *Runoff, *Water quality control, r pollution sources, Storm water, Fauna, invertebrates, Invertebrates, Streams, Silk n, Dean's Brook, London, England, High-Population dynamics, Spatial distribution.

biological indices were applied to samples of macro-invertebrate benthos from an urban n. A range of physico-chemical parameters water samples were also determined. The quality of Silk Stream and its tributary, s Brook, determined by processing macro-ebrate data with the Trent Biotic Index, ller's Score system and Community Diversi-dex, deteriorated from a fairly clean to a ly polluted state within a distance of six eters. The Community Diversity Index was cted from physico-chemical data by multivar-nalysis and was found to be similar to the ved diversity index for fairly clean and mod-y polluted conditions but was dissimilar for e pollution occurrences. Although the specif-uence of street runoff was not totally satisfac-demonstrated by the intermittently collected co-chemical data, the spatial and temporal ion in macro-invertebrate numbers and spe-oted in the study do provide a basis for a first evaluation of storm runoff on urban channel gy. (Baker-IVI)
00749

RIENT SUPPLY OF LAKE GREBINER BY ATMOSPHERIC PRECIPITATION SURFACE RUN-OFF FROM THE WA-SHED AREA (NAHRSTOFFZUFUHREN GREBINER SEES DURCH ATMOSPHAR-E NIEDERSCHLAGE UND OBERFLA-NABSCHWEMMUNG DES EINZUGSGE-TES),
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
For primary bibliographic entry see Field 2H.
W85-00770

MIXING OF BURDEKIN RIVER FLOOD WATERS IN THE GREAT BARRIER REEF,
Western Australia Univ., Nedlands. Dept. of Civil Engineering.
E. Wolanski, and D. van Sended.
Australian Journal of Marine and Freshwater Research, Vol. 34, No. 1, p 49-63, 1983. 7 Fig, 19 Ref.

Descriptors: *Winds, *Floods, *Great Barrier Reef, *Burdekin River, Geomorphology, Fate of pollutants, Plumes, Mud, Barotrophic shelf wave, Sediments, Rainfall runoff, Mixing.

The spread and dispersion of Burdekin River flood waters in the Great Barrier Reef province is of considerable interest to geomorphologists studying the distribution of terrigenous sediments over the continental shelf, and to biologists and planners interesed in the interaction of river runoff and coral reefs and the likely effects of the construction of a dam on the Burdekin River. The Burdekin River floods intermittently, resulting in plumes that are initially advected northwards along the coastline. Wind fluctuations in the central region of the Great Barrier Reef from December 1980 to February 1981 generated low-frequency reversing longshore current superimposed on the northward longshore currents initially generated both by intense direct rainfall over the continental shelf and by Burdekin River floods. The river plumes, which account for terrigenous mud distribution on the sea floor, were swept over the Great Barrier Reef. The intense direct rainfall over the continental shelf and Burdekin River floods may create a barotropic shelf wave. (Baker-IVI)
W85-00776

MODELLING THE TRANSPORT OF REACTING CHEMICAL CONTAMINANTS IN NATURAL STREAMS,
Commonwealth Scientific and Industrial Research Organization, Ryde (Australia). Physical Technology Unit.
B. M. Chapman, R. O. James, R. F. Jung, and H. G. Washington.
Australian Journal of Marine and Freshwater Research, Vol. 33, No. 4, p 617-628, 1982. 2 Fig, 3 Tab, 21 Ref.

Descriptors: *Model studies, *River flow, *Fate of pollutants, Advection, Dispersion, Chemical reactions, Acid mine drainage, Solute transport, Sodium acetate, Potassium bicarbonate.

A need exists for a river model in which advection and dispersion are controlled by general functional hydrological parameters and in which the many chemical reactions occurring in the river are treated simultaneously in detail. Such a model (RIVEQL) is briefly described and then applied to a creek, contaminated with acid mine drainage, into which the weak bases sodium acetate and potassium bicarbonate are intentionally injected. The model can also be used to simulate much more complex situations which might arise from accidental spills. These could involve, for example, nonuniform dispersion coefficients and volumetric flow rates, and time varying injection rates of several separate point and distribution sources of different chemical inputs occurring simultaneously along the stream. (Baker-IVI)
W85-00778

TRACE METALS IN SEDIMENTS FROM THE YARRA RIVER,
Melbourne Univ., Parkville (Australia). Dept. of Geography.
M. Ellaway, B. T. Hart, and R. Beckett.
Australian Journal of Marine and Freshwater Research, Vol. 33, No. 5, p 761-778, 1982. 3 Fig, 3 Tab, 60 Ref.

Descriptors: *Trace metals, *River sediments, *Yarra River, *Australia, Sedimentation, Iron, Manganese, Cadmium, Copper, Lead, Zinc, Estuarine environments, Heavy metals, Water pollution sources, Fate of pollutants.

The distribution and phase association of iron, manganese, cadmium, copper, lead and zinc in bottom sediments taken from the freshwater, estuarine and bay regions of the Yarra River were investigated. The fraction of the estuarine sediments smaller than 20 micro m contained substantially higher concentrations of cadmium, copper, lead and zinc than did the corresponding sediment fraction from the upper river and bay regions. Sequential chemical extraction revealed that most of the veriability in the trace metal concentration of these sediments was associated with changes in the reducible phase. Sediments in the Yarra River system contain elevated trace metal concentrations in the estuary, probably as a result of associations with iron and manganese oxide colloids that are coagulated and sedimented in the estuary. The reduction in trace metal concentrations in the bay sediments could be due to either remobilization or physical dilution of the sediment. The increase in metal concentrations in the estuary is caused by the city of Melbourne which is situated on and upstream of the estuary. Trace metals enter the lower freshwater section of the river from stormwater runoff and from a number ofsewage treatment plants that discharge to creeks eventually flowing into the Yarra. (Baker-IVI)
W85-00780

UPTAKE OF CADMIUM BY THE SEAGRASS HETEROZOSTERA TASMANICA FROM CORIO BAY AND WESTERN PORT, VICTORIA,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Lab.
G. J. Fabris, J. E. Harris, and J. D. Smith.
Australian Journal of Marine and Freshwater Research, Vol. 33, No. 5, p 829-836, 1982. 2 Fig, 3 Tab, 24 Ref.

Descriptors: *Cadmium, *Victoria, *Corio Bay, *Western Port, *Australia, *Seagrasses, Fate of pollutants, Heavy metals, Leaves, Rhizomes, Roots.

Laboratory experiments showed that both the leaves and the root-rhizome system of H. tasmanica can accumulate cadmium from their environment when cadmium is present in a soluble form. As the cadmium was added in ionic form, the major species in solution would be predominantly inorganic complexes with chloride ions. The fractionation experiments indicated that foliar cadmium uptake involves cadmium transport through cell membranes. The amount of cadmium accumulated by the leaves was lower than that accumulated by root-rhizomes. The root-rhizome system, with its complex structure of fine root hairs, offers a greater surface area for sorption than do the leaves. It is also possible that the structure and composition of the surface of leaves inhibit the transport of sorbed cadmium across cell membranes to a greater extent than does the surface of the root-rhizomes. The rate of cadmium uptake by the leaves was relatively fast initially but decreased rapidly to a constant low value after about 150 hr in both the 40 and 400 microgram/l treatments. The final cadmium concentration in the leaves is in proportion to the concentration in the seawater. Field experiments indicate that seagrass with initially low concentrations of cadmium in leaves and root-rhizomes, and growing in sediment low in cadmium, accumulate cadmium primarily in the leaves only when exposed to elevated cadmium concentrations in the water. There was no indication of basipetal or acropetal transport of cadmium in the laboratory experiments with H. tasmanica. (Baker-IVI)
W85-00784

FACTORS INFLUENCING CONCENTRATIONS OF POLYCHLORINATED BIPHENYLS IN ORGANISMS FROM AN ESTUARINE ECOSYSTEM,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
G. R. Shaw, and D. W. Connell.

Australian Journal of Marine and Freshwater Research, Vol. 33, No. 6, p 1057-1070, 1982. 6 Fig, 2 Tab, 37 Ref.

Descriptors: *Polychlorinated biphenyls, *Estuarine environment, *Australia, *Brisbane River, *Bioaccumulation, *Biological magnification, Moreton Bay, Logan River, Arochlors, Sediment concentration, Polychaetes, Mullet, Pelicans, Gulls, Catfish, Steric effects, Partition coefficient, Fish, Birds, Invertebrates.

Polychlorinated biphenyls (PCB's) were detected in both the abiotic and biotic components of the Brisbane River estuary (Australia). Fish, bird, invertebrate, and the oyster blennie specimens and water and surface sediment samples were collected from the estuary in 1979 and 1980. Polychaetes were collected from a PCB-free site in Moreton Bay and juvenile sea mullet were collected from a PCB-free site in the Logan River estuary. Maximum average concentrations were determined in the muscle tissue of pelican (8.2 mg/kg), gull (2.6 mg/kg) and catfish (2.1 mg/kg). Biomagnification was shown not to be a significant factor controlling PCB concentrations in the organisms investigated except in pelicans and gulls. In these cases, estimates of uptake from food sources indicated that biomagnification could be the major process involved. Metabolism or excretion was also found to influence the observed PCB composition of these organisms. Field and laboratory data indicated that, with some benthic organisms, sediment concentrations were the major influence on body concentrations of PCB's and a direct relationship between body concentration and the log of sediment concentration was established. The uptake of individual PCB's was influenced primarily by two factors: the partition coefficient of n-octanol to water (p) and stereochemical effects. A direct relationship between uptake and the product of log p and the steric effect coefficient was demonstrated. Maximum uptake was found with penta- and hexachlorobiphenyls which are predominant in Arochlor 1254. Comparatively less uptake was found with di-, tri- and tetrachlorobiphenyls (Arochlor 1242), which have lower values for log p, and hepta- and octachlorobiphenyls, predominant in Arochlor 1260, which have lower steric effect coefficients. (Collier-IVI)
W85-00787

WATER POLLUTION BY URANIUM ORE TREATMENT WORKS,
Compagnie Francaise des Minerais d'Uranium, Paris (France).
For primary bibliographic entry see Field 5C.
W85-00793

MERCURY LEVELS IN FISH, INVERTEBRATES AND SEDIMENT IN A RECENTLY RECORDED POLLUTED AREA (NISSUM BROAD, WESTERN LIMFJORD, DENMARK),
Marine Pollution Lab., Charlottenlund (Denmark).
T. Kiorboe, F. Mohlenberg, and H. U. Riisgard.
Marine Pollution Bulletin, Vol. 14, No. 1, p 21-24, January, 1983. 1 Fig, 1 Tab, 12 Ref.

Descriptors: *Nissum Broad, *Limfjord, *Denmark, *Mercury, *Contamination, *Fish, *Invertebrates, *Sediments, Goby, Flounder, Mussels, Periwinkles, Biological magification, Path of pollutants.

A chemical factory at the west coast of Nissum Broad, the western Limfjord, Denmark, worked up, in the period 1952-1962, 600 tons of metallic mercury; 30 tons of the mercury were either discharged into the Nissum Broad by process waste water or otherwise disposed of or lost. Sediment samples and macroinvertebrate, spotted goby (Pomatoschistus microps), flounder (Platichthys flesus), mussel (Mytilus edulis), and periwinkle (Littorina littorea) specimens were collected in the area in 1981. Sediment contained up to 22 ppm (dry wt) of mercury, deposit-feeding bivalves between 1.4 and 4.4 ppm (wet wt), suspension-feeding bivalves between 0.9 and 1.9 ppm and predatory fish between 0.3 and 0.8 ppm. There was no consistent pattern of mercury concentration with trophic level. Outside the 'hot spot' area, the mercury concentration in sediment and mussels rapidly decreased with increasing distance from the former factory. Mercury concentration in flounders collected near the factory averaged 0.735 + or - 0.255 ppm and in flounders collected 2 km distant averaged 0.847 + or - 0.318 ppm, but did not differ significantly. (Collier-IVI)
W85-00801

TRACE METALS IN A TIDAL MEDITERRANEAN EMBAYMENT,
Athens Univ. (Greece). Inorganic Chemistry Lab.
M. Scoullos, and M. Dassenakis.
Marine Pollution Bulletin, Vol. 14, No. 1, p 24-29, January, 1983. 6 Fig, 3 Tab, 11 Ref.

Descriptors: *Greece, *Euvoikos gulf, *Euripos, *Trace metals, *Tidal currents, Sediments, Lead, Copper, Zinc, Chromium, Iron, Magnesium, Nickel, Suspended solids, Path of pollutants.

The Euvoikos gulf, and the strait of Euripos therein, is a restricted embayment on the eastern coast of Greece having a significant, unusual tidal phenomenon. The area receives some domestic, trade and industrial wastes from the town of Chalkis and several coast industries. In 1980, sea water samples and surface sediment samples were collected and analyzed for Pb, Cu, Zn, Cr, Fe, Mn and Ni. Thorough mixing, resuspension and transport of fine particles and direct discharges are the major mechanisms affecting the distribution patterns of these trace elements, both in the seawaters and the sediments. Fine particles do not accumulate in the channel; they are removed towards the coast or deeper areas which are less affected by the tides and then settle, giving rise to metal concentration peaks in the sediments. (Collier-IVI)
W85-00802

UPPER LAMINGTON RIVER INTENSIVE SURVEY, INTENSIVE SURVEY NO. 803404.
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
Report, August 1981. 224 p, 13 Tab, 21 Fig, 20 Ref, 8 Append.

Descriptors: *Rivers, *Surveys, *Biological analysis, *Chemical analysis, Physical analysis, River basins, Watersheds, Dissolved oxygen, Stream discharge, Streambeds, Effluents, Water quality, Wastewater, Wastewater pollution, Water pollution control, Biomass, Aquatic plants, Wastewater treatment, *New Jersey, Lamington River.

During the summer of 1980 the New Jersey Division of Water Resources conducted an intensive survey of the Lamington (Black) River between State Highway 10 in Roxbury Township and State Highway 24 in Chester Township. The State undertook the project to gather effluent and stream water quality information to be used in calculating an effluent limitation for Roxbury Township's Ajax Terrace Wastewater Pollution Control Plant No. 1. The study found that the Lamington River was a moderately degraded river system which underwent changes in water quality and aquatic plant biomass as a result of natural and artifical (man-related) causes. Ten stations were routinely sampled for physical, chemical, and biological constituents during the study. Several other sources, including municipal utility authorities and local governments, provided information such as rainfall data, unique flow information, and sewage treatment plant discharge data. The evaluated value of many water quality constituents at the head of the study area indicated slight degradation, possibly the result of the two industrial effluents, the associated land use, and the lakes upstream of Route 10. The upstream segment was characterized by elevated dissolved oxygen and un-ionized ammonia concentrations attributed to the aquatic plant photosynthesis and decomposition, respectively. The lake also served as a heat sink, keeping diurnal temperature fluctuation low. (Fazio-Omniplan)
W85-00819

1980 WHIPPANY RIVER INTENSIVE SURVEY, INTENSIVE SURVEY NO. 803403,
New Jersey Dept. of Environmental Protecti
Trenton. Div. of Water Resources.
J. T. Reading.
Report, June 1981. 118 p, 6 Fig, 19 Tab, 16 Re
Append.

Descriptors: *River basins, *Rivers, *Surve
Water quality, *Water quality standards, Wa
load, Watersheds, Wastewater treatment, I
solved oxygen, Chemical analysis, Biological a
ples, Physical analysis, Effluents, Sediments, *N
Jersey, Whippany River.

During 1980 the New Jersey Bureau of Monitor
and Data Management conducted an intens
survey of the Whippany River to verify a
solved oxygen model for the Whippany River
veloped by the State's Department of Environm
tal Protection. Secondarily, the Bureau of Mo
ling and Wasteload Allocations will use the dat
develop wasteload allocations for point sour
along the river. This report evaluates the wa
quality data obtained during the survey and ass
es the overall water quality of the Whippany Ri
System. The upper segment of Whippany Ri
from the outfall of Speedwell Lake to just
stream of the Morristown Sewage Treatment Pl
(STP) had fair water quality, and the segment fr
just below the Morristown STP discharge to I
wards Road had poor water quality. Upgrading
the Morristown STP should do much to impro
the water quality of the segment of the river bel
its discharge. After a field reconnaissance, stat
stream bed geometries were determined by phy
cal measurement. Water quality sampling was c
ducted over two separate three-day periods
relatively consistent low flow conditions and t
single-day periods immediately after or during s
nificant precipitation. The three major samp
sources having negative influences on Whippa
River water quality were the Morristown STP,
Hanover STP, and Black Brook. (Fazio-Omnipl
W85-00820

MUSCONETCONG RIVER INTENSI SURVEY REPORT 803401,
New Jersey Dept. of Environmental Protecti
Trenton. Div. of Water Resources.
C. G. Schiller, and K. Wagner.
Report, August 1981. 96 p, 5 Tab, 18 Ref,
Append.

Descriptors: *River basins, *Rivers, *Surve
*Water quality, *Biological samples, Waste lo
Wastewater, Wastewater treatment, Physical an
ysis, River flow, Chemical analysis, Watershe
Pollutants, Catchment areas, Dissolved oxyg
Sediments, *New Jersey, Musconetcong River.

During the summer of 1980 New Jersey's Bure
of Monitoring Management conducted an intens
survey along the upper portion of the Muscon
cong River Drainage Basin to establish pres
water quality and assess the river's capability
assimilate additional wastewaters from the p
posed expansion of the Musconetcong Sewera
Authority treatment facility. While results indic
ed no noticeable impact from non-point sourc
the geological makeup of the watershed is su
that future development may pose a problem. T
interaction of the surface and ground water,
steep slopes, and the rock outcroppings all indic
unfavorable conditions for on-site sewage dispo
and erosion control. Future land developm
should be planned so as to maximize collect
treatment and establish well defined practices
erosion and runoff control during construction
tivities and storm events. After a field reconna
sance to finalize station locations and identify
tential problem areas, station stream bed geor
tries were determined by physical measureme
Water quality sampling procedures were those o
lined in the Field Procedures Manual for Wat
Data Acquisition. Chemical and bacteriologi
samples were analyzed pursuant to USEPA
proved methods. Observed water quality was s
acceptable for the designated use as classifi
being FW-2. (Fazio-Omniplan)
W85-00821

TER QUALITY AND BIOLOGICAL EF-
CTS OF THE ACCURATE FORMING IN-
STRIAL DISCHARGE.
v Jersey Dept. of Environmental Protection,
nton. Div. of Water Resources.
ort NJ 0002275, undated. 21 p, 1 Fig, 5 Tab, 6

criptors: *Water quality, *Effluents, *Water
pling, *Water quality standards, Ecosystems,
ogical samples, Industrial wastes, Chemical
ysis, Macroinvertebrates, Aquatic insects, Pri-
y productivity, Chlorophyll a, Heavy metals,
atile solids, *New Jersey, Wallkill River.

November 1981 the New Jersey Bureau of
nitoring and Data Management studied the ef-
s of Accurate Forming's industrial effluent on
Wallkill River as part of a U.S. Environmental
tection Agency program designed to verify
er quality criteria derived from laboratory
ies with field data. The Bureau collected both
ogical and chemical samples. The Wallkill
er upstream from Accurate Formings' industri-
ffluent was relatively clean and supported a
thy biological community. The Ames Rubber
ent had a deleterious effect on the macroinver-
ate population of the left channel upstream
n Highway 94, but no effect was detectable 250
downstream. The Ames River industrial dis-
ge and/or Accurate Forming sanitary effluent
e apparently responsible for increases in ben-
, 1,1,1-trichloroethane, trichloroethylene and
l coliform bacteria measured upstream from
Accurate Forming industrial effluent. Accurate
ming's effluent had a devastating effect on the
roinvertebrate population 60 feet downstream
n the discharge, reducing population density by
and number of genera by 49%. Concentra-
s of methylene chloride, trivalent chromium,
valent chromium and nickel were excessive as
e effluent temperature and pH. Methylene
ride continued to be detected 300 feet down-
m from the effluent discharge. (Fazio-Omni-
)
-00822

MPARISON OF AQUATIC SPECIES COM-
SITION AND DIVERSITY IN DISTURBED
) UNDISTURBED PINELANDS WATERS,
gers - The State Univ., Camden, NJ. Dept. of
ogy.
D. Morgan.
ort, Undated. 61 p, 8 Fig, 17 Tab, 42 Ref.

criptors: *Streams, *Stream biota, *Aquatic in-
s, *Water quality data, *Fish, *Algae, *Macro-
es, Water quality, Stream profiles, Nitrogen
pounds, Acidity, Phosphorus, Biological sam-
Correlation coefficient, *New Jersey, Pine
ens.

study characterizes the physical, chemical,
biological features of six New Jersey Pine
ens second order streams and compares the
r quality and biota of disturbed and undis-
ed streams. The study demonstrated significant
itative and quantitative differences between
rbed and undisturbed streams. The water qual-
ata show that disturbed streams are character-
by elevated NO3-N and pH. These streams do
consistently differ in any other physical or
nical parameter measured. Thus, the observed
rences in biota appear directly related to dif-
nces in nitrogen and pH. It is not clear why
phorus in the disturbed streams is so low. The
othesis is that disturbed streams are phosphorus
ed could be tested by studies on streams with
ated phosphorus (stream sections below
ge treatment plants would be ideal). The pre-
on would be that increased phosphorus will
lt in a biota dramatically different from that
d in even the most disturbed stream in this
y. As many water quality parameters as possi-
were measured at the field sites. All biological
pling occurred on the same dates as water
ity sampling except for aquatic insects. The pH
NO3-N values for the disturbed streams aver-
5.9 and 426 micrograms/liter respectively
pared with 4.3 and 19 micrograms/liter in the
sturbed streams, which are statistically signifi-
differences. (Fazio-Omniplan)
-00823

EXECUTIVE SUMMARY, WATER POLLUTION STUDIES, FOX RIVER VALLEY, WISCONSIN.
Killam (Elston T.) Associates, Inc., Millburn, NJ.
Report, May 1978. 47 p, 5 Fig, 8 Tab, 1 Append.

Descriptors: *Water pollution sources, *Agricultural watersheds, *Urban watersheds, *Sediment discharge, *Toxicity, *Septic tanks, *Dredging, *Trophic level, *Nutrients, Water quality, Chemical wastes, Pesticide toxicity, Heavy metals, Eutrophication, Chlorophyll a, Phosphorus, Pollutants, Wastewater treatment, Water pollution control, Lakes, Bays, Rivers, *Wisconsin, *Fox River Valley.

During 1976, consultants to the Fox Valley Water Quality Planning Agency identified existing and projected magnitudes of non-point source pollution in the Fox River Valley Waters. These studies were necessary to complete the Agency's Areawide Waste Treatment Management Planning responsibilities. The Agency also sponsored studies of the trophic status of the Winnebago Pool and Lower Green Bay to set a benchmark for measurement of future pollution control, and it developed a nutrient budget for the pool lake system for decision-making about water quality goals. The six-volume Characterization of Non-point Waste Sources contains the findings, the methodology, and raw concentration and flow data. Two different trophic assessment methods found Winnebago Lake to be the most eutrophic of 12 Wisconsin lakes but without excessively high levels of chlorophyll-a in comparison to other shallow lakes around the world. In the Inner Bay area, loading of phosphorus from the Lower Fox River accounts for approximately half of the variability of average total phosphorus concentration. The nutrient budget, technically linking the non-point source and trophic status studies, contains six sources of nutrient pollution in the area: septic tanks, municipal wastewater treatment plants, urban runoff, rural runoff, and pollutant loadings from the Upper Fox and Wolf Rivers. The water quality problems of the Winnebago Pool are the cause of some of the problems in the Lower Fox River and in Lower Green Bay. (Fazio-Omniplan)
W85-00827

GROUNDWATER: A SURVEY OF CONTAMINATION POTENTIAL IN THE FOX VALLEY REGION,
Wisconsin Univ.-Oshkosh.
M. L. Bohrer, M. R. Krolow, and J. C. Laumer.
Report, September 1981. 88 p, 13 Fig, 8 Tab, 26 Ref, 2 Append.

Descriptors: *Groundwater recharge, *Groundwater pollution, *Water quality, *Geohydrology, Groundwater reservoirs, Groundwater management, Groundwater movement, Bedrock, Glacial deposits, Soil texture, Soil properties, Soil structure, Land use, Aquifers, Surface Water, Surface-groundwater relations, Waste disposal, Geologic mapping, Sulfates, Chlorides, Landfills, *Wisconsin, Fox River Valley.

In 1975 the Fox Valley Water Quality Planning Agency began management planning in the Fox Valley of Wisconsin, with the goal of developing a system to restore and maintain a high quality surface water resource. Before any comprehensive planning may be undertaken, more data are needed, especially on the natural quality of water from the area's aquifers, groundwater flow patterns, existing usage of groundwater, and potential sites of contamination. A literature review and field work determined the potential for groundwater contamination. To assess the present quality of groundwater and to identify areas already degraded, the Agency surveyed residents of areas with a high potential for contamination. Quality problems are relatively common, most relating to poor taste and/or odor and attributable to the high levels of dissolved solids. The prevalent bedrock formations of the area are dolomites. The deepest aquifer consists of the sandstone formations of Cambrian and Ordovician age. The major impermeable formations are the Maquoketa Shale and the Precambrian crystalline rock. The bedrock is covered with glacial deposits. Recharge of the Valley's bedrock aquifers principally occurs in sandy soils west of the Fox Cities. Saline groundwater is present in the deep sandstone aquifer. This report provides geologic and groundwater information specific to the Fox Valley region in a format of use to planners, engineers, local government officials, and area residents. (Fazio-Omniplan)
W85-00830

WATER QUALITY MANAGEMENT PLAN, FOX RIVER VALLEY, WISCONSIN, ADDENDUM II: WASTELOAD ALLOCATION AND POLICY RECOMMENDATIONS FOR DISCHARGERS TO THE LOWER FOX RIVER FROM NEENAH-MENASHA TO DE PERE.
Fox Valley Water Quality Planning Agency, Menasha, WI.
For primary bibliographic entry see Field 5G.
W85-00832

CHARACTERIZATION OF NON-POINT WASTE SOURCES, REPORT NO. 6: SUMMARY OF NON-POINT WASTE LOADS, (FOX RIVER VALLEY, WISC.),
McMahon Associates, Inc., Menasha, WI.
R. R. Much, and G. Kemp.
Report, April 1978. 135 p, 13 Fig, 30 Tab, 4 Append.

Descriptors: *Water pollution sources, *Waste load, *Watersheds, *Sediment discharge, *Septic tanks, Septic wastewater, Dredging, Water quality, Storm runoff, Storm seepage, Surface water, Pollutants, Heavy metals, Chemical wastes, *Wisconsin, Fox River Valley.

As part of the planning program for Wisconsin's Fox Valley 208 area, the Fox Valley Water Quality Planning Agency conducted 5 non-point waste source characterization studies to analyze the most significant non-point waste sources in the Fox Valley, to determine if they are significant to water quality, and to determine what actions need to be taken for more precise characterizations. Non-point sources of water pollution are defined as: urban and rural storm water runoff; subsurface flows discharging into surface water; multiple, small scattered sources such as residential septic tank systems or activities, for example, dredging and construction of facilities that involve some disruption of the land or water environment and thereby introduce pollutants into the water system. This report summarizes the key findings of each of the 5 studies and identifies topics requiring additional study and the type of program required to accomplish the work. The total Characterization of Non-Point Waste Sources Program used a literature review and study area inventory and survey, a sampling and monitoring program to obtain primary data, and a determination of pollutant loadings and associated conditions. The 5 studies conducted were: 1) test watershed monitoring and sampling program; 2) sediment source and delivery rate study; 3) survey of toxic chemicals use and distribution; 4) septic tank study; and 5) instream alteration study. (Fazio-Omniplan)
W85-00833

POLYCHLORINATED BIPHENYL CONCENTRATIONS IN THE HUDSON RIVER WATER AND TREATED DRINKING WATER AT WATERFORD, N.Y.,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 5F.
W85-00835

WATER-QUALITY ASSESSMENT OF STORMWATER RUNOFF FROM A HEAVILY USED URBAN HIGHWAY BRIDGE IN MIAMI, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. J. McKenzie, and G. A. Irwin.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4153, 1983. 45 p, 15 Fig, 3 Tab, 20 Ref.

Descriptors: *Water quality, *Storm runoff, *Highway effects, *Florida, Miami.

Runoff from a heavily-traveled, 1.43-acre bridge section of Interstate-95 in Miami, Florida, was comprehensively monitored for both quality and quantity during five selected storms between November 1979 and May 1981. For most water-quality parameters, 6 to 11 samples were collected during each of the 5 runoff events. Concentrations of most parameters in the runoff were quite variable both during individual storm events and among the five storm events; however, the ranges in parameter concentration were about the same magnitude report for numerous other highway and urban drainages. Data were normalized to estimate the average, discharge-weighted parameter loads per storm per acre of bridge surface and results suggested that the most significant factor influencing stormwater loads was parameter concentration. Rainfall intensity and runoff volume, however, influenced rates of loading. The total number of antecedent dry days and traffic volume did not appear to be conspicously related to either runoff concentrations or loads. (USGS)
W85-00841

EFFECTS OF SPECIFIC LAND USES ON NONPOINT SOURCES OF SUSPENDED SEDIMENT, NUTRIENTS, AND HERBICIDES-PEQUEA CREEK BASIN, PENNSYLVANIA 1979-80,
Geological Survey, Harrisburg, PA. Water Resources Div.
P. L. Lietman, J. R. Ward, and T. E. Behrendt.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, Colo. 80225. USGS Water-Resources Investigations Report 83-4113, 1983. 88 p, 41 Fig, 16 Tab, 24 Ref.

Descriptors: *Storm runoff, *Pesticides, *Phosphorus, *Nitrate, *Nitrogen, *Sediment, *Land use, Agricultural watersheds, *Water quality, Transport, *Pennsylvania, Susquehanna River basin, Lancaster County, Pequea Creek.

Land use effects on water quality of receiving streams were examined in Pequea Creek basin, an agricultural area draining into the Susquehanna River. Streamflow was measured and base-flow and composite storm samples were analyzed for suspended sediment, nutrients, and triazine herbicides from Pequea Creek and specific land-use subbasins (forest, corn, rural residential, and pasture). Maximum base-flow concentrations of the constituents were: total organic nitrogen and phosphorus from the pasture, total nitrate nitrogen (about double the U.S. Public Health standard of 10 milligrams per liter) and atrazine from the corn site, prometone from the residential site, and simazine from Pequea Creek. The highest mean storm concentrations of suspended sediment were from the corn site, of organic nitrogen from the corn and pasture sites, and of nitrate nitrogen, phosphorus, and atrazine concentrations from the corn site. Phosphorus and atrazine concentrations were highest during intense storms following fertilizer and herbicide applications. Constituent loads from Pequea Creek during some months significantly increased the loads of nitrate nitrogen and suspended sediment of the Susquehanna River. The loads, in tons, from Pequea Creek in 1980 with 100,000 acre-feet of water were: suspended sediment, 12,000; nitrate, 840; organic nitrogen, 72; phosphorus, 21; organic carbon, 540; atrazine, 0.05; simazine, 0.03; and prometone, less than 0.01. (USGS)
W85-00855

TRENDS IN POLYCHLORINATED BIPHENYL CONCENTRATIONS IN HUDSON RIVER WATER FIVE YEARS AFTER ELIMINATION OF POINT SOURCES,
Geological Survey, Albany, NY. Water Resources Div.
R. A. Schroeder, and C. R. Barnes.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, Colo. 80225. USGS Water-Resources Investigations Report 83-4206, 1983. 28 p, 8 Fig, 9 Tab, 50 Ref.

Descriptors: *Polychlorinated biphenyls, Water quality, Rivers, Suspended sediment, Riverbeds, *Path of pollutants, Sediment transport, *Hudson River, Pollutant transport, Hudson Estuary, *New York.

Industrial discharge of polychlorinated biphenyls (PCBs) to the Hudson River from 1950 to the mid-1970's has resulted in serious degradation of the water. Contaminated river-bottom sediments continue to contribute PCBs to the river water. Concentrations in the sediment range from several hundred micrograms per gram near the outfall to less than 10 micrograms per gram in the lower estuary. PCBs are supplied by bottom sediments to the overlying water by two mechanisms--desorption and resuspension. Because desorption is a relatively constant process, concentrations of PCBs decrease as water discharge increases. At high flow, however, scouring by turbulence causes resuspension of PCB-laden sediment. Transport rates indicate that most PCBs enter the water from the most contaminated sediments, which are within 20 kilometers of the outfall. Mean daily transport from the upper river (except during high discharges) has decreased from 10 kilograms in 1976 to 5 kilograms in the late 1970's and to 1 kilogram in 1981. This decrease probably results from the burial of highly contaminated sediments by cleaner sediments originating upstream. (USGS)
W85-00856

GROUND-WATER HYDROLOGY BEFORE, DURING, AND AFTER COAL STRIP MINING OF A SMALL WATERSHED IN COSHOCTON COUNTY, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
A. C. Razem.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, Colo. 80225. USGS Water-Resources Investigations Report 83-4155, 1983. 36 p, 17 Fig, 3 Tab, 8 Ref.

Descriptors: *Groundwater, *Strip mines, Perched water, Saturated zone, Water quality, Spoil banks, Observation wells, Base flow, *Ohio, Coshocton County.

Ground-water conditions before, during, and after surface mining of a small watershed are described as part of a study to determine the effects of mining on hydrologic systems. The watershed was underlain by stratified sedimentary rocks containing three aquifers. The top and middle aquifers were perched above clay beds that underlay the major coal seams; the lowermost aquifer is part of a regional aquifer system and neither water levels nor water quality have been affected by mining. Replacement of the top aquifer by spoils during mining has caused many changes in the land surface, recharge rates, discharge rates, saturated thickness, water-table gradient, hydraulic conductivity, storage, and water quality. Changes in the middle aquifer include: the amount of recharge from precipitation, amount of leakage through the overlying clay bed, and water quality in some areas. Resaturation of the mining spoils during postmining has been slow and irregular, however, water levels in wells in the middle aquifer have remained virtually unchanged. The water quality in the mining spoils is significantly poorer than water in the original aquifer. Specific conductance concentration of water in the spoils is 2,020 micromhos per centimeter and sulfate is 940 milligrams per liter. Water levels and water quality in the deep aquifer have not been affected by mining. (USGS)
W85-00857

TECHNIQUES FOR EVALUATING SPATIAL AND TEMPORAL VARIABILITY IN SURFACE WATER QUALITY AS RELATED TO SOIL MOISTURE AND SUBSURFACE WATER FLUX IN FORESTED WATERSHEDS,
Nevada Univ., Reno. Dept. of Range, Wildlife and Forestry.
J. J. Rhodes, C. M. Skau, and J. C. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202589, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, Desert Research Inst. Publication No. 43011, October, 1983. 23 p, 6 Fig, 40 Ref. Project No. OWRT A-105-NEV (1), Co
tract/Grant No. 14-34-0001-2130.

Descriptors: Water quality, *Piezometers, Perm
ability coefficient, *Soil moisture, Recharg
Chemical analysis, Forest watersheds, *Nevad
Clear Creek watershed, Subsurface water, Path
pollutants, Nutrients, Orthophosphates, Nitrate n
trogen, Spatial variation, Temporal variation.

This study focuses on the nutrient (nitrate nitroge
and orthophosphate) pathways from precipitatio
(rain and snow) through subsurface flow to strean
flow for a forested watershed near Lake Tahoe
Nevada, U.S.A. It describes instrumentation (re
cording precipitation gages, snow courses, piezo
meters, neutron access probes, porous cup so
water samplers, and recording streamflow gage
used along with practical problems encountered i
deep snow accumulation and melt. Despite prob
lems in being below chemical detection limits an
with equipment failure, the monitoring networ
was most effective in describing the hydrologi
system response and provides a strong basis o
which to make chemical inferences. Presently
most of the field study's problems have been allev
ated and the past year's results should prove mo
useful in anticipating response and aiding in sam
pling at crucial times. Additionally, future researc
needs have been identified. While the instrumenta
tion used monitors various separate aspects of th
hydrologic system, the combination of data allow
a much more complete view of a complex syster
that has been previously available.
W85-00860

LOW-LEVEL RADIOACTIVE-WASTE BURIAL AT THE PALOS FOREST PRESERVE, ILLINOIS: GEOLOGY AND HYDROLOGY OF THE GLACIAL DRIFT, AS RELATED TO THE MIGRATION OF TRITIUM,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 5E.
W85-00865

PREDICTING SOLUTE YIELDS IN THE NATURAL WATERS OF A SUBALPINE SYSTEM IN ALBERTA, CANADA,
Northern Forest Research Centre, Edmonton (Alberta).
For primary bibliographic entry see Field 2K.
W85-00876

UPTAKE OF ZN, CD, AND HG BY FISH IN THE PRESENCE OF COMPETING COMPARTMENTS,
Alberta Environmental Centre, Vegreville.
S. Ramamoorthy, and K. Blumhagen.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 5, p 750-756, May, 1984. 3 Fig, 3 Tab, 28 Ref.

Descriptors: *Fish, *Heavy metals, *Accumulation, *Zinc, *Cadmium, *Mercury, Trout, Heavy metals, Organic matter, Sediments, Suspended solids, Fate of pollutants.

Rainbow trout were exposed to Zn, Cd, and Hg in the presence of competing compartments compartmentalized in a novel experimental apparatus. In fish uptake of Hg was more than doubled in the presence of Zn and Cd. Organic matter decreased the uptake of Hg and Zn but enhanced that of Cd. It was determined that organic matter decreased the uptake of Hg and Zn by fish but enhanced the uptake of Cd; equilibration with one heavy metal ion did not limit the fish in accumulating another heavy metal ion; possibly there exists different or multiple binding sites in fish for different heavy metal ions; mass balancing for the heavy metal ions studied revealed excellent recoveries for Cd and Zn but not Hg. The calculated partition coefficients (fish/substrate) for Zn, Cd, and Hg showed that these compartments are critical in the flux of Zn and Cd whereas sediment and suspended solids only determine the flux of Hg. (Baker-IVI)
W85-00891

IC STRENGTH CORRECTION FOR ENT OF AMMONIA IONIZATION IN SHWATER,
State Univ., Logan. Dept. of Civil and Environmental Engineering.
primary bibliographic entry see Field 2K.
-00895

NSPORT OF PCBS FROM AQUATIC TO RESTRIAL ENVIRONMENTS BY EMERG- CHIRONOMIDS,
d Univ. (Sweden). Limnological Inst.
arsson.
ronmental Pollution (Series A), Vol. 34, No. 283-289, June, 1984. 1 Fig, 1 Tab, 14 Ref.

criptors: *Fate of pollutants, *Midges, *Polyrinated biphenyls, *Growth stages, Sediment amination, Organochlorines, Larval growth e, Mature growth stage, Lead, Biological magation, Fats.

transport of PCBs from sediment to air by rging chironomids was studied in aquatic labory model systems. The uptake of PCBs from ic sediments by chironoid larvae was directly ed to PCB concentrations in the sediment. The entration factor, the slope of the linear regres- showed a low variation within the PCB levels ed. This indicates that the main process of uptake in the larvae was physical/chemical, partitioning of the PCB compounds between ment/interstitial water and the animals. A active uptake by, for instance, ingestion of ontaminated sediment particles and an active te in the gut would result in a larger variation e concentration factor. A direct relationship also found between the Pb concentration in ediment and concentrations in adult chirono- and exuviae. When chironomid larvae metahosed to adults the PCB compounds were entrated and a concentration factor of 4.6 (SD was obtained. When the chironomid larvae ged, their weight was reduced by a factor of rom 27.8 to 7.3 mg. The exuviae retained 17% e PCB compounds. Consequently, the loss of ht and the small amount of PCBs retained in xuviae explains the increase in concentration g the larva to adult process. When based on ctable fat calculations the concentration r was considerably lower, due to the higher ontent of adult chironomids compared with at content of the larvae. Accordingly, the compounds were diluted in the fat of adult nomids. The concentration of PCBs during rocess from larva to adult is important for the port of the compounds from the aquatic to the strial environment. Adult chiromoids con- d by insectivorous birds may contribute a derable amount of chlorinated hydrocarbons eir diet. No changes were noted in the PCB re originally added and that found in sedi- or chironomids. (Baker-IVI)
-00910

E OF PENTACHLOROPHENOL IN THE OF QUINTE, LAKE ONTARIO,
nal Water Research Inst., Burlington (Ontar- Environmental Contaminants Div.
. Fox, and S. R. Joshi.
al of Great Lakes Research, Vol. 10, No. 2, p 96, 1984. 2 Fig, 2 Tab, 12 Ref.

riptors: *Bay of Quinte, *Lake Ontario, *Penorophenol, *Fate of pollutants, Fish, Bioaccution, Chlorophenols, Decomposition.

tered water, surface film, sediment, and biota les were collected from the Bay of Quinte een May and September of 1978 and analyzed hlorophenols (CPs). Sectioned sediment cores dated using Pb-210 and Cs-137 analyses. Penorophenol (PCP) discharged from a point e in the upper bay was found at elevated ntrations throughout the 87 km length of the n water, surface film, sediments, and biota. al degradation of PCP to 2,3,4,6- and 2,3,5,6- hlorophenols (TTCP) by photochemical reve dechlorination was proposed to explain enhancement relative to PCP in the water nn and surface film. Further degradation via oxidative processes undoubtedly occurred but was not detected in this study. PCP and TTCP concentrations suggest a moderate to high degree of persistence in the aquatic environment. CP concentrations in sediments indicate that both PCP and TTCP accumulate by the settling of particles to which CPs are adsorbed, and that little change occurs over decades of burial. Limited measurements of biota showed a significant bioaccumulation of PCP in fish. (Baker-IVI)
W85-00925

TETRACHLORO-9H-CARBAZOLE, A PREVIOUSLY UNRECOGNIZED CONTAMINANT IN SEDIMENTS OF THE BUFFALO RIVER,
Environmental Research Lab.-Duluth, MN.
For primary bibliographic entry see Field 5C.
W85-00927

DISTRIBUTION OF HEAVY METALS IN BOTTOM MUD OF RIVERS IX. -DISTRIBUTION OF TOTAL AND ACID-SOLUBLE CU-,
Takasaki Coll. of Economics, Gumma (Japan).
F. Tada, and S. Suzuki.
Japanese Journal of Limnology, Vol. 43, No. 3, p 157-163, 1982. 6 Fig, 2 Tab, 12 Ref.

Descriptors: *Copper, *River sediments, *Japan, Bottom sediments, Mine wastes, Urban wastes, Path of pollutants, Organic matter, Mine drainage.

The total and 0.5N-HCl soluble Cu contents in the bottom mud of major rivers in Japan were determined. Base-line levels of total and acid-soluble Cu were 23 and 7 ppm, respectively. Total Cu content is generally affected by the parent rock in non-polluted rivers. A large part of Cu occurring in the bottom mud of urban rivers is associated with organic matter and is very soluble in 0.5N-HCl. The content of total Cu is high in bottom mud containing the drainage of mines but decreases drastically downstream. Thus the rivers of Japan are divided into three types based on Cu content: non-polluted, urban, and mining rivers. (Baker-IVI)
W85-00929

INFLUENCES OF HUMAN EXCREMENT ON WATER QUALITY IN THE MINAMI-ASAKAWA RIVER,
Kyoto Univ., Beppu (Japan). Geophysical Research Station.
K. Hosoya, and N. Ogura.
Japanese Journal of Limnology, Vol. 43, No. 3, p 199-207, 1982. 6 Fig, 3 Tab, 21 Ref.

Descriptors: *Japan, *Minami-Asakawa River, *Wastewater, *Water quality, Coprastanol, Feces, Organic carbon, Septic tanks, Water pollution sources, Fate of pollutants.

Influences of human excrement (night-soil) on water quality in Minami-Asakawa River (Japan) were studied during July 26-27, 1979, using coprostanol as an index of fecal pollution. Concentrations of coprostanol were 0.0-2.7 micro g/L (mean 1.6 micro g/L) at MA-3 (midstream) and 0.03-12.2 micro g/L (mean 4.0 micro g/L) at MA-5 (downstream). Higher concentrations were observed in sewage water flowing into the river between MA-3 and MA-5: 4.3-61.2 micro g/L (mean 22.9 micro g/L) at Sw-1 and 2.2-43.4 micro g/L (mean 11.8 micro g/L) at Sw-2. Coprostanol seemed to be derived from waste water mainly from septic tanks. It was found by budgets between MA-3 and MA-5 that coprostanol tends to change from particulate to dissolved form during river flow. However, apparent decrease of the total amount was not observed, and therefore coprostanol is considered to be fairly resistant to bacterial attack and behaves as a conservative substance in the river. It was suggested that organic loadings of night-soil origin were only 2% of the daily loadings of total organic carbon at MA-5, and great parts of remaining loadings were due to untreated domestic waste water. (Author's abstract)
W85-00934

ASSESSMENT OF AQUATIC RESOURCES ALTERED OR AT RISK FROM ACIDIC DEPOSITION,
Butler Univ., Indianapolis, IN. Holcomb Research Inst.
O. L. Loucks, R. W. Miller, and T. V. Armentano.
Northeastern Environmental Science, Vol. 3, No. 1, p 8-23, 1984. 1 Fig, 16 Tab, 30 Ref.

*Acid rain, *Water pollution effects, Alkalinity, Canadian Shield, Water pollution sources.

This study develops a baseline inventory of aquatic resources (lakes and streams) in the acid-sensitive regions of the eastern United States and estimates the potential magnitude of lake and stream alteration from acidic deposition. The approach to the inventory includes: (i) criteria, adopted from soil and watershed studies, which allowed the listing of individual counties, throughout 27 eastern states, having a moderate or high risk to the aquatic resource from acidic deposition; (ii) aggregation of these counties into 14 acid-sensitive regions totaling 245,000 square miles, and representing 23 of the 27 states; (iii) estimation of the number of lakes and miles of first- and second-order streams, using inventory procedures on USGS maps; and (iv) estimation of the total population of low alkalinity lakes and streams using state water-quality surveys and five recognized alkalinity classes. The results of the study show 17,000 (+ or - 10-20%) lakes in the 14 acid-sensitive regions. Of these, approximately 9,400 (+ or - 20%) are estimated to have alkalinity less than 200 micro-equivalents per liter, a level indicating either sensitivity to acid inputs or existing alteration by these inputs. For streams, a total of 117,000 (+ or - 10%) miles of first- and second-order streams occurs in the 14 regions, of which 60,000 miles (+ or - 20%) can be defined as aquatic resources already altered or seriously at risk. Alkalinity data from unimpacted areas of the Canadian Shield that are comparable geologically to the more heavily impacted areas of the U.S., along with historical time-trend data for alkalinity in the affected areas, have been used to define an 'acid-altered' status for lakes now observed as being in the lowest alkalinity classes. An estimated 3,000 lakes and 23,000 miles of stream (+ or - 20%) in the eastern U.S. meet the acid-altered criterion. (Author's abstract)
W85-00936

CONCENTRATION AND SURFACE MORPHOLOGY OF CHARCOAL PARTICLES IN SEDIMENTS OF GREEN LAKE, N.Y.: IMPLICATIONS REGARDING THE USE OF ENERGY IN THE PAST,
New York State Office of Public Health, Albany. Center for Labs. and Research.
B. K. Kothari, and M. Wahlen.
Northeastern Environmental Science, Vol. 3, No. 1, p 24-29, 1984. 3 Fig, 1 Tab, 11 Ref.

Descriptors: *Green Lake, *New York, *Charcoal particles, *Lake sediments, Electron microscopy, Fly ash, Fuel combustion, Coal, Oil, Wood, Sediments, Water pollution sources.

Concentration and surface morphology of charcoal particles > 38 micro m in diameter have been studied (using scanning electron microscopy techniques) in seven Green Lake (Fayetteville, New York) sediment samples deposited between 1580-1979 to determine the flux and distribution of charcoal particles from oil, coal, and wood combustion. For comparison, charcoal particles in oil, coal, and wood fly ash samples have also been analyzed. The fluxes of charcoal particles to the lake sediments generally decreased with depth in the sediment core. Charcoal particles from oil and coal burning are dominant in the three top sediment samples, deposited between 1905-1979, while the three bottom sediment samples, deposited between 1590-1823, mostly contain charcoal particles from wood burning; in the middle layer, deposited between 1845-1861, charcoal particles from both fossil fuel burning and wood combustion are found in roughly similar numbers. The source distribution and the amount of charcoal particles in various sediment layers can be qualitatively understood in terms of

usage of oil, coal and wood in the past. (Author's abstract)
W85-00937

LEGISLATORS PAUSE; ENGINEERS REFINE CONTROL TECHNOLOGIES,
For primary bibliographic entry see Field 6E.
W85-00941

INTERSTITIAL WATER METABOLITE CHEMISTRY IN A MARINE MINE TAILINGS DEPOSIT, RUPERT INLET, B.C.,
British Columbia Univ., Vancouver. Dept. of Oceanography.
T. F. Pedersen.
Canadian Journal of Earth Sciences, Vol. 21, No. 1, p 1-9, January, 1984. 10 Fig, 2 Tab, 32 Ref.

Descriptors: *Interstitial water, *Marine environments, *Mine wastes, *British Columbia, Rupert Inlet, Holberg Inlet, Phosphates, Ammonia, Alkalinity, Sulfates, Calcium, Hydrogen ion concentration.

The distributions of PO4(3-), NH4(+), SO4(2-), titration alkalinity, Ca(2+), and pH in interstitial waters collected from mine tailings and natural sediments in Rupert and Holberg inlets (Vancouver Island, British Columbia) are discussed. In natural sediments, dissolved ammonia, phosphate, and titration alkalinity increase with depth, and sulfate decreases, following established patterns for coastal sediments. In rapidly accumulating tailings, however, no dissolved phosphate enrichment is observed despite significant sulfate reduction. This phosphate depletion is accompanied by a calcium enrichment and a relatively high pH, which is probably due to the addition of lime to the tailings during milling. Solubility considerations suggest that the phosphate distributions in both tailings and natural deposits are controlled by equilibrium with respect to carbonate fluorapatite. Lime addition appears to increase the supersaturation of the pore water with respect to carbonate fluorapatite, resulting in phosphate consumption by the tailings. The tailings thus inhibit benthic phosphate regeneration, which is now known to be an important factor in the phosphorus budget of some coastal waters. It is demonstrated that such inhibition is not important in Rupert Inlet due to a short water residence time; however, it could be of significance in poorly mixed or stratified water bodies including lakes and some fjords. (Author's abstract)
W85-00955

CONCEPT OF POLLUTANT ACCUMULATION IN THE DISCUSSION ON ENVIRONMENTAL PROTECTION, PART II: MECHANISM AND ASSESSMENT OF TRACE SUBSTANCES IN SURFACE WATERS (ZUM BEGRIFF DER ANREICHERUNG IN DER UMWELTSCHUTZDISKUSSION TEIL II: MECHANISMUS UND BEWERTUNG DER ANREICHERUNG VON SPURENSTOFFEN IN GEWASSERN),
Bundesanstalt fuer Gewaesserkunde, Coblenz (Germany, F.R.).
H. Hellmann.
Deutsche Gewasserkundliche Mitteilungen, Vol. 27, No. 5/6, p 146-153, December, 1983. 4 Fig, 4 Tab, 33 Ref.

Descriptors: *Accumulation, *Fate of pollutants, *Trace substances, Biological magnification, Bioaccumulation, Adsorption, Absorption, Ion exchange, Mass transfer, Food chains.

The accumulation of trace substances, e.g. suspended matter or living organisms, may be explained on the basis of different mechanisms. Mass transfer at phase boundaries such as oil/water or water/phytoplankton is a natural phenomenon. The mechanisms of most importance in the aquatic biotope are adsorption, absorption, ion exchange, accumulation (sorption) and (bio)magnification. Mass transfer by these processes may lead to an increase in concentration in the matrix considered. The term magnification is recommended for the increase in concentration within ecologic cycles or in a food chain. Persistent substances seem to be prone to a particularly intensive accumulation upon transition from aqueous to non-aqueous environments (such as from fish to birds). Well-known techniques for determining the accumulation behavior such as the octanol/water partition coefficient are important indicators, but do not suffice for estimating the order of magnitude of biomagnification. (Moore-IVI)
W85-00962

CONTAMINATION OF THE FEDERAL MAIN WATERWAYS BY FISSION PRODUCTS EFFECTED BY THE CHINESE NUCLEAR TEST FROM OCTOBER 16TH, 1980 (UBER AUSWIRKUNGEN DES KERNWAFFENVERSUCHES DER VOLKSREPUBLIK CHINA VOM 16. 10. 1980 IM BEREICH DER BUNDESWASSERSTRASSEN),
Bundesanstalt fuer Gewaesserkunde, Coblenz (Germany, F.R.).
H. Mundschenk.
Deutsche Gewasserkundliche Mitteilungen, Vol. 27, No. 5/6, p 158-167, December, 1983. 10 Fig, 1 Tab, 20 Ref.

Descriptors: *Nuclear tests, *Fallout, *West Germany, *Fate of pollutants, Water pollution sources, Rivers, Sediments, Suspended sediments, Zirconium, Niobium, Cerium, Rubidium, Rhine River.

Fission products originating from the Chinese nuclear weapon tests of Oct. 16, 1980 could be determined in sediments and suspended matter in the federal waterways. The ratio of Zr-95/Ce-144 measured in samples from different sites suggests that the stratospheric nuclear debris must be inhomogenous since the composition of fission products varies from site to site. For the transfer of unsoluble nuclides (Zr-95, Nb-95, Ce-144, Ru-103) from precipitation to suspended matter of sediments, a transfer coefficient could be estimated from the data observed. From the total amount of nuclides deposited in river basin of the Rhine fromn Konstanz to Koblenz only a small fraction of about 0.49 % is transported out of this region by suspended matter. The radiation doses on the sediment pathway, calculated for definite exposition conditions, amount to only a minute fraction of the leglly allowed yearly doses for the whole body. (Wheatley-IVI)
W85-00964

WATER RESOURCES DEVELOPMENT AND MANAGEMENT PLANS; PART 6: OUALITY SIMULATION (BEWIRTSCHAFTUNGSPLANE; TEIL VI: GUTESIMULATION),
Hanover Univ. (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
H. Lehmann.
Deutsche Gewasserkundliche Mitteilungen. Vol. 27, No. 5/6, p 172-179, December, 1984. 13 Fig, 6 Ref.

Descriptors: *Water quality, *Simulation, *Leine River, *West Germany, *Model studies, Path of pollutants, Biological oxygen demand, Chemical oxygen demand, Rivers, Ammonia, Suspended solids, Nitrates.

Several water quality models were used, based on analysis of data relating to river conditions. Three models are compared for the Leine River. The best results were obtained using the SIMUCEV model which is sufficiently complex for large river basins. This model can calculate water quality changes under present and future conditions. The combined degradations of COD and BOD in relationship to oxygen, SS, ammonia, nitrate, and conservative substances are calculated. Each of the waste effluents can be followed down the river separately. (Wheatley-IVI)
W85-00966

WATER RESOURCES DEVELOPMENT AND MANAGEMENT PLANS; PART 7: TIME VARIABLE EFFLUENTS IN WATER QUALITY COMPUTATIONS - AN ASPECT OF THE WATER QUALITY MANAGEMENT STUDY 'BEWIRTSCHAFTUNGSPLAN LEINE' (BEWIRTSCHAFTUNGSPLANE; TEIL VII: GUTEBERECHNUNGEN MIT ZEITVARIANTEN SCHMUTZWASSEREINLEITUNGEN - EIN TEILASPEKT DER PILOTSTUDIE BEWIRTSCHAFTUNGSPLAN LEINE),
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Siedlungswasserwirtschaft.
I. Bantz, R. G. Cembrowicz, and H. H. Hahn.
Deutsche Gewasserkundliche Mitteilungen, Vol. 27, No. 5/6, p 179-186, December, 1983. 8 Fig, 3 Tab, 41 Ref.

Descriptors: *Water quality, *Leine River, *West Germany, *Effluents, *Mathematical models, Dissolved oxygen, Saint-Venant equations, Path of pollutants, Nonuniform flow, Water quality control.

A dynamic water quality model has been developed to show the impact of waste water effluent dynamics due to water quality and sanitation changes. Nonsteady state flow and constituent modelling was applied. The model contains a flow routing based upon the Saint-Venant equations. Computational examples illustrate the exact effects of time variant waste effluents from treatment plants upon water quality. Superimposed quality computations focus upon parameters and processes influencing the oxygen concentration. The number of parameters involved that influence the constituent concentrations all but facilitate general conclusions regarding control strategies of time variant waste input into a river. (Wheatley-IVI)
W85-00967

APPLICATION OF NUTRIENT LOADING MODELS TO THE ANALYSIS OF TROPHIC CONDITIONS IN LAKE OKEECHOBEE, FLORIDA,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
C. R. Kratzer, and P. L. Brezonik.
Environmental Management, Vol. 8, No. 2, p 109-120, March, 1984. 2 Fig, 9 Tab, 25 Ref.

Descriptors: *Lake Okeechobee, *Florida, *Nutrients, *Eutrophication, Nitrogen, Phosphorus, Mathematical models, Chlorophyll a, Water pollution control, Pollution load, Water quality, Model studies.

Lake Okeechobee (surface area = 1830 sq km, mean depth = 3.5 m), the largest lake in Florida, is eutrophic and has nitrogen and phosphorus loading rates in excess of nearly all established criteria. Large spatial and temporal variations occur for trophic state parameters in the lake. This variability is attributed to seasonal and longer term variations in climatic and hydrologic conditions and to varying land-use practices in the watersheds of influent streams. Phosphorus loading rate and trophic state data fit reasonably well to various input-output models developed for temperate lakes. Modification of the models by regression analysis to fit data for Florida lakes resulted in improved predictions for most parameters. A 75% reduction of phosphorus loading from the largest source (the Taylor Creek-Nubbins Slough watershed) would reduce the average chlorophyll a concentration by less than 20%. Complete elimination of inputs from the largest nitrogen source (the Everglades Agricultural Area) would decrease the average nitrogen concentration in the lake by about 20%. The nutrient models used in this analysis consider the lake as a homogeneous reactor. In order to determine changes that may occur in water quality within specific regions of the lake as a result of nutrient controls, more sophisticated spatially refined models would be required. (Moore-IVI)
W85-00977

SPATIAL UPTAKE OF DISSOLVED ORGANIC CARBON IN RIVER BEDS,
University Coll. of North Wales, Bangor. School of Animal Biology.
S. Mickleburgh, M. A. Lock, and T. E. Ford.
Hydrobiologia, Vol. 108, No. 2, p 115-119, 1984. 1 Fig, 2 Tab, 17 Ref.

criptors: *Dissolved solids, *Absorption, eam beds, *Wales, River Clywedog, River ven, River Braint, Organic carbon, Microorgaıs, Seasonal variation, Rivers.

uptake of dissolved organic carbon by three am bed components; surface stones, underlying vel and organic floc, was measured in three rs in North Wales. Overall, surface stones and erlying gravel appeared to be the major sites of ke but the relative importance of these two ponents varied both temporally and spatially. anic floc was relatively unimportant as a site of olved organic carbon (DOC) uptake. In the mer experiment on the River Clywedog, the test uptake of DOC was associated with the , amounting to 79% of the initial concentra- The surface stones produced a reduction of whereas the uptake due to organic floc unted to only 24% of the initial concentration. he autumn the greatest uptake was associated the core, but at a lower level than in the mer, 42%. On this occasion very little of this ke could be attributed to the surface stones %) while the uptake by the organic floc was stically nonsignificant at 1%, suggesting that underlying gravel was the major site of DOC ke. The River Ogwen was sampled in the mn. Surface stones and organic floc were sam- during low discharge conditions. For all river components the uptake was low, with that ciated with the surface stones being statistical- significant while uptake by the floc and under- gravel were each around 10%. The uptake ciated with the underlying gravel may have positively or negatively influenced by the eding spate. The River Braint was sampled in mn when discharge remained steady through- the experiment period. Greatest uptake was ciated with the surface stones (35%) while ke by the underlying gravel amounted to 21% that by the organic floc amounted to 9%. ter-IVI)
5-01009

TIAL ANALYSIS OF ACID PRECIPITAN DATA,
ironmental Monitoring Systems Lab., Rech Triangle Park, NC.
. Finkelstein.
nal of Climate and Applied Meteorology, Vol. No. 1, p 52-62, January, 1984. 14 Fig, 3 Tab, 21

criptors: *Acid rain, *Spatial distribution, iging, Sampling sites, Interpolation, Acid pretation, Variograms, Networks, Error analysis.

lies on the spatial distribution of acid deposi- are based upon a rather sparse network of pling stations available. Kriging, an interpola- procedure that minimizes interpolation error gives an accurate estimate of that error, is an ropriate objective analysis procedure for the y of spatial variability and structure in acid ipitation data. Variograms for some anions and ons found in precipitation were prepared with from the eastern part of the U.S. They ved a clear dependence on distance of separa- Analysis of data from sites that are close ther helps to define the variograms near the in, agreeing well with estimates of precision duplicate samplers. A test of the Kriging rpolation procedure and its estimate of interpon uncertainty was done by interpolation to where data were already available. The comson showed no significant bias. The method is very seviceable in network design. With the of variograms from the existing network, the ree of improvement to be expected from inses in the number of sites may be shown. ging can also be used for determining optimum ement of new sites or for developing completew networks. (Moore-IVI)
5-01040

COVERY OF A POLLUTED ESTUARINE STEM: A MESOCOSM EXPERIMENT,
de Island Univ., Narragansett. Graduate ool of Oceanography.
A. Oviatt, M. E. Q. Pilson, S. W. Nixon, J. B. hsen, and D. T. Rudnick.
Marine Ecology - Progress Series, Vol. 16, No. 3, p 203-217, March, 1984. 10 Fig, 10 Tab, 46 Ref.

Descriptors: *Estuarine environment, *Fate of pollutants, *Mesocosms, Heavy metals, Wastewater pollution, Hydrocarbons, Phytoplankton, Zooplankton, Benthic fauna, Nutrients, Chlorophyll, Dissolved oxygen, Sediment contamination, Rhode Island.

An ecosystem-level experiment was carried out to determine the rate at which water columns in estuarine areas grossly polluted by sewage, heavy metals, and hydrocarbons can recover and the rates at which pollutant concentrations within sediments decrease when the input of pollutants is terminated. Grossly polluted sediment from the Providence River (Rhode Island), measurably polluted sediment from mid Narragansett Bay, and relatively unpolluted sediment from Rhode Island Sound were placed in mesocosms containing clean flowing sea water. After 5 mo the behavior of the grossly polluted system was not dramatically different from the other 2 situations and seasonal patterns of phytoplankton, zooplankton, and benthic fauna were similar. The grossly polluted system was much more similar to the other 2 treatment situations than to in situ conditions at the Providence River sediment source with regard to nutrients, chlorophyll concentrations and oxygen concentrations, suggesting that new pollutants dictate environmental conditions much more strongly than old pollutants trapped in sediments. The experiment predicts rapid recovery for temperate estuarine systems, once pollutant loading has been discontinued, although pollutant material would remain detectable in the sediments for a very long period of time. (Author's abstract)
W85-01046

VARIATION IN THE CONTENTS OF NITROGENOUS COMPOUNDS IN PRECIPITATION OVER LAKE DONGHU, WUHAN,
Q. Liu, F. Lu, and J. Hui.
Oceanologia et Limnologia Sinica, Vol. 14, No. 5, p 454-459, September, 1983. 2 Fig, 3 Tab, 7 Ref.

Descriptors: *Precipitation, *Nitrogen compounds, *Lake Donghu, *Wuhan, *China, Ammonia, Oxides, Lakes, Seasonal variation.

The contents and variation of nitrogenous compounds in precipitation water over Lake Donghu, Wuhan was investigated from April 1962 to March 1963 and from June to August of 1980. In the earlier time period the average value of the total inorganic nitrogenous compounds was 0.447 mg N/l with ammonia nitrogen comprising 73.03% of the total of inorganic nitrogenous compounds. NO2-N and NO3-N were 2.55% and 24.42%, respectively. Ammonia nitrogen showed pronounced seasonal variation, being high at the end of winter and the beginning of spring, low in autumn and the lowest in summer. During continuous precipitation, the content of nitrogenous compounds was high in the initial phase and then reduced gradually. The content of ammonia nitrogen in precipitation water increased 2.5 times to 8 times during the summer of 1980 as compared with that in summer of 1962. NO3-N was reduced 7.5 to 9 times. The total amount of inorganic nitrogenous compounds transmitted through lake surface into the lake by precipitation was 9.8 tons in 1962 and 20 tons in 1980. That transmitted into the drainage basin of the lake by precipitation water in 1980 was 134.0 tons, and 65.4 tons in 1962. (Baker-IVI)
W85-01047

STUDY OF STRONTIUM-90 IN SEDIMENT OF THE BOHAI BAY,
P. Li, and J. Gu.
Oceanologia et Limnologia Sinica, Vol. 14, No. 6, p 565-570, November, 1983. 2 Fig, 8 Ref.

Descriptors: *Sediments, *Bohai Bay, *Strontium radioisotopes, *Jiyun River, Water analysis, Chemical analysis, Path of pollutants, Adsorption.

Radioactive contamination with strontium-90 in sediments of the Bohai Bay was higher than other regions of the world, being about 86 pCi/kg. The radioactivity of Sr-90 is only about 4500 times that of K-40 in sediment. The ratio of Cs-137/Sr-90 is about 2.3. The distribution of Sr-90 in sediment shows that it is closely related to the type of sediment and the movement of sediment and seawater. The concentration of Sr-90 is higher in clayey mud than in sandy clay and clayey silt in general, and is low in sediment in regions where the movement of seawater is rapid. Lower concentrations are found in the anchorage and channel, and higher concentrations in the mouth of the Jiyun River. The amount in the Jiyun River may be related to the carrying and cleaning effects of silt and other material in seawater. The cocrystal of carbonate (Ca, Mg), the adsorption effect of suspended material and the carrying effects of silt may be the main pathways of transport from seawater to sediment for Sr-90. Biological adsorption, as well as adsorption of sediment, may be less effective than the pathway mentioned above. (Baker-IVI)
W85-01049

SEASONAL AND ENVIRONMENTAL VARIATION IN CADMIUM, COPPER, LEAD AND ZINC CONCENTRATIONS IN EELGRASS (ZOSTERA MARINA L.) IN THE LIMFJORD, DENMARK,
Aarhus Univ. (Denmark). Botanical Inst.
For primary bibliographic entry see Field 2L.
W85-01080

EFFECTS OF COPPER CHELATE ON PHOTOSYNTHESIS AND SOME ENZYME ACTIVITIES OF ELODEA CANADENSIS,
Technische Hochschule, Aachen (Germany, F.R.). Lehrstuhl fuer Landschaftsokologie und Landschaftsgestalung.
For primary bibliographic entry see Field 5C.
W85-01083

COPPER AND LEAD UPTAKE BY AQUATIC MACROPHYTES IN EASTERN CONNECTICUT, U.S.A.,
Connecticut Univ., Storrs. Biological Sciences Group.
R. M. Heisey, and A. W. H. Damman.
Aquatic Botany, Vol. 14, No. 3, p 213-229, November, 1982. 6 Fig, 3 Tab, 51 Ref. OWRT project A-052-CONN.

Descriptors: *Copper, *Lead, *Macrophytes, *Connecticut, *Uptake, Water pollution sources, Urban areas, Industrial wastes, Aquatic plants, Fate of pollutants, Submerged plants, Heavy metals.

Copper and lead concentrations of submersed, floating-leaved and emergent macrophytes in three interconnected rivers subjected to different amounts of human influence were compared. Concentrations were highest downstream from a printed circuit factory and near urban areas. Lowest concentrations occurred in rural areas. Pontederia cordata L., an emergent species, had lower copper concentrations than Potamogeton epihydrus Raf. and other floating-leaved and submersed macrophytes, but differences among growth forms were small or negligible for lead. Concentrations of both elements were much higher in Pontederia rhizomes and roots than in shoots, especially in polluted areas. Copper concentrations of Pontederia seemed to depend primarily on concentrations in the sediments, whereas copper concentrations of Potamogeton and other floating-leaved and submersed species appeared more indicative of water quality. The lead concentrations of Pontederia seemed to be controlled primarily by uptake from sediments and atmospheric inputs. Differences in lead concentrations of Potamogeton were small among rivers, indicating that foliar absorption and acropetal translocation of lead from roots is low. (Author's abstract)
W85-01084

RAIN CHEMISTRY UNDER THE PLUME FROM AN OIL-FIRED POWER PLANT - A CASE STUDY,

State Univ. of New York Coll. at Oswego. Coll. of Arts and Science.
A. J. Stamm, P. Caplan, and R. A. Hinrichs.
Atmospheric Environment, Vol. 18, No. 4, p 817-823, 1984. 7 Fig, 3 Tab, 11 Ref. Research Foundation of the State Univ. of New York grant 228-7153A.

Descriptors: *Rain, *Smoke, *Powerplants, *Oswego, *New York, *Hydrogen ion concentration, Plumes, Water pollution sources, Air pollution, Sulfur, Magnesium, Acid rain, Vanadium.

Rain was sampled near an oil-fired power plant in Oswego, N.Y. under conditions in which the smoke plume was embedded in a low stratus cloud. This plant burns high-sulfur oil (up to 2.8% sulfur) with MgO added to protect the stack, so it was of interest to investigate the net change in pH under the plume. Closely-spaced rainwater samples were taken from 3 ground level rows perpendicular to the plume at roughly 2, 3 and 4 km from the stack. Analysis showed that the rain was less acidic (by about one half pH unit) under the plume in the first row and comparable to background by the third row. A strong increase in magnesium (3-16 times) and some increase in sulfate was measured under the plume, but no increase in nitrate was seen. Vanadium was found to be a good indicator of plume presence. (Author's abstract)
W85-01086

PERSISTENCE AND FATE OF METHYL PARATHION IN SEA WATER,
National Research Centre, Cairo (Egypt). Water Pollution Control Lab.
M. I. Badawy, and M. A. El-Dib.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 1, p 40-49, July, 1984. 4 Fig, 3 Tab, 29 Ref.

Descriptors: *Fate of pollutants, *Insecticides, *Seawater, Chemical reactions, Degradation, Methyl parathion, Toxicity, Salinity, Acidity, Agricultural chemicals, Hydrogen ion concentration.

Hydrolysis of methyl parathion proceeded as a reaction of pseudo-first order kinetics. The values of the rate constant and the half lives at the studied pH values indicate the relative stability of methyl parathion in acidic and neutral aquatic solutions. The insecticide was sensitive to hydroxide ions and at pH 8.5, which prevails under natural conditions, the hydrolysis rate increased. Half life time was also reduced to 38.5 days. The rate of chemical hydrolysis of methyl parathion decreased with the increase of salt content in solution. Sodium chloride did not appear to be involved in the hydrolysis process. Consequently, methyl parathion will be relatively more stable in water of high salinity such as sea or ocean waters, and the insecticide is more liable to exert its toxic effects on aquatic life. Microbial degradation of the insecticide included reduction of nitro group, dealkylation and hydrolysis of the ester linkage. (Baker-IVI)
W85-01090

BORON CONTENT IN THE SEDIMENTS FROM THE ST. LAWRENCE ESTUARY OFF RIMOUSKI, QUEBEC, CANADA,
Quebec Univ., Rimouski. Dept. of Oceanography.
M. Bergeron, and J. Lebel.
Chemical Geology, Vol. 42, No. 1/4, p 77-83, January, 1984. 1 Fig, 1 Tab, 20 Ref.

Descriptors: *Boron, *Sediment contamination, *Estuaries, *St. Lawrence Estuary, Sediment transport, Sediment-water interfaces, Organic matter, Fate of pollutants, Iron hydroxides.

Analyses of boron in a box core taken in the St. Lawrence estuary demonstrated the mobility of this element within the sediment. Boron demonstrates a certain amount of mobility following its deposition as a constituent of sedimentary particles. In the sediment, this mobility is limited: some of the solid-phase boron which is dissolved returns to the solid phase before it can escape at the water-sediment interface. During the settling process itself, the B content of the solid phase in sedimenting particles is uniformly distributed in the various fractions. The dissolution of Fe-hydroxides may result in the transfer of B to the organic material, probably via the liquid phase. This organic matrix itself can also be degraded, releasing the boron. In addition, the microscopy work of others on coastal sediments has shown that organic matter forms some aggregates with mineral particles, where clay particles are coated by an organic matrix. The boron associated with the organic matter could slowly diffuse from this coating into the crystal lattice, resulting in a transfer of B from the oxidizable fraction to the residual fraction. (Baker-IVI)
W85-01094

USE OF REPROCESSING EFFLUENT RADIONUCLIDES IN THE GEOCHRONOLOGY OF RECENT SEDIMENTS,
Commission of the European Communities, Ispra (Italy). Joint Research Centre.
For primary bibliographic entry see Field 2L.
W85-01098

FAYETTEVILLE GREEN LAKE, NEW YORK, U.S.A., VIII. MASS BALANCE FOR 137-CS IN WATER, VARVED AND NON-VARVED SEDIMENTS,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
G. J. Brunskill, S. D. Ludlam, and T.-H. Peng.
Chemical Geology, Vol. 44, No. 1/3, p 101-117, May, 1984. 3 Fig, 8 Tab, 34 Ref. DOE contract W-7405-eng-26.

Descriptors: *Cesium radioisotopes, *Lake sediments, *Varves, *Fayetteville Green Lake, *New York, Sediments, Fallout, Mixing, Bioturbation, Sedimentation, Fate of pollutants.

A mass balance for Cs-137 was done in Fayetteville Green Lake. The effects of physical mixing and bioturbation on Cs-137 distributions in the deep water varved sediments are near zero. It is demonstrated that sediment varve Cs-137 activity fluxes mimic fallout records qualitatively, but retain only 30-40% of integral unit area fallout from 1954 to 1976. About half the post-1970 annual flux of Cs-137 to deep-water varve sedimentation was derived from resuspension and/or dissolution of Cs-137 in shallow-water sediments. Pore water diffusion of Cs-137 in these carbonate-rich varves is $<$ 5 times 10 to the minus 11th power sq cm/sec. Only 65% of 1954-1976 Cs-137 fallout can be found in the sediments and water. Outflow must account for 35% of Cs-137 input to the lake. (Baker-IVI)
W85-01102

ATMOSPHERIC INPUT OF HEAVY METALS CHRONICLED IN LAKE SEDIMENTS OF THE ALGONQUIN PROVINCIAL PARK, ONTARIO, CANADA,
National Water Research Inst., Burlington (Ontario).
H. K. T. Wong, J. O. Nriagu, and R. D. Coker.
Chemical Geology, Vol. 44, No. 1/3, p 187-201, May, 1984. 5 Fig, 4 Tab, 20 Ref.

Descriptors: *Lakes, *Heavy metals, *Algonquin Provincial Park, *Ontario, Lead, Zinc, Copper, Nickel, Cadmium, Lake sediments, Lead radioisotopes, Organic matter, Atmospheric deposition.

The flux of lead, zinc, copper, nickel, and cadmium into ten remote lakes in the Algonquin Provincial Park of Ontario was determined. Deviation from constant sedimentation rates in recent sediments depicted in the Pb-210 profiles can be related to human activities within the last 100 years. There is an overall enrichment 2-fold for Ni, Cu, Zn, and Cd in surficial sediments together with a 25-fold increase for Pb. The gyttja contain 25-50% organic matter with organic C/organic N ratios which strongly suggest high influx of allochthonous plant debris. The extent of recent atmospheric deposition of trace metals transported from long range sources has been demonstrated. The rate of metal accumulation and enrichment in the Algonquin lake sediments are comparable to the rates found in the Adirondacks and New England States. The most drastic increase in rates of deposition of pollutant metals occurred within the last 30-50 years. (Baker-IVI)
W85-01104

WATER-QUALITY MODELLING: A COMPARISON OF TRANSPORT-ORIENTED AND ECOLOGY-ORIENTED APPROACHES,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
L. Somlyody.
Ecological Modelling, Vol. 17, No. 3-4, p 183-207, December 1982. 11 Fig, 38 Ref.

Descriptors: *Water quality models, *Model studies, *Model testing, *Mathematical models, *River Sajo, *Lake Balaton, *Hungary, Cadmium, Kalman filtering, Transport, Wind-driven currents, Lake sediments, Boundary conditions.

Two extreme types of water-quality models can be distinguished: transport models, for a conservative material, which are over-simplified with respect to biology and chemistry, and based on partial differential equations; and ecological models of a system, under the assumption of complete mixing, which often exclude the influence of transport and consists of a set of ordinary differential equations. No overall procedure is given for overcoming the gap between these model types; instead, a framework is suggested which is based on establishing the relative importances of the various subprocesses determining water quality and proceeding to the corresponding model structure. Two examples are presented; one concerns heavy-metal pollution of River Sajo, Hungary, the second involves Lake Balaton, Hungary, for which the wind-induced interaction between water and sediment was analyzed. In the first situation, a one-dimensional, coupled hydrodynamic-transport-water-quality model for three cadmium compartments was adopted. For the second problem, it was necessary to determine the unknown boundary condition at the lake bottom. This latter was achieved by simplifying the governing transport equation into an ordinary differential equation and introducing some simplifying hypotheses. Given data from regular, intensive observations, the calibration, identification and validation of this model were carried out using the extended Kalman filtering technique. (Collier-IVI)
W85-01116

5C. Effects Of Pollution

DISSOLVED ORGANIC CARBON AS A CONTROLLING FACTOR IN OXYGEN CONSUMPTION IN NATURAL AND MAN-MADE WATERS,
Tokyo Univ. of Agriculture and Technology (Japan). Faculty of Agriculture.
For primary bibliographic entry see Field 5B.
W85-00530

DIATOM ASSEMBLAGES IN LACUSTRINE SEDIMENTS OF LAKE SHIBU-IKE, L. MISUMI-IKE, L. NAGA-IKE, L. KIDO-IKE IN SHIGA HIGHLAND AND A NEW BIOTIC INDEX BASED ON THE DIATOM ASSEMBLAGE FOR THE ACIDITY OF LAKE WATER (IN JAPANESE),
Nara Women's Univ. (Japan). Dept. of Biology.
T. Watanabe, and I. Yasuda.
Japanese Journal of Limnology, Vol. 43, No. 4, p 237-245, October, 1982. 4 Tab, 40 Ref.

Descriptors: *Japan, *Lake Shibu-ike, *Lake Misumi-ike, *Lake Naga-ike, *Lake Kido-ike, *Diatoms, *Acidity, Lake sediments, Biotic index, Hydrogen ion concentration, Bioindicators, Water pollution effects, Tolerance, Species composition.

Diatom populations were identified for lake bottom - surface sediment samples taken from the following four lakes of the Shiga Highland of Japan in August 1976 and June 1977: Lake Shibu-ike, L. Naga-ike, L. Kido-ike, and L. Misumi-ike. Diatom taxa occurring in freshwater with low pH values were classified into two categories according to their tolerance of increasing acidity. Ex-

emely tolerant taxa are often dominant in the eshwater below pH 5.5; tolerant taxa occur in ater below pH 6.0, but are not dominant in the ater below pH 5.5. A new biotic index based on atom assemblage in lacustrine sediments for the ater acidity in average was computed as: DIA ne diatom index for the water acidity) equals the tal of the relative abundance of all extremely erant taxa in the sample plus 1/2 of the total of e relative abundance of all tolerant taxa. The lues of DIA for each lake tended to show a clear ationship with the average pH value in each e water. Values of mean pH and DIA for 1976 d 1977 (respectively) for each lake are as fol-ws: L. Shibu-ike, pH 4.7, DIA = 91.3, pH 4.8, A = 92.9; L. Misumi-ike, pH 4.9, DIA = 72.8, 5.1, DIA = 72.1; L. Naga-ike, pH 5.1, DIA = 8, pH 5.1, DIA = 72.1; L. Kido-ike, pH 6.8, A = 19.5, pH 7.4, DIA = 11.6. (Collier-IVI)
85-00535

TTORAL SURVEY OF THE CHIRONOMI-AE IN RESERVOIRS OF NAGOYA CITY ND SUBURBS,
chi Medical Univ. Association, Nagakute pan). Dept. of Parasitology
Kondo, and T. Suzuki.
anese Journal of Limnology, Vol. 43, No. 4, p 5-279, October, 1982. 1 Fig, 2 Tab, 12 Ref.

scriptors: *Nagoya City, *Japan, *Midges, eservoirs, *Species composition, Water pollu-n effects, Littoral zone, Trophic level.

ironomidae were collected in August 1981 from littoral bottom sediments of twenty reservoirs Nagoya City district (A) and suburbs. The sub-s were divided into three districts: utheast(B), East(C), and Northeast(D). The four tricts were divided by trophic state, degree of lution, and geographic features of reservoirs: ervoirs in A are mostly polluted; reservoirs in B all eutrophic; reservoirs in C and D are mostly sotrophic or oligotrophic and have transparent ter. Chironomid midges obtained were classified three sub-families, twenty genera, thirty-seven cies and two groups. From the species composi-n of chironomid communities, the twenty reser-rs were broadly divided into two areas; I goya City and Southeastern suburbs) and II stern and Northeastern suburbs). The Chirono-s species were abundantly obtained from the ervoirs of Nagoya City district, in which C. anus was most frequently collected. Glyptoten-es glaucus and Dicrotendipes niveicauda were conspicuous. Polypedilum nubifer was mmon in the reservoirs of the three suburban ricts, while Tanytarsus was predominant in the or reservoirs of all districts. Demeijerea sp., taneura monilis and Procladius were frequently nd in the reservoirs of the Eastern and of the rtheastern suburban districts. Lauterborniella ipennis and Polypedilum prolixitarum, on the er hand, were abundant in a dystrophic reser-r located in the Northeastern suburban district. llier-IVI)
5-00539

RRELATION OF THE FLORA OF AQUAT-MACROPHYTES WITH THE CHEMICAL NTENTS OF WATER IN THE IRRIGATION SERVOIRS OF TOKAI DISTRICT (IN JAPA-SE),
imuragakuen Takakura High School, Nagoya pan).
primary bibliographic entry see Field 2H.
5-00540

UDIES ON A FRESHWATER RED TIDE IN KE BIWA - I. CHANGES IN THE DISTRIBU-ON OF PHYTOPLANKTON AND NUTRI-TS (IN JAPANESE),
oto Univ. (Japan). Div. of Tropical Agriculture.
Yoshida, O. Mitamura, N. Tanaka, and H. lota.
anese Journal of Limnology, Vol. 44, No. 1, p 7, January, 1983. 3 Fig, 3 Tab, 12 Ref.

criptors: *Lake Biwa, *Japan, *Red tide, *Phy-ankton, *Nutrients, *Uroglena, Nitrogen, Phosphate, Silicate, Chlorophyll a, Water pollution effects, Dinoflagellates, Eutrophication.

In order to clarify the mechanism triggering the occurrence of a freshwater red tide of Uroglena americana that took place in Lake Biwa from May to June since 1977, a series of studies were undertaken in the northern basin of the lake. In 1978, Dinobryon barvaricum, Uroglena americana, Closterium aciculare, Aphanothece clathrata, and Planktosphaeria gelatinosa occurred successively as dominant phytoplankton species from early May to late June. Mean concentrations of dissolved inorganic nitrogen (DIN), urea-N, phosphate-P, and silicate-Si at a representative station (St. 4) were 9.8, 1.2, 0.18, and 1.5 micro g at./l, respectively, and changes of these concentrations were not so large except for the increasing silicate-Si concentration on June 29. Concentrations of chlorophylla were ca. 2-40 mg/cu m, 50-340 mg/sq m, and these concentrations usually were high and variable near the surface, especially at the time of the occurrence of freshwater red tide. The results suggested that the effects of growth and accumulation of U. americana were large in the occurrence of freshwater red tide in the lake. (Author's abstract)
W85-00541

RELATIONSHIP BETWEEN FISH POPULATIONS AND PH FOR LAKES IN SOUTHERMOST NORWAY,
Oslo Univ. (Norway). Inst. of Zoophysiology.
I. P. Muniz, H. M. Seip, and I. H. Sevaldrud.
Water, Air, and Soil Pollution, Vol. 23, p 97-113, 1984. 10 Fig, 2 Tab, 31 Ref.

Descriptors: *Norway, *Hydrogen ion concentration, *Lake fisheries, *Fish populations, Trout, Conductivity, Water pollution effects, Aluminum, Nitrogen, Sulfur, Water chemistry.

Improvement in the fishery status of lakes for a given reduction in anthropogenic emissions of sulfur and nitrogen compounds occurs in three steps: change in deposition due to changed emissions; change in water chemistry in lakes due to changed deposition; and change in fish status due to change in water chemistry. Fish status in terms of 'good', 'sparse', 'lost', 'never had fish', has previously been reported for several thousands of lakes in southernmost Norway. In more than a thousand of these lakes pH and conductivity have also been measured. These data have been used to establish a relationship between pH and fish status (brown trout). A uniform pH increase of 0.2 units will result in status changes from category 'lost' to 'sparse' in 12% of the lakes (27% of the lakes which have lost the fish population). Altogether 21% of the lakes are predicted to change to a better category. Aluminum concentrations and speciation play an important role in fish status; the data base used did not include these values. A fixed pH shift was used in order to make the approach applicable. This is a rather drastic simplification since the lakes will respond very differently to a reduction in S deposition depending on the original acidity and other factors. (Collier-IVI)
W85-00550

IMPACT OF DETERGENT PHOSPHORUS BANS ON RECEIVING WATER QUALITY,
Procter and Gamble Co., Cincinnati, OH. Environmental Safety Dept.
A. W. Maki, D. B. Porcella, and R. H. Wendt.
Water Research, Vol. 18, No. 7, p 893-903, 1984. 3 Fig, 5 Tab, 52 Ref.

Descriptors: *Detergents, *Phosphorus, *Water quality, Indiana, New York, Michigan, Minnesota, Wisconsin, Sediments, Water pollution effects, Eutrophication.

Phosphorus (P) and its complexes are discharged as natural components of domestic wastewaters and include P from human waste and food waste as well as residual detergent P; significant amounts of P also reach surface waters from non-point sources such as agricultural and urban runoff. In a number of areas where legislation banned the sale of phosphorus detergents (Indiana, New York, Michigan, Minnesota, and Wisconsin), limnological investigations in natural lakes were carried out to assess the impact of the ban upon receiving water quality. The release of P from sediment, as well as the effect of thermocline migration, serves to increase productivity without affecting the external P budget. Detergent P bans represent a very small change in P loading, and no significant water-quality effects have been related to bans. Reductions of P in wastewaters, even up to 50%, may not substantially improve the trophic status of lakes. When P concentration is the primary factor causing eutrophication, water quality benefits can not be achieved by bans of detergent phosphorous. Such benefits require overall control of both point and non-point sources of phosphorus. (Collier-IVI)
W85-00558

SEDIMENTOLOGICAL AND BIOLOGICAL CHANGES ASSOCIATED WITH THE CONSTRUCTION OF THE OIL TERMINAL OF ANTIFER, FRANCE,
Centre Oceanologique de Bretagne, Brest (France).
Y. Monbet.
Water Science and Technology, Vol. 16, No. 3-4, p 399-406, 1984. 4 Fig, 5 Tab, 13 Ref.

Descriptors: *Antifer, *France, *Oil terminals, *Sedimentation, *Benthic fauna, *Breakwaters, Particle size, Silting, Clays, Dredging, Biomass, Environmental impact assessment, Silting, Organic matter, Wastewater outfall, Oil tankers, Jetties, Water pollution effects.

The Antifer Oil Terminal was constructed 20 km north of the Port of Le Havre access channel and 4 km south of the Cap d'Antifer at St. Jouin Bruneval; a northern sloping breakwater 3.5 km long was built to a depth of -22 m to permit the access of 500,000 d.w.t. tankers. In 1978, three years after the end of the construction, sediments were found to decrease dramatically in medium grain size in area sheltered by the newly built breakwater. Increase of percentage of silt and clays (90% against 20%) was observed leeward of the jetty. The benthic fauna showed significant modifications. Although the same community (Pectinaria koreni, Abra alba) recolonized the bottom after the dredging of up to 30 million cu m of sediments, an increase in abundance occurred. Biomass remained at a constant level and decrease of diversity was observed. Considering the rate of siltation, and assuming a constant siltation rate equal to the rate observed from 1975 to 1978, a simple regressive model relating biomass to mean grain size of sediments has been developed. This model allowed the prediction of biomass and production of the two principal species for the period 1978-1981. Continuous siltation within the harbor leads to a maximum of biomass from years after the end of the construction, followed by a decrease of standing stock. This process may be explained by the respective tolerance of the two principal species to increased silt content and also probably by the accumulation of organic matter which may impede the development of natural populations. Similar schemes of biomass variations have been observed near sewage outfalls due to increased siltation and accumulation of organic matter in sediments. (Collier-IVI)
W85-00563

SIMULATION OF ECOLOGICAL IMPACTS OF THE NEW OUTER-HARBOUR DEVELOPMENT IN ZEEBRUGGE,
Waterbouwkundig Lab., Borgerhout (Belgium).
For primary bibliographic entry see Field 6G.
W85-00565

ECO-ENGINEERING ASPECTS OF THE HEATED WATER DISPOSAL IN THE BLACK SEA,
Institutul Politechnic din Bucuresti (Romania). Dept. of Energetics.
P. Roman.
Water Science and Technology, Vol. 16, No. 3-4, p 609-617, 1984. 10 Fig, 2 Tab, 17 Ref.

Descriptors: *Thermal pollution, *Fog, *Thermal plumes, *Navigable waters, *Black Sea, *Danube River, Channels, Waterways, Plumes, Dispersion, Temperature effects, Environmental effects, Mixing, Cooling water, Nuclear powerplants.

The hydraulics and related excess temperatures diffusion pattern of the heated freshwater discharged from the navigation channel in the Black Sea are analyzed. This navigation channel relays the Danube River, before its final meander toward the Delta, directly to the open sea. As a result, the water course is shortened. When construction is completed, the inlet water will not enter the channel directly from the river but first be diverted to a nuclear power plant which will be located at the beginning of the channel. Thus the cooling water passes through the plant condenser and is discharged into the channel with a great amount of heat. The discharge will be between 150 and 224 cu m/sec in the final stage and the temperature will exceed that of the receiving water by 7 and 12 C in summer and winter, respectively. The water entering the sea will still be 5 to 11 above the sea water temperature. The jet-plume type model was applied to the channel discharge in the Black Sea to obtain an idea about the limit of spreading in undisturbed conditions in the receiving waters. The sensitivity of the model to variable wind and current conditions and various values of the entrainment coefficients is considered. The longitudinal spread of the transition region of mixing between the fresh and salt water, taking into account the heat transfer across the air-water interface, can be described reasonably well using a one-dimensional dispersion in an open channel flow. One important aspect corresponding to the diffusion process near the channel outlet is the occurrence of fog, increased by the higher temperature of the superficial layer of the receiving water. The natural recorded occurrence of fog will be more than doubled in the presence of the excess temperature and sometimes the fog will be heavy with very little visibility in the area, under 100 m. (Baker-IVI)
W85-00570

MODELLING THE EUTROPHICATION PROCESS OF LAKE IJSSEL,
Waterloopkundig Lab., Delft (Netherlands).
R. Klomp, F. J. Los, J. A. van Pagee, N. M. de Rooy, and J. G. C. Smits.
Water Science and Technology, Vol. 16, No. 3-4, p 687-698, 1984. 8 Fig, 8 Ref.

Descriptors: *Eutrophication, *Lake IJssel, *Netherlands, *Mathematical models, Model studies, Cyanophyta, Phytoplankton, Limnology, Water quality management, Nutrients.

The main freshwater source for The Netherlands is the Rhine River, which is highly polluted by more or less treated industrial and domestic waste water, and therefore contains high concentration of nutrients. A branch of the Rhine flows into the largest freshwater lake in The Netherlands, Lake IJssel. The lake is affected by severe (blue green) phytoplankton blooms. The Dutch government initiated in 1979 a project in which a eutrophication model was applied to delta region of the river Rhine basin (Lake IJssel e.g. the estuary closed in 1928). The eutrophication model consists of two parts, BLOOM II, a phytoplankton model and CHARON, a model which describes the chemistry of the lake. The models have been calibrated, verified and applied to the system of the river Rhine and the Lake IJssel in the framework of a eutrophication study. The models are used to analyze the eutrophication process in the lake and to quantify the influence of policy and management scenarios including waste water treatment and measures with respect to nutrient reduction. The modelling approach results in a consistent and reasonable picture of the eutrophication process of Lake IJssel. Uncertain and crucial assumptions in the modelling approach are related to: bottom/water interaction; buoyancy of bluegreen algae; light adaptation of phytoplankton; the difficulty of zooplankton modelling; and the background extinction. The modelling approach is able to handle general policy and management questions. (Moore-IVI)
W85-00578

DEVELOPMENT AND ECODISASTER: A LESSON FROM COCHIN BACKWATER SYSTEM,
Cochin Univ. (India). School of Environmental Studies.
K. P. Balakrishnan, and C. B. Lalithambika Devi.
Water Science and Technology, Vol. 16, No. 3-4, p 707-716, 1984. 1 Tab, 3 Ref.

Descriptors: *Cochin, *India, *Kerala, *Environmental effects, Dam effects, Industrial development, Urban development, Land development, Ports, Shipping, Human population, Climate, Water pollution effects.

Kerala, with a unique climate, has rich and varied ecosystems with luxuriant and diverse plant and animal communities. This has led to a high density of human population. The State has resorted to modern technological methods for its economic development which includes industrialization and improvement of agricultural production. The establishment of a modern port at Cochin has transformed the region into the industrial capital of the State. Simultaneous with economic progress, the environmental conditions have become deranged due to large scale shipping operations. Of late the environmental problems are increasing in the highly productive backwater system, due to industrial effluents. How development programs can undermine the ecological balance and cause deleterious effects as well as unforseen consequences are well illustrated by the deltaic region of Kuttanad - 'the rice bowl of Kerala'. Dams, at the upper reaches of the rivers, provide power for industry and water for irrigation. But inadvertent denudation of the forests due to continuous human settlement and related activities will not only damage the dams, the industry and agriculture but also the climate of the region. The high density of population exerts undue pressure on the ecosystem whether it be terrestrial, aerial or aquatic and causes serious imbalances. (Author's abstract)
W85-00580

BIOGEOCHEMICAL FATE AND TOXICITY OF MERCURY IN CONTROLLED EXPERIMENTAL ECOSYSTEMS,
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 5B.
W85-00651

CONSEQUENCES OF OIL POLLUTION ON THE DECOMPOSITION OF VASCULAR PLANT LITTER IN FRESHWATER LAKES: PART 2- NUTRIENT EXCHANGE BETWEEN LITTER AND THE ENVIRONMENT,
Texas Univ. Health Science Center at San Antonio. School of Public Health
M. D. Werner, and V. D. Adams.
Environmental Pollution (Series A), Vol. 34, No. 2, p 101-117, June, 1984. 2 Fig, 8 Tab, 23 Ref.

Descriptors: *Oil pollution, *Cycling nutrients, *Aquatic plants, *Litter, *Decomposition, Nitrogen, Phosphorus, Macrophytes, Potamogeton, Lakes.

Freshwater vascular plants can be an important component of the nutrient cycle in aquatic ecosystems when high plant biomass exists. Because of the potential role of macrophyte decay in the nutrient cycle of lakes, a study was undertaken to determine how crude oil may alter the nutrient dynamics between macrophyte litter and its environment. Oiled and unoiled litter from Potamogeton foliosus was enclosed in litter bags and placed in two oligotrophic lakes. A local crude oil, Western Wyoming Crude was used. The crude oil associated with decomposing P. foliosus alters nitrogen and phosphorus exchange between the plant litter and its aquatic environment. The crude oil did not affect the nutrient content of the litter at any given stage of decomposition. The rate of nutrient loss per initial unit mass of litter was reduced because the oil reduced the rate of litter decomposition. The greatest effect of the oil was to reduce the portion of litter-lost nutrients which was released to the surrounding water in an inorganic form. An average of 56% less inorganic phosphorus per unit of litter mass decomposed was released to the environment due to the crude oil. No inorg nitrogen was released from oiled litter, altho 21% of the nitrogen lost from unoiled litter released to the environment in inorganic fo Nitrogen limitation to decomposers may have duced the rate of oiled litter decomposit (Moore-IVI)
W85-00681

CADMIUM UPTAKE BY THE WATER HY CINTH: EFFECTS OF SOLUTION FACTO
Michigan Univ.-Flint. Dept. of Chemistry.
D. H. O'Keefe, J. K. Hardy, and R. A. Rao.
Environmental Pollution (Series A), Vol. 34, 2, p 133-147, June, 1984. 7 Fig, 2 Tab, 22 R

Descriptors: *Cadmium, *Uptake, *Water h cinth, *Water pollution effects, Cadmium radio topes, Radioactive tracers, Diffusion, Phytot city, Zinc, Hydrogen ion concentration.

Factors affecting Cd(+2) uptake by the wa hyacinth Eichhornia crassipes were examined. radiotracer (Cd-109) was employed to moni uptake. A constant amount of radiotracer was u in every experimental solution resulting in a co parable sensitivity throughout the concentrat range studied (0.0001-1000 ppm). Concentrati above 100 ppm were acutely toxic to the plants. biphasic rate of uptake was observed with a f phase of about 4 h and a slow phase of at least h. Stirring the solution enhanced uptake in the f phase, suggesting that uptake is in part diffus limited. Increasing the pH from 2 to 5 enhanc the uptake rate. When Hoagland's solution v present, higher pH values decreased the rate. T presence of the micronutrient Zn(+2) decrea the uptake rate. These metals appear to comp for the same site(s) on the roots. Plants sequentia exposed (three times; 48 h each) to differ Cd(+2) concentrations continued to take up t metal and to exhibit the biphasic rate profi Plants removed from Cd(+2) solution after 48 did not release any of the metal when placed fresh Hoagland's solution. (Author's abstract)
W85-00682

INFLUENCE OF PH, DISSOLVED OXYGE SUSPENDED SOLIDS OR DISSOLVE SOLIDS UPON VENTILATORY AND COUG FREQUENCIES IN THE BLUEGILL LEPOM MACROCHIRUS AND BROOK TROUT SA VELINUS FONTINALIS,
Environmental Research Lab.-Duluth, MN.
R. W. Carlson.
Environmental Pollution (Series A), Vol. 34, N 2, p 149-169, June, 1984. 4 Fig, 43 Ref.

Descriptors: *Trout, *Bluegills, *Ventilatio *Coughing, *Dissolved oxygen, *Suspended solic *Dissolved solids, *Hydrogen ion concentratio Water pollution effects, Monitoring, Hardne Carbon dioxide, Bioindicators.

Conservative no-effect concentration ranges we estimated for ventilatory and coughing respons of bluegill sunfish Lepomis macrochirus and bro trout Salvelinus fontinalis exposed to altered p or to changes in dissolved oxygen (DO), suspend solids, or dissolved solids concentrations. The limits predict safe, or non-alarm-causing, variatio of these non-toxic environmental variables in a plied biomonitoring systems using Lake Superi or similarly constituted waters as a dilution sourc Bluegill ventilatory and coughing responses we slightly more sensitive than those of brook tro Bluegills showed increased ventilatory frequen in dissolved oxygen concentrations below 77% a saturation, pH 6-7 and below, and hardness of 1 mg/liter (as CaCO3) or higher, but no increase ventilation in suspended solids concentrations to 323 NTU of clay particles. Brook trout respon ed with increased ventilation only in concentr tions of DO at 44%, pH of 6.0 and 231 NT suspended solids. Ventilatory frequency respons at low pH were attributed to increased free C released by acidification of the dilution wate Over the DO range tested (44-117%) coughi was unaffected in both species. Bluegill coughi increased at pH levels above 9.0, but not below t

rol pH of 8.0. Increases also occurred in some ended solids concentrations (90 NTU and e) and in hardness of 190 mg/liter and above. k trout coughing was unaffected over the pH e 5.1-10.1 and at all suspended solids (0.6-318) concentrations tested. The only coughing onse observed for brook trout in different dis- d solids concentrations occurred at 1022 mg/ hardness. (Author's abstract)
-00683

ERRELATION OF WATER QUALITY, L PARASITES, AND GILL PATHOLOGY SOME FISHES FROM SOUTH BISCAYNE , FLORIDA,
. Skinner.
ery Bulletin, Vol. 80, No, 2, p 269-280, April, 3 Fig, 6 Tab, 48 Ref.

riptors: *Biscayne Bay, *Florida, *Water ty, *Fish parasites, *Gills, Parasitism, Trema-, Mojarra, Snapper, Needlefish, Water pollu- effects.

ogenetic trematode infestation of the gills and athology of yellow-fin mojarra, Gerres ciner- (Gerreidae); gray snapper, Lutjanus griseus anidae); and timucu (needlefish), Strongylura cu (Belonidae) were studied in relation to r quality in south Biscayne Bay, Florida. The western part of the bay still retains much of atural shoreline, but it is broken by drainage s which carry agricultural, industrial, and n wastes into that part of the bay. The south- rn shoreline of Biscayne Bay is formed by a of islands with no major direct sources of r pollution. The gills of hosts from the habitat inferior water quality were heavily infested the Monogenea Neodiplectanum wenningeri G. cinereus), Ancyrocephalus sp. (on L. gri- and Ancyrocephalus parvus (on S. timucu) uffered from excessive mucus secretion, epith- hyperplasia, fusion of gill lamellae, clubbing usion of filaments, and aneurisms. Light infes- ns and little or no abnormal tissue changes noted in fish from the area of good water ty. The pollutants in the water may have as an irritant, stressing the fish, and produc- hysical and physiological changes which re- d resistance to infestation by Monogenea. re-IVI)
-00687

ECTS OF LONG-TERM MERCURY EXPO- E ON HEMATOLOGY OF STRIPED BASS, RONE SAXATILIS,
onal Marine Fisheries Service, Milford, CT. rd Lab.
. Dawson.
ery Bulletin, Vol. 80, No. 2, p 389-392, April, 2 Tab, 22 Ref.

riptors: *Mercury, *Bass, *Blood, *Water tion effects, Industrial wastes, Hematology, um, Calcium, Protein, Potassium, Osmotic ure, Fish, Toxicity, Seawater.

striped bass, Morone saxatilis, living along the of the heavy populated Atlantic coast of h America is subject to considerable domestic industrial pollution. In order to learn more t the sublethal effects of mercury on striped fish taken from a hatchery where they had reared in freshwater were placed into the ng Milford Harbor seawater and allowed to mate for 2 wk prior to exposure to mercury. cury was added at concentrations of 5 and 10 Fish were exposed for 60 days. Mercury had jor disruptive influence on the hematology of triped bass, affecting both the red cell compo- of the blood and the plasma chemistry. Hema- t, hemoglobin, and RBC all decreased follow- nercury exposure. In each case the response significantly greater at the higher mercury entration. The reduction in hemoglobin was ortional to the reduction in red cell count, about 10% in the 5 ppb exposed animals and t 25% in the 10 ppb exposed animals. This is cted in the lack of change of the mean corpus- hemoglobin and indicates that the lowered oglobin concentration in exposed fish is the result of a lower number of circulating erythrocytes and not of a smaller quantity of hemoglobin in each cell. Exposure to mercury also affected the osmo- and ion-regulatory capacity of the striped bass. There was no significant difference between 5 ppb exposed fish and controls in any of the five plasma chemistry variables measured. In the 10 ppb exposed animals, the plasma sodium and the osmolality increased to 238 mEq/l and 462 mOsm. Plasma calcium dropped to 3.98 mEq/l in the 10 ppb exposed group, significantly lower than the control value of 4.52. There was no significant difference between controls and 10-ppb exposed fish in plasma protein or potassium. (Baker-IVI)
W85-00688

ACUTE TOXICITY AND CHEMICAL CHARACTERISTICS OF MODERATELY POLLUTED RUNOFF FROM HIGHWAYS,
Norsk Treteknisk Inst., Oslo.
E. Gjessing, E. Lygren, S. Andersen, L. Berglind, and G. Carlberg.
Science of the Total Environment, Vol. 33, p 225-232, February, 1984. 7 Fig, 1 Tab, 2 Ref.

Descriptors: *Runoff, *Highways, *Toxicity, Water pollution effects, Organic compounds, Polychlorinated biphenyls, Chemical analysis, Water analysis, Bacteria, Fish, Algae, Fungi, Hydrocarbons.

Runoff from a highway has been characterized by physical, chemical and biological methods. Several organic micropollutants have been identified, such as PAH's, PCB, and other chlorinated constituents. The biological methods include toxicity tests on salmon, algae, bacteria, and fungi. Studies on the hatching of salmon eggs in the sedimented part of the highway runoff are also included. Approximately 1/3 of the dissolved organic matter and 2/3 of the organic matter that was connected to the particulates were found to be extractable with organic solvents. Only a fraction of this is, however, identified. The sample contained organic chlorine in the range of 100 micrograms Cl/l. The identified chloro-organic matter can, however, explain only a few percent of the organic chlorine in the sample. Acute toxicity tests did not show any negative effects on growth or behavior for bacteria, fungi, protozoa, algae, fish and fish eggs. The heterotrophic organisms were clearly stimulated by the runoff water, the algae were stimulated in their growth rate with rather high concentration and neither the fish eggs nor the 1 year old salmon appeared to be affected by undiluted runoff water. Apparently the pollutants are associated with particulate matter and the total amount of available organic and inorganics are moderate. None of the tests on acute toxicity suggest any negative effect. It is essential to note that chronic effects and the bioaccumulation potential have not been evaluated. (Baker-IVI)
W85-00745

EFFECT OF PHOSPHORUS AND NITROGEN ADDITION ON THE ALGAL BIOMASS AND SPECIES COMPOSITION OF AN ACIDIC LAKE,
West Virginia Univ., Morgantown. Dept. of Biology.
G. Wilcox, and J. De Costa.
Archiv fur Hydrobiologie, Vol. 94, No. 4, p 393-424, 1982. 11 Fig, 17 Tab, 67 Ref.

Descriptors: *Cheat Lake, *West Virginia, *Phosphorous, *Nitrogen, *Acid Lakes, *Algae, *Biomass, *Species composition, Nitrate, Hydrogen ion concentration, Chlorophyll a, Chlorella, Botryococcus, Peridinium, Phytoplankton, Succession, Dominance, Water pollution effects, Limiting nutrients.

Cheat Lake in Monongalia County, West Virginia, is an acid lake formed by the construction of a dam in 1926. Two bag experiments were performed in the spring and fall of 1976 to determine the effect of nutrient addition on the algal biomass and species composition of an acidic lake. In experiment 1, phosphorus (100 micro g/l) was added alone and in combination with nitrate nitrogen (700 micro g/l); pH ranged from 4.5 to 4.8. Other treatments included nitrate nitrogen added alone and a control treatment which enclosed lake water with no further treatment added. In experiment 2, three levels of phosphorus (50, 100, and 150 micro g/l) were added to replicate phosphorus bags, along with a control treatment; pH ranged from 4.7 to 5.9. Uncorrected chlorophyll-a concentrations were significantly greater in the phosphorus treatments in both experiments compared to concentrations in the lake (sampled at surface and 1 meter depths), control, and nitrogen treatments. The phosphorus plus nitrogen treatment in experiment 1 did not produce any greater algal biomass than the phosphorus treatment. Nitrogen addition did not change the algal composition from the population at the start of the experiment. The phosphorus treatments in both experiments became almost unispecific in dominance by Chlorella sp. The dominant phytoplankton present in the lake during these experiments were Chlorella sp., Botryococcus Braunii, and Peridinium inconspicuum. Even at very low pH, the addition of phosphorus can cause phytoplankton blooms; while there are small changes in dominance by algal species, there is no gross succession in the species dominance in the phytoplankton. (Collier-IVI)
W85-00762

ECOLOGICAL EFFECTS OF MINE EFFLUENTS ON THE SOUTH ESK RIVER, NORTH-EASTERN TASMANIA; III. BENTHIC MACROINVERTEBRATES,
Canberra Coll. of Advanced Education, Belconnen (Australia).
R. H. Norris, P. S. Lake, and R. Swain.
Australian Journal of Marine and Freshwater Research, Vol. 33, No. 5, p 789-809, 1982. 2 Fig, 7 Tab, 48 Ref.

Descriptors: *Mine wastes, *Benthic environment, *South Esk River, *Tasmania, Macroinvertebrates, Invertebrates, Water pollution effects, Environmental effects, Trace metals.

The ecological effects of mine effluents on the South Esk River were investigated over 2 years on a 170 km section of the river. Quantitative samples of benthic macroinvertebrates were collected at eight sites using an air-lift sampler. Drifting fauna were also collected in the river adjacent to the point of trace metal inflow and in a tributary entering the contaminated section. As far as 80 km downstream from the source of trace metals, the numbers of individuals and the numbers of taxa were reduced in relation to upstream sites. From the 29 most commonly occurring taxa, three groups are defined by clustering strategies, each of which reacted to the trace metal contamination in a very different way. It is unlikely that the distribution or abundance of each taxon is being determined solely by trace metal contamination. Some taxa may be very sensitive to trace metals whereas other taxa that are less abundant in the metal contaminated section of the river may be being affected by indirect effects of trace metal contamination such as decreased substrata stability or elimination of a particular type of food. The multivariate analysis technique proved to be a sensitive means for the detection of trace metal contamination. (Baker-IVI)
W85-00782

MACROBENTHOS OF THE COOLING WATER DISCHARGE CANAL OF THE GLADSTONE POWER STATION, QUEENSLAND,
Queensland Electricity Generating Board, Brisbane (Australia). Scientific Services Branch.
P. Saenger, W. Stephenson, and J. Moverley.
Australian Journal of Marine and Freshwater Research, Vol. 33, No. 6, p 1083-1095, 1982. 6 Fig, 4 Tab, 10 Ref.

Descriptors: *Benthos, *Gladstone Power Station, *Calliope River, *Queensland, *Australia, *Cooling water, *Discharge canals, Powerplants, Thermal pollution, Population density, Water temperature, Flow rates, Sediments, Water pollution effects.

Quantitative sampling of the macrobenthos of the cooling water discharge canal of the Gladstone Power Station (Queensland, Australia) has been conducted monthly from September 1976 to July 1980 (sampling times 1-47), to provide information on (i) the effects of an initially small but increasing thermal discharge on this biota, and (ii) the likely effects that could be expected to occur in the Calliope River, which will ultimately receive a 65 cu m/s thermal discharge with a maximum temperature differential of 8.2 degrees C when the power station is fully commissioned. Considerable fluctuation was found in the biotic data; however, the number of benthic organisms correlates more closely with flow rates in the canal than with any other abiotic factor, showing a positive correlation for sampling times 1-32, followed by a negative correlation for times 33-47. Times classification also indicated a major dichotomy at times 32-34. It is concluded that the changes in the benthos of the canal can be attributed primarily to changes in flow rates, which, in turn, have altered the sediment composition. This is supported by a change in the benthic fauna, with a gradual replacement of species of known sandy mud affinities by species living on or in stiff clays. With a design maximum temperature differential of 8.2 degrees C and with lower water velocities outside the canal, the present data suggest that it is unlikely that the benthic fauna of the Calliope River, adjacent to the power station, will be markedly altered as a result of the thermal discharge; however, because of abiotic and biotic differences between the canal and the river, the testing of this extrapolation must await the analysis of the 'post-thermal' data presently being collected. (Author's abstract)
W85-00789

WATER POLLUTION BY URANIUM ORE TREATMENT WORKS,
Compagnie Francaise des Minerais d'Uranium, Paris (France).
H. Vinot, and J. P. Larpent.
Hydrobiologia, Vol. 112, No. 2, p 125-129, May, 1984. 1 Fig, 3 Tab, 10 Ref.

Descriptors: *Uranium, *Radioactive wastes, *Heavy metals, Mineral industry, Industrial plants, Radioactivity, Toxicity, Fish, Crustaceans, Algae, Sulfates, Chlorides, Copper, Zinc, Water pollution effects, Water pollution sources.

Uranium ore treatment works are responsible for a strong increase in minerals and, to a lesser extent, radio-activity in the rivers receiving their outflows. In certain streams, the fauna and the flora can disappear completely. The study has shown that the toxicity does not directly affect fish or crustacea but only algae, the growth of which is either partly or totally inhibited, depending on the dilution provided by the watercourse. This toxicity is not due to the uranium or to the sulfates and chlorides used in the treatment process, but to traces of heavy metals present in the reject, such as copper and zinc. The disappearance of the microalgae, which are the first link of the food chain, has important consequences, provoking the disappearance of the higher trophic levels leading to fish. (Author's abstract)
W85-00793

INFLUENCE OF POLLUTION ON THE HARPACTICOID COPEPODS OF TWO NORTH SEA ESTUARIES,
Ghent Rijksuniversiteit (Belgium). Lab. voor Morfologie and Systematiek.
D. van Damme, C. Heip, and K. A. Willems.
Hydrobiologia, Vol. 112, No. 2, p 143-160, May, 1984. 2 Fig, 7 Tab, 87 Ref.

Descriptors: *Westerschelde, *Eems-Dollard, *Netherlands, *Estuaries, *Copepods, *Water pollution effects, Bioindicators, Heavy metals, Population density, Phosphates, Nitrates, Pesticides, Cyanide, Detergents, Phenols, Oil, Polychlorobenzenes, Hydrocarbons, Zinc, Copper, Lead.

Seasonal monitoring of the meiobenthos in the Westerschelde (a Dutch estuary), revealed an anomaly in density and diversity of harpacticoid copepods. Another Dutch estuary, the Eems-Dollard, has comparable hydrodynamical, physical and sedimentological characteristics and a similar fauna, but even in the severely organically polluted oligohaline mudflats of this estuary, annual average density and diversity of endo-epibenthic harpacticoid communities are higher than at similar less enriched meso- to polyhaline biotopes of the Westerschelde. Besides the concentrations of inorganic pollutants, such as phosphates and nitrates, the concentrations of pesticides, cyanide, detergents, phenols, oils, polychlorobenzenes, polycyclic aromatic hydrocarbons and heavy metals were compared in both estuaries and compared to suggested permissive levels when available. From this it appears that these pollutants are present in the Westerschelde either in too low concentrations to be considered dangerous or at concentrations comparable to those occurring in the Eems Dollard, except for heavy metals. The load of a.o. Zn, Cu and Pb is distinctly and persistently higher in sediments and suspensions of the Westerschelde than in the Eems Dollard and copper is continuously present in a concentration at which, according to bioassays, egg production and larval development of planktonic copepods are severly affected. The remarkable scarcity of harpacticoid life on nutrient rich mudflats of the Westerschelde is thus probably due to heavy metal pollution. Since no other hard-bodied meio- and macrobenthic taxa nor the plankton of this estuary show such a marked impoverishment, benthic harpacticoids prove to be suitable as indicators for the first stages of ecosystem-breakdown in estuarine and coastal zones polluted by trace-metals. (Author's abstract)
W85-00795

INFLUENCE OF POLLUTION ON THE DENSITY AND PRODUCTION OF CHIRONOMIDAE (DIPTERA) IN RUNNING WATERS,
Brno Univ. (Czechoslovakia). Faculty of Natural Sciences.
B. Losos.
Limnologica (Berlin), Vol. 15, No. 1, p 7-19, March, 1984. 4 Fig, 2 Tab, 19 Ref.

Descriptors: *Midges, *Population dynamics, *Water pollution effects, Jihlava River, Primary productivity, Lotic environment, Saprobity, Limnology, Streams, Mountains, Lentic environment, Standing water.

The density and production of Chironomidae larvae were evaluated in dependence on the degree of pollution on the one hand in trout streams of mountain type and of the highlands type polluted by town waste on the other hand in the epipotamon of the Jihlava River. The following substrates were studied in the lotic and in the lenitic zones: stones, stands of water macrophyta in current, bank reeds, and muddy sediments near the banks. Conspicuous changes were found in the species composition and in the dominance of the community of larvae in the saprobities followed. While in oligosaprobity there prevailed larvae of Diamesa insignipes, D. thienemanni, and Potthastia gaedii, in beta-meso-saprobity there were Diplocladius cultriger and Brillia modesta, in alpha-meso- to polysaprobity larvae of the genus Orthocladius and Chironomus gr. thummi. At the same time diversity index dropped from 3.5 to 2.5 in the communities of larvae living on stones in the current, in mud it was only as low as 0.5. In the trout streams, abundance, biomass and production of larvae increased in the direction from oligosaprobity to polysaprobity in the communities of larvae living on stones in the current. Extraordinarily high values were found in the community of larvae in mud in the alpha-meso- to poly-saprobity with the prevailing dominant form Chironomus gr. thummi. In the Jihlava River different densities and production values were found according to the type of substrate. The highest values were noted in the community of larvae in water stands in the current and on bank reeds, the lowest in the community of larvae on stones and in muddy sediments near the bank. The values were relatively higher in the lotic zone. The P/B coefficient decreased from oligosaprobity to alpha-meso- to polysaprobity in the community of larvae living on stones in the current from 11.1 to 3.4 in the trout streams. In the Jihlava River the P/B coefficient varied between 8.4 and 13.3. (Baker-IVI)
W85-00796

STUDIES ON THE SEDIMENTS AND PLANK TONIC ALGAE OF THE POLLUTED KHOR/ CANAL AND THE SHATT AL-ARAB RIVER AT BASRAH, IRAQ,
University Coll., Cardiff (Wales). Dept. of Plan Science.
S. E. Antoine.
Limnologica (Berlin), Vol. 15, No. 1, p 55-61 March, 1984. 1 Fig, 3 Tab, 11 Ref.

Descriptors: *Sediments, *Plankton, *Algae, *Iraq *Shatt al-Arab River, *Khora Canal, Phosphates Calcium, Magnesium, Phytoplankton, Periphyton Nutrients, Organic matter, Acidity, Water pollu tion effects, Municipal wastes.

Sediments and phytoplankton of the Khora Cana and Shatt al-Arab River at Basrah were investigat ed as sewage and agricultural wastes have beer entering the waters and greatly affecting the qual ity of the canal water. In all, 95 algal taxa were identified. Of these 95, 45 were diatom species some of which were found to be indicators of brackish, alkaline or hard water conditions or of waters of high mineral or nutrient content. Most of the phytoplankton species were also common among the periphyton. Concentrations of organic matter were high in the canal sediments, primarily a result of sewage dumping and the decay of aquatic organisms. Sewage and agricultural pollution also increased nutrient levels in the canal sediments. A positive relationship was noted between organic matter and nutrient contents and between calcium and phosphate of the sediments. Amounts of silica frustules in the sediments affected the amounts of silica. High silica content of canal water seems to increase silica content of sediments. This process is regulated by the acidity of the water. Calcium and magnesium contents of canal sediment were also high. High organic matter was correlated with high calcium amounts. Magnesium may be added to the sediment through the decay of dead sedimented green plants. Calcium and magnesium may be precipitated as insoluble carbonate and thus increase their contents in the sediment through photosynthetic activities of phytoplankton. (Baker-IVI)
W85-00797

POLLUTION AND SAPROBIC STATUS OF EASTERN KALINADI,
D.A.V. Coll., Muzaffarnager (India). Dept. of Zoology.
S. R. Verma, P. Sharma, A. Tyagi, S. Rani, and A. Kumar.
Limnologica (Berlin), Vol. 15, No. 1, p 69-133, March, 1984. 40 Fig, 31 Tab, 147 Ref.

Descriptors: *Water pollution effects, *Saprobic status, *Eastern Kalinadi, *India, Bacteria, Biochemical oxygen demand, Self-purification, Rivers, Bottom sediments, Chemical analysis, Municipal wastes, Industrial wastes, Waste disposal, Physicochemical properties, Fish, Aquatic life.

Eastern Kalinadi is a perennial river, which originates near the village of Rasulpur in the Muzaffarnagar district and then flows through the Western and Eastern districts of Uttar Pradesh. The river finally opens into the holy river Ganga near Kannauj in Farrukhabad district. Untreated wastes from several industrial units are disposed of into the river along with sewage from the colony and city. Some of the industrial wastes entering the river are from the Upper India Sugar Mills, at Khatauli; Darurala Sugar Works, Daurala; Modi Rugger Ltd, Modipuram; Central Distillery, Meerut; Modi Industrial complex, Modinagar; and the Panniji Sugar Mills, Bulandshahr. Ecological features of a section of Eastern Kalinadi along a 210 km stretch were investigated. The effects of the pollution are found in both winter and summer, but reach a maximum in the dry weather flow. Specific effects on physico-chemical characteristics of the water, biota, bottom deposits, self-purification capacity of the river, biochemical oxygen demand, plankton, fish, and bacteria are discussed. The detrimental effect of different industrial wastes upon Eastern Kalinadi has progressed to a point

which direct efforts are necessary for abate-
of such pollution. (Baker-IVI)
-00798

ECTS OF POLLUTION ON THE THOS OF THE FIRTH OF FORTH,
er Coll., Edinburgh (Scotland). Dept. of Bio-
al Sciences.
Read, K. J. Anderson, J. E. Matthews, P. G.
on, and M. C. Halliday.
ne Pollution Bulletin, Vol. 14, No. 1, p 12-16,
ary, 1983. 3 Fig, 12 Ref.

riptors: *Firth of Forth, *Scotland, *Benthos,
ter pollution effects, Wastewater pollution,
ended solids, Edinburgh.

ng-term benthic study has been undertaken in
Firth of Forth (Scotland) to assess the environ-
al impact of a new sewage treatment scheme
he city of Edinburgh. The Sewage Scheme
ces the suspended solids content of the liquid
ent by approximately 60% and achieves a
ring of the concentration of materials in solu-
through more efficient dilution and dispersion.
ed changes in the intertidal benthic flora and
have been recorded along the Edinburgh
al zone. These changes have been apparent as
decline and disappearance of populations of
in pollution indicator species and the appear-
and establishment of several species previous-
recorded along the more polluted parts of the
burgh shoreline. Study of the sublittoral
os has shown no deleterious effect arising
the new effluent outfall, although there does
ar to be some enhancement of the fauna in the
(Author's abstract)
-00800

LUTION EFFECTS ON ECOBIOLOGY OF THIC POLYCHAETES IN VISAKHAPAT-M HARBOUR (BAY OF BENGAL),
hra Univ., Waltair (India). Dept. of Zoology.
. Raman, and P. N. Ganapati.
ne Pollution Bulletin, Vol. 14, No. 2, p 46-52,
uary, 1983. 5 Fig, 2 Tab, 15 Ref.

riptors: *India, *Bay of Bengal, *Visakhapat-
Harbour, *Benthos, *Polychaetes, *Water
tion effects, *Ecological effects, Physico-
ical aspects, Species diversity, Population
ity, Dissolved oxygen, Salinity, Organic
er.

truction of a 2 sq km outer harbor in 1975 at
khapatnam (India) on the Bay of Bengal, has
icted water flow and increased the organic
in the inner harbor. The harbor receives most
e city's domestic effluent and effluents from a
ty of industrial installations. Studies of the
ico-chemical and biological characteristics
carried out over a period of two years from
-1977. Polychaetes were the most diverse
hic group and formed a very large percentage
ne organisms collected at any station. Away
the outfall, the total number of the individ-
decreased after an initial peak of opportunists,
bly Capitella capitata (a capitellid), but then
number of species increased at increasing dis-
e from the source of enrichment. At the
ge outfall, no microfauna were noticed; away
this region, diversity (Margalef's diversity
, d; Shannon-Wiener index, H'; the evenness
ponent, J') increased in the direction of the
The benthic fauna occurs in three distinct
nblages: Capitella capitata-Nereis glandicincta
e inner harbor; Cossura coasta-Tharyx marioni
he outer harbor; and a Chloeia-Axiothella-
etozone-Nephtys assemblage in the open sea.
ace salinity in the inner harbor ranged from 1
4.02 0/00 and in the outer harbor ranged from
o 34.02 0/00. Dissolved oxygen in the inner
or ranged from 0 to 19.6 mg/L and in the
r harbor was well over 4 mg/L (median 7.2
L). Substrate organic matter was highest at the
ll area (median 7.31%) and was lowest at the
sea station (median 0.93%). A depletion in
number of species occurred in areas where the
unt of substrate organic matter was more than
%. (Collier-IVI)
5-00803

COLD BROOK MACROINVERTEBRATE SURVEY,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
J. Brzozowski.
Report, August 1981. 24 p, 1 Fig, 2 Tab, 1 Append.

Descriptors: *Fish, *Macroinvertebrates, *Oil spills, Fish, Stream biota, Streams, Surveys, Trout, Biological sampling, Substrates, Sampling, *New Jersey, Cold Brook.

On November 8, 1979, a Getty Pipe Company oil pipeline fractured outside of Oldwick in Tewksbury Township, New Jersey, spilling approximately 10,000 gallons of Number 2 diesel fuel into a tributary of Cold Brook. Cold Brook, an FW-2 trout production stream suffered a disastrous fish-kill with an estimated 500 fish removed from the stream. The New Jersey Divisions of Water Resources and Fish, Game, and Wildlife conducted a biological study of the affected area to: (1) assess the immediate and long term impact of the oil spill on the fish and invertebrate communities; and (2) measure the biological recovery of the stream through time. Qualitative macroinvertebrate sampling was conducted on the Cold Brook and tributary one week after the oil spill. Quantitative sampling was later conducted using Hester-Dendy artificial substrates. The oil spill had a devastating impact on the macroinvertebrate community in Cold Brook. Only one species was recovered alive at Oldwick approximately 1.7 miles downstream of the oil's entry into Cold Brook. The initial stage of biological recovery was evident at station 3 two months after the spill when 15 taxa was noted. The stream supported a healthy macroinvertebrate community eight months after the spill. Over 50 taxa were identified at stations 3 and 4, and organism density had increased to 500 and 1,000 organisms per sampler at the respective stations. (Fazio-Omniplan)
W85-00816

WATER QUALITY AND BIOLOGICAL EFFECTS OF THE ACCURATE FORMING INDUSTRIAL DISCHARGE.
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
For primary bibliographic entry see Field 5B.
W85-00822

COMPARISON OF AQUATIC SPECIES COMPOSITION AND DIVERSITY IN DISTURBED AND UNDISTURBED PINELANDS WATERS,
Rutgers - The State Univ., Camden, NJ. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W85-00823

TROPHIC STATUS OF THE WINNEBAGO POOL LAKES,
Fox Valley Water Quality Planning Agency, Menasha, WI.
W. E. Sloey, and F. L. Spangler.
Report to the Fox Valley Water Quality Planning Agency, December 1977. 97 p, 14 Fig, 7 Tab, 47 Ref, 1 Append.

Descriptors: *Trophic level, *Lakes, *Eutrophic lakes, *Water quality, *Mathematical models, Dissolved oxygen, Oxygen, Secchi disks, Chlorophyll a, Phosphorus, Regression analysis, Nitrogen, Water level, Water level fluctuations, Wind waves, Carp, Sheepshead, *Wisconsin, Winnebago Pool Lakes, Fox River Valley.

The primary goal of this study was to determine the current trophic state of Lakes Winnebago, Butte des Morts, and Poygan during 1976-77. The secondary goal was to determine the effect of calm weather conditions on the concentrations of dissolved oxygen (DO) in the Winnebago pool lakes, the largest single reservoir of water in Wisconsin (1.94 million acre-feet) and probably the most economically important. Excessive algal populations in the summer render the water unacceptable for high quality domestic or recreation uses. The authors suggest three techniques to improve water clarity by facilitating the re-establishment of aquatic vegetation: a) water level adjustments and control; b) in-lake structures to reduce wind generated waves; c) rough fish removal to reduce sediment disturbance and nutrient pumping action of carp and sheepshead. The researchers gathered data on temperature, DO, pH, total phosphorus, chlorophyll a, transparency, conductivity, and alkalinity as well as Secchi disc transparency. Lakes in the pool are not unique in any aspect of water quality. The lower limit of transparency was the same for all three lakes (0.3 m). Winnebago had the highest total phosphorus concentrations and the widest range. Chlorophyll was the most variable of the parameters studied. Oxygen concentrations revealed a wide range indicative of extreme biological activity. DO deficits (2-3 mg/l) can be expected throughout most of the water column of Winnebago on calm summer days. (Fazio-Omniplan)
W85-00829

TRENDS IN POLYCHLORINATED BIPHENYL CONCENTRATIONS IN HUDSON RIVER WATER FIVE YEARS AFTER ELIMINATION OF POINT SOURCES,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-00856

COPPER EFFECT ON DYNAMICS OF ORGANIC MATERIALS IN MARINE CONTROLLED ECOSYSTEMS,
Tsukuba Univ., Ibaraki, Japan, Inst. of Biological Sciences.
H. Seki, F. A. Whitney, and C. S. Wong.
Archiv fur Hydrobiologie, Vol. 96, No. 2, p 176-189, January, 1983. 4 Fig, 8 Tab, 23 Ref.

Descriptors: *Copper, *Water pollution effects, *Organic matter, *Marine environment, Ecosystems, Microorganisms, Trophic level, Controlled Experimental Ecosystems.

The effect of copper at a low level of 8 micrograms/l on the dynamics of organic materials was examined in enclosed marine ecosystems using three 1/4 scale Controlled Experimental Ecosystems (CEE) moored in Patricia Bay, British Columbia, Canada. The environment enclosed in each CEE bag was confirmed to have been characteristic of a mesotrophic system throughout the study. This is characteristic of the marine environment of Patricia Bay during the summer season. The impact of the 8 ppb copper addition was most remarkable on heterotrophic microorganisms, resulting in decreased microbial uptake kinetics firstly to a minimum one and a half days after the addition of copper. Thereafter the kinetics were activated to attain a much higher level than the original value within a few days. Once the new population of the copper insensitive microorganisms from the natural population was completely acclimatized to the new polluted ecosystem, a new steady-state equilibrium was established within the same trophic level as before the perturbation. The inclusion of glucose with the copper perturbation was found to depress the microbial uptake of organic materials. (Baker-IVI)
W85-00872

HEAVY METAL DISTRIBUTION IN NORWEGIAN ACIDIC LAKES: A PRELIMINARY RECORD,
E. Fjerdingstad, and J. P. Nilssen.
Archiv fur Hydrobiologie, Vol. 96, No. 2, p 190-204, January, 1983. 6 Fig, 3 Tab, 54 Ref.

Descriptors: *Heavy metals, *Acid lakes, *Norway, Water pollution effects, Copper, Lead, Zinc, Cadmium, Chromium, Molybdenum, Vegetation, Lake sediments, Acidification, Fish.

The study area was located in Southern Norway, in a region considerably influenced by industrial emissions further south in Europe. An acidification process has been confirmed within the last three decades following a catastrophic decrease in salmonid fishes. The area is covered with snow from late November to mid-April, resulting in an in-

creasing inflow of pollutants accumulated during winter to lakes during snow melting periods in spring. There seems to be no strong trend in the distribution of heavy metals in water in the various lakes, in spite of their very varying water quality. No increase was noted in the innermost acidic lakes regarding total values. Vegetation accumulated considerable amounts of Pb and Cu, up to 800 microg/g dry weight. The sediment accumulation represented normal backgrounds for unpolluted areas, or were slightly higher. It is assumed that these levels do not affect benthic animal distribution, since pH is always higher in sediments in acidic lakes than in the water, and the major fraction of the metal species may be chelated. Concentrations of heavy metals in fish was high in the acidic lakes investigated, close to that recommended by WHO for fish for consumption. Less than one kilo fish should be consumed per person per week. Large discrepancies exist in the data recorded concerning accumulation of heavy metals in fish organs. (Baker-IVI)
W85-00873

DETOXIFICATION/TOXIFICATION OF CADMIUM IN SCORPIONFISH (SCORPAENA GUTTATA): ACUTE EXPOSURE,
Southern California Coastal Water Research Project Authority, Long Beach.
For primary bibliographic entry see Field 5A.
W85-00878

BEHAVIOURAL BIOASSAY FOR IMPAIRED SEA-WATER QUALITY USING THE PLANTIGRADES OF THE COMMON MUSSEL MYTILUS EDULIS L.: THE EFFECT OF PH ON COPPER SPECIATION AND TOXICITY,
Sheffield Univ. (England). Dept. of Zoology.
N. M. H. Sheffrin, and E. E. Williams.
Aquatic Toxicology, Vol. 5, No. 2, p 109-116, May, 1984. 1 Fig, 4 Tab, 20 Ref.

Descriptors: *Copper, *Mussels, *Toxicity, *Behavior, *Hydrogen ion concentration, Water pollution effects, Marine environment, Larval growth stage, Metal speciation.

This study uses pH as an example of a physicochemical parameter that affects metal speciation and animal responses in the marine environment. A behavioral bioassay with the plantigrade stages of Mytilus edulis, together with potentiometric stripping analysis (PSA) have been used to demonstrate the relationship between pH and the more bioavailable, labile copper species to copper toxicity. Results of the PSA analyses for labile and total copper at pH 7.8 and 6.8 for copper levels 1 to 5 indicate no significant difference between the pH levels of measured total copper, but there does appear to be more labile copper at pH 6.8 than at pH 7.8. The probability of a plantigrade crawling is lower for all copper levels at pH 6.8 than at pH 7.8. There is no interaction between the pH levels at any copper level, as indicated by tha parallelism between the response lines. At pH 7.8 the probability of crawling decreases after copper level 3, but at pH 6.8 the decrease occurring after copper level 2 and copper level 3 is inhibitory. The analysis of deviance verifies that the effects of pH and copper are both highly significant and that there is no interaction between these two parameters. Crawling rate is consistently lower at pH 6.8 and parallelism is again evident in the response. The probability of a plantigrade attaching is also lower at pH 6.8 and there is no interaction between pH and copper although both produce highly significant effects. (Baker-IVI)
W85-00879

LONG-TERM SUBLETHAL PHYSIOLOGICAL EFFECTS ON RAINBOW TROUT, SALMO GAIRDNERI, DURING EXPOSURE TO CADMIUM AND AFTER SUBSEQUENT RECOVERY,
Goeteborg Univ. (Sweden). Dept. of Zoophysiology.
C. Haux, and A. Larsson.
Aquatic Toxicology, Vol. 5, No. 2, p 129-142, May, 1984. 5 Fig, 3 Tab, 36 Ref.

Descriptors: *Trout, *Toxicity, *Cadmium, *Water pollution effects, Anemia, Physiological effects, Carbohydrates, Metabolism.

The effects on hematology, blood plasma ion balance and carbohydrate metabolism were studied in rainbow trout, Salmo gairdneri, kept in brackish water, and after 18 and 30 wk of exposure to sublethal levels of cadmium (10 and 100 micro g Cd/liter), after 25 and 57 wk of subsequent recovery in clean water. Physiological disturbances such as anemia, hypocalcemia, hypermagnesemia, and hyperglycemia seem to persist during prolonged exposure and, most probably, for as long as the exposure continues. Elimination of cadmium will proceed very slowly, implicating a biological half life of more than a year in liver and kidneys. The anemia and the disturbed ion balance registered earlier during exposure seem to disappear within 6 to 13 months of recovery. This suggests that it is the presence of free cadmium ions during the exposure which is mainly responsible for most of the observed biochemical and hematological effects. Possibly these are caused by interactions between the free cadmium ions and membrane structures and functions. After removal of the external cadmium, the fish apparently have the ability to compensate for the disturbances, and to restore normal biochemical and hematological processes, despite the internal load of accumulated cadmium in body. The only effect persisting a long time after cadmium exposure is the disturbed carbohydrate metabolism. The imbalance of the endocrine control, induced by cadmium, seems to be of a profound nature. This may be related to the selective uptake and accumulation of cadmium in the pancreas and to impaired insulin production in the fish. (Baker-IVI)
W85-00881

QUANTITATIVE STRUCTURE-ACTIVITY RELATIONSHIPS AND TOXICITY STUDIES OF MIXTURES OF CHEMICALS WITH ANAESTHETIC POTENCY: ACUTE LETHAL AND SUBLETHAL TOXICITY TO DAPHNIA MAGNA,
Utrecht Rijksuniversiteit (Netherlands). Dept. of Veterinary Pharmacology, Pharmacy and Toxicology.
J. Hermens, H. Canton, P. Janssen, and R. de Jong.
Aquatic Toxicology, Vol. 5, No. 2, p 143-154, May, 1984. 1 Fig, 10 Tab, 20 Ref.

Descriptors: *Water pollution effects, *Structure-activity relationships, *Toxicity, *Daphnia, Organic compounds, Mixtures.

Quantitative structure-activity relationships (QSARs) were calculated between hydrophobicity of a group of organic chemicals with anaesthetic potency and toxicity (immobilization, mortality and inhibition of reproduction) to Daphnia magna. Differences in slopes of the high quality QSARs might be explained in terms of possible different sites of action for the three criteria of effect. The chemicals used belong to a group of more or less lipophilic nonreactive organic compounds with unspecific acute toxcity. The study demonstrated that joint effects of different compounds are also present on the sublethal level of exposure, The toxicity of mixtures of the tested chemicals, which probably acted simple similar, as was demonstrated with QSAR studies, was concentration additive or very near to it. It is difficult to conclude if the small deviation from concentration addition on a sublethal level, as found in the study of inhibition of reproduction, is systematic because little information is available. (Baker-IVI)
W85-00882

PHYSIOLOGICAL DISTURBANCES IN RAINBOW TROUT, SALMO GAIRDNERI (R.) EXPOSED AT TWO TEMPERATURES OF EFFLUENTS FROM A TITANIUM DIOXIDE INDUSTRY,
Uppsala Univ. (Sweden). Inst. of Zoophysiology.
K.-J. Lehtinen, A. Larsson, and G. Klingstedt.
Aquatic Toxicology, Vol. 5, No. 2, p 155-166, May, 1984. 1 Fig, 4 Tab, 28 Ref.

Descriptors: *Water pollution effects, *Industrial wastes, *Trout, *Titantium dioxide, *Water temperature, Toxicity, Fish, Iron,.

Rainbow trout were exposed to the supernatant waste water from a TiO2 producing plant in a continuous flow test for 2 wk at two temperatures. Presedimentation chambers were used to separate the solid, precipitated fraction of the waste water from the soluble part. The chemical analysis of the test water showed different concentrations of water soluble iron at the two temperatures studied. The iron concentration in the cold water was 0.32 mg/l, in the warm water 0.25 mg/l. Both these concentrations are much lower than a value of 3.5 mg/l, calculated from the composition of the diluted waste water and the dilution factor of the experiment. Spectra obtained from gills of an unexposed and an exposed fish were nearly identical and showed that there was no difference in metal content between the groups. After 2 wk the exposed fish showed a significantly increased hematocrit value at 13.1 to 14.4 degrees C, but not at 7.4 to 7.9 degrees C. On the other hand, exposure did not cause any alteration in hemoglobin content or number of red and white blood cells. In male fish exposed at 7.4-7.9 degrees C., the activity of the enzyme delta-aminolevulinic acid dehydratase in blood was inhibited. No significantly decreased enzyme activity was detected when both sexes were treated together. The blood plasma contents of the osmotically important ions, sodium and chloride, were significantly higher in fish exposed to effluent at the high water temperature. The calcium concentration in blood plasma was significantly lower in the exposed fish at the low temperature. Otherwise, the concentrations of inorganic ions in blood plasma, as well as the water content in liver and muscle tissue, were not altered by the effluent exposure. The titanium dioxide industrial effluent caused significantly higher levels of blood glucose and blood lactate in fish at high temperature, while no changes of these parameters were noted at low water temperature. Liver glycogen content was 28-34% lower in the exposed fish, most pronounced at low temperature. The muscle glycogen content was not significantly changed in the exposed fish. Not even the liver size was affected by the effluent exposure. (Baker-IVI)
W85-00883

LONG-TERM EFFECTS OF ARSENIC ACCUMULATION IN RAINBOW TROUT, SALMO GAIRDNERI,
Ottawa Univ. (Ontario). Dept. of Biology.
A. A. Oladimeji, S. U. Qadri, and A. S. W. deFreitas.
Bulletin of Environmental Contamination and Toxicology, Vol. 32, No. 6, p 732-741, June, 1984. 1 Fig, 2 Tab, 18 Ref.

Descriptors: *Arsenic, *Trout, Blood, Water pollution effects, Bioaccumulation, Toxicity, Hemoglobin.

Orally ingested arsenic caused a significant decrease in hemoglobin levels that was inversely related to the duration of exposure. The mean corpuscular hemoglobin concentration was also reduced after 8 weeks of exposure, suggesting that the primary effect of the arsenic on blood was a decrease in the hemoglobin in the red blood cells and not hemolysis of the cells. Arsenic accumulation in rainbow trout tissues increased with increasing levels of arsenic in the diet. The liver contained the highest levels of arsenic. Residue levels of arsenic in the skin were next highest to those for the liver. The keratin of hair and nails is rich in disulfide, and it is suggested that the arsenic could have been bound to the sulfhydryl groups in the skin and scale of fish, resulting in the observed high levels. Muscle tissue sampled in the present study did not accumulate as much arsenic as the liver or skin. (Baker-IVI)
W85-00884

MERCURY UPTAKE BY LAKE TROUT, SALVELINUS NAMAYCUSH, RELATIVE TO AGE, GROWTH, AND DIET IN TADENAC LAKE

H COMPARATIVE DATA FROM OTHER CAMBRIAN SHIELD LAKES,
ph Univ. (Ontario). Dept. of Zoology.
MacCrimmon, C. D. Wren, and B. L. Gots.
dian Journal of Fisheries and Aquatic Scienc-
ol. 40, No. 2, p 114-120, February, 1983. 3
Tab, 30 Ref.

riptors: *Mercury, *Tadenac Lake, *Ontario,
ut, Growth rate, Fish food, Toxicity, Accu-
ion, Bioindicators, Precambrian Shield,
, Heavy metals.

trout released into Tadenac Lake as juve-
show a pronounced acceleration in growth
following a change in diet from benthic inver-
es to rainbow smelt. An abrupt increase in
ate of mercury accumulation in white muscle
ese fish occurs at the same time. Mercury
in lake trout and coresident smelt from Ta-
and eight neighboring lakes reveal maximum
reaching 10.0 and 0.84 micro g/g, respec-
. Mercury levels in lake trout from Tadenac,
ndisturbed PreCambrian Shield ecosystem,
ut detected indigenous sources, exceed the
evel at sexual maturity and at a size less than
ally acceptable for human use. As the growth
are similar in various water, differences in
t of mercury accumulation is attributed to
ences in mercury availability among lakes.
smelt is an appropriate indicator species for
anking of cold water lakes relative to the
bility of mercury for uptake by lake trout
other living aquatic organisms. (Baker-IVI)
-00885

ERANCE AND RESISTANCE TO CADMI-
IN WHITE SUCKERS (CATOSTOMUS
MERSONI) PREVIOUSLY EXPOSED TO
MIUM, MERCURY, ZINC, OR SELENI-

rtment of Fisheries and Oceans, Winnipeg
itoba). Freshwater Inst.
. Duncan, and J. F. Klaverkamp.
dian Journal of Fisheries and Aquatic Scienc-
ol. 40, No. 2, p 128-138, February, 1983. 5
3 Tab, 77 Ref.

riptors: *Cadmium, *Suckers, *Tolerance,
istance, *Mercury, *Zinc, *Selenium, Toxici-
Survival, Heavy metals, Water pollution ef-
, Acclimation.

near relation was noted between the median
val time (MST) value and metal concentration
plotted on a logarithmic scale. The Cd toxic-
urve was based on pooled data from seven Cd
ity tests using control suckers. There were no
table differences between individual tests. For
Zn, and Hg toxicity curves a sharp break in
inear relationship is evident resulting in longer
values at the lower metal concentrations.
e suckers exposed to 5 mg of Hg, Cd, Zn, or
would have an MST of 2.97, 12.6, 26.4, or
ter than 100 hr, respectively. LC50 values
ed from the Cd, Zn, Hg, and Se toxicity
es show the order of metal toxicity as Hg >
> Zn >> Se. Toxicity curves demonstrate
effects of duration and concentration of suble-
Cd exposure on subsequent Cd toxicity. In-
sing the acclimation period from 1 to 2 weeks
little effect on MST values. Cd LC50 values
nd on the sublethal Cd level during the accli-
on period. Exposure of suckers to 410 or 730
o g Cd/l during a 1 wk acclimation period
eased both resistance and tolerance to Cd. Tox-
curves demonstrate the effects of sublethal
Zn, or Se exposure on subsequent Cd toxicity.
osure to 220 micrograms Hg/L prior to toxici-
esting increased both resistance and tolerance
Cd as evidenced by the toxicity curve being
ed up and to the right of the curve for control
ers. Suckers preexposed to 220 microg Hg/L
12- and 24-hr Cd LC50 values approximately
order of magnitude greater than control values
a 96 hr Cd LC50 value nearly 4 times the
rol value. Cd resistance increased in suckers
xposed to 195 or 890 microg Zn/L but Cd
rance did not. MST values obtained from ap-
riate Cd toxicity curves at specific concentra-
s provided comparison of changes in Cd resist-
. Exposure of suckers to elevated Cd or Hg levels prior to lethal Cd challenge resulted in up to three or five-fold increases, respectively, in MST values relative to values for control suckers. (Baker-IVI)
W85-00886

LACK OF EFFECT OF ARSENIC ON PHYTOPLANKTON COMMUNITIES IN DIFFERENT NUTRIENT CONDITIONS,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. Planas, and A. Lamarche.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 40, No. 2, p 156-161, February, 1983. 3 Fig, 4 Tab, 18 Ref.

Descriptors: *Phytoplankton, *Arsenic, *Water pollution effects, Nutrients, Chlorophyll, Biomass, Eutrophication, Toxicity, Organic matter.

The effect of arsenic on phytoplankton biomass was studied in an oligo-mesotrophic lake inside enclosures filled with lake water. To show the importance of eutrophication on the effect of arsenic speciation, and the possible higher toxicity of the reduced forms of arsenic on phytoplankton biomass, inorganic nutrients and organic matter were added separately to the cylinders, in the presence or absence of arsenic. Arsenic caused little change in phytoplankton biomass, measured as chlorophyll a or as biovolumes, in any of the cylinders during the 1st week of the experiment. Thereafter the biomass increased in cylinders enriched with organic matter and nutrients, with and without arsenic. (Baker-IVI)
W85-00888

TOXICITY OF THE HERBICIDES DIQUAT AND ENDOTHALL TO GOLDFISH,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences.
C. R. Berry, Jr.
Environmental Pollution (Series A), Vol. 34, No.3, p 251-258, June, 1984. 1 Fig, 1 Tab, 14 Ref. Army Corps of Engineers contract DAW 65-74-C-0013.

Descriptors: *Herbicides, *Goldfish, *Toxicity, *Diquat, *Endothall, Behavioral effects, Fish, Water pollution effects, Fish behavior, Avoidance.

Acute and behavioral toxicity to goldfish Carassius auratus was determined for the aquatic herbicides diquat and endothall, separately and combined as a 1:1 mixture by volume. The static 96-hr TL-m of endothall was 372 mg/l with 95% confidence limits of 340-406 mg/l. That for diquat was 85 mg/l with CI = 76-95 mg/l. The TL-m for the mixture was 64 mg/liter diquat to 64 mg/l endothall. The toxicity of the mixture exceeded that of either herbicide alone, suggesting an additive effect. Hypertrophied gill epithelial cells were found in fish exposed to diquat at concentrations of 32 mg/l and higher, and to the mixture of 32 mg/l each of diquat and endothall. Gill hypertropy was also apparent in fish exposed to concentrations of 80 mg/l of endothall or more. The degree of hypertrophy was not directly proportional to concentration and gill structure of exposed and control fish was not consistently different. No abnormal changes were found in olfactory epithelium, taste buds or the epithelial lining of the cephalic lateral line canals in fish exposed to the herbicides either separately or combined. When a mixture of 0.11 mg/l diquat: 0.17 mg/liter endothall was added to the avoidance chamber, the mean distance of the test fish was 0.2 m farther from the toxicant entry point than that of the control group. This change did not indicate a significant avoidance. A tendency toward avoidance was noted at a mixture of 1.1 mg/l diquat and 1.7 mg/l endothall, and avoidance was highly significant at a concentration 100 x the proposed treatment rate. When diquat (1.10 mg/l) and endothall (1.70 mg/l) were tested separately, only diquat was significantly avoided. (Baker-IVI)
W85-00909

TETRACHLORO-9H-CARBAZOLE, A PREVIOUSLY UNRECOGNIZED CONTAMINANT IN SEDIMENTS OF THE BUFFALO RIVER,
Environmental Research Lab.-Duluth, MN.
D. W. Kuehl, E. Durhan, B. C. Butterworth, and D. Linn.
Journal of Great Lakes Research, Vol. 10, No. 2, p 210-214, 1984. 3 Fig, 2 Tab, 8 Ref.

Descriptors: *River sediments, *Buffalo River, *New York, *Tetrachloro-9h-carbazole, Fish, Toxicity, Polychorinated biphenyls, Tetrachlorodibenzo-p-dioxin, Fluorene, Dibenzofuran, Phenanthrene, Carbazoles, Industrial wastes, Path of pollutants, Water pollution effects.

Three sediment samples taken from the Buffalo River, New York, have been analyzed for polychlorinated planar molecules similar in structure to the highly toxic 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). A large number of polychlorinated planar chemicals were found similar in structure not only to TCDD but also to TCDF (tetrachlorodibenzofurans). These residues may be partially responsible for the unusual effects upon Buffalo River fish. Levels of chemical residues in the river sediment appear to be highest near an area where a dye manufacturing plant had previously discharged into the river. Specific chemicals identified in the sediments included chlorinated dibenzofuran, fluorene, biphenylene, phenanthrene, naphthalene, and 9H-carbazole. 1,3,6,8-Tetrachloro-9H-carbazole was identified as the major chemical of this type in the sediments, and quantified at levels as high as 25 mg/g at one site. (Baker-IVI)
W85-00927

TOXIC SITUATION TO DAPHNIDS IN THE LOWER WUPPER RIVER - A SUPPLEMENTAL METHOD OF WATER QUALITY SURVEILLANCE (DIE DAPHNIENTOXISCHE SITUATION IN DER UNTEREN WUPPER - EINE ERGANZENDE METHODE DER GEWASSERGUTEUBERWACHLUNG),
Landesamt fuer Wasser und Abfall Nordrhein-Westfalen, Dusseldorf (Germany, F.R.).
J. Knie.
Deutsche Gewasserkundliche Mitteilungen, Vol. 27, No. 5/6, p 153-157, December, 1983. 3 Fig, 5 Ref.

Descriptors: *Toxicity, *Water quality, *Pollution index, *Wupper River, *Daphnia, Saprobity index, Arthropods, Ecological effects, Wastewater pollution, Water pollution effects.

For more than three years the lower Wupper River was toxicologically investigated with the aid of Daphnia tests. The waters from the drain of the Rutenbeck sewage treatment plant to the junction with the Rhine were found to be highly toxic. Arthropods are particularly endangered in this 41 km section, and fish were only indirectly affected due to the lack of food. Based on the values of toxicity to daphnids, the Wupper River has been divided into several classes of different toxicity levels. Each toxicity level is associated with a special color, permitting the differences in quality in different river sections to be easily recognized at first sight. This new method completes and extends ecological and limnological research for determining the saprobity index. (Wheatley-IVI)
W85-00963

ANALYSES OF THE MACRO-DRIFT FROM THE INLET-RAKE SHUTTER TO THE NUCLEAR POWER PLANT OF WURGASSEN AT THE UPPER WESER RIVER (UNTERSUCHUNGEN UBER DIE ZUSAMMENSETZUNG DES RECHENGUTES AM KKW WURFGASSEN/OBERWESER),
For primary bibliographic entry see Field 6G.
W85-00971

LIMNOLOGICAL EFFECTS OF PEATLAND DRAINAGE AND FERTILIZATION AS REFLECTED IN THE VARVED SEDIMENT OF A DEEP LAKE,
Joensuu Univ. (Finland). Karelian Inst.
For primary bibliographic entry see Field 2H.
W85-00982

CHARACTERISTIC DEFORMITIES IN TUBIFICID OLIGOCHAETES INHABITING POLLUTED BAYS OF LAKE VANERN, SOUTHERN SWEDEN,

Uppsala Univ. (Sweden). Dept. of Zoology.
G. Milbrink.
Hydrobiologia, Vol. 106, No. 2, p 169-184, September, 1983. 8 Fig, 2 Tab, 45 Ref.

Descriptors: *Tubificids, *Deformities, *Water pollution effects, *Lake Vanern, *Sweden, Toxicity, Industrial wastes, Municipal wastewater, Mercury, Zinc, Cadmium, Chlorinated hydrocarbon, Heavy metals.

Tubificid worms of the species Pomatothrix hammoniensis with characteristic, but hitherto unknown, deformities are described from four bays and fjords of Lake Vanern, Southern Sweden. These worms are easily recognized, since their chaetae are grotesquely enlarged distally, others are strongly serrated or deeply split, etc. These deformities are clearly associated with pollutants, since the limited areas of the lake in which they occur have long been under severe stress from industrial and municipal wastes, especially from nearby pulp mill and chlor-alkaline industries from which mercury compounds are known to emanate. Lake Vanern belongs to the most mercury-polluted major lakes of the world with sediment concentrations of up to 10,000 ng Hg/g dry weight (natural background value about 30 ng/g dry weight). The Kendall Rank statistical test showed a highly significant correlation (tau = 0.87; S = 14) between the incidence of deformities and mercury deposits in the lake. Zinc and cadmium are also deposited in large concentrations in the lake and there are also a variety of chlorinated organic compounds in the wastewater about which we know little at present. It is speculated that synergistic effects between contaminants may be responsible for the deformities. It is likely that the observed deformities are mainly of phenotypic origin, since aberrant young specimens are uncommon. (Author's abstract)
W85-00985

SELECTIVE EFFECTS OF PHYTOPLANKTON ENTRAINMENT AT THE SURRY POWER PLANT, JAMES RIVER, VIRGINIA,

Hampton Inst., VA. Center for Marine and Coastal Environmental Studies.
R. A. Jordan, P. G. Martin, and C. E. Sutton.
Hydrobiologia, Vol. 106, No. 3, p 253-261, October, 1983. 7 Fig, 1 Tab, 25 Ref.

Descriptors: *Phytoplankton, *Entrainment, *James River, *Virginia, *Surrey Power Plant, Cooling water, Water temperature, Diatoms, Powerplants, Salinity, Environmental effects.

Loss of cryptophyte cells entrained in the Surry Power Plant cooling water was significantly correlated with discharge water temperature in the range 27.2-37.5 C. Entrained Skeletonema costatum and benthic diatom populations experienced losses of 25-80% in the summer, but correlations between % loss and discharge temperature were insignificant. Cropping by benthic filter feeders in the intake and discharge canals could account for the summer removal of diatoms. Shortening of entrained S. costatum chains was detected in both winter and summer, indicating a mechanical effect of turbulence. Benthic diatoms were vulnerable to entrainment only during daylight hours, when they migrated to the sediment surface at low tide. Skeletonema costatum was most vulnerable in the summer, when elevated salinities permitted it to range upstream to the intake area. Cryptophyte populations peaked in the summer when entrainment loss was greatest. The composition of the entrained phytoplankton community was altered by the species specific interactions of factors affecting vulnerability and entrainment loss. At Surry the discharged cooling water mixes rapidly with the main stem James River, and the selective effects of entrainment are not detectable in phytoplankton samples taken beyond the immediate discharge zone. More persistent modifications of the phytoplankton could be expected at sites where power plants discharge into creeks or embayments. (Author's abstract)
W85-00987

HEAVY METALS IN WATER, SEDIMENTS AND INVERTEBRATES FROM A METAL-CONTAMINATED RIVER FREE OF ORGANIC POLLUTION,

Durham Univ. (England). Dept. of Botany.
I. G. Burrows, and B. A. Whitton.
Hydrobiologia, Vol. 106, No. 3, p 263-273, October, 1983. 1 Fig, 9 Tab, 47 Ref.

Descriptors: *Heavy metals, *Sediment contamination, *Invertebrates, *River Derwent, *England, Fluorspar, Mine wastes, Zinc, Cadmium, Lead, Chemical composition, Water pollution effects, Biological magnification, Insects.

A study was made of water, sediments and invertebrates in the R. Derwent, North-East England, at one site above and three sites below a stream bringing in high concentrations of Zn, Cd and Pb derived from an active fluorspar mine. The mean concentrations of these metals in filtrable water at the unpolluted site were 0.020, < 0.0003, 0.005 mg/l, respectively, while those at the first polluted site were 0.29, 0.0006, 0.016 mg/l. The benthic macroinvertebrate fauna was dominated by insects; all taxa present at the unpolluted site were represented at one or more of the polluted sites. In almost all cases the elevated concentrations of metals in water and sediments at polluted sites were paralleled by higher concentrations in animals. Significant positive correlations were demonstrated between metal concentrations in certain taxa and those in their environment e.g. Ecdyonurus venosus and aqueous Pb. Mayflies tended to concentrate Zn, Cd and Pb to higher levels than other groups. Comparison of carnivorous species with other taxa revealed no indication of increased metal concentrations at higher trophic levels. (Author's abstract)
W85-00988

EFFECTS OF PENTACHLOROPHENOL (NA PCP) ON SURVIVAL, ACTIVITY AND METABOLISM IN RHINOMUGIL CORSULA (HAMILTON), CYPRINUS CARPIO (LINNAEUS) AND TILAPIA MOSSAMBICA (PETERS),

Central Inland Fisheries Research Sub-Station, Allahabad (India).
M. M. Peer, J. Nirmala, and M. N. Kutty.
Hydrobiologia, Vol. 108, No. 1, p 19-24, October, 1983. 5 Fig, 1 Tab, 39 Ref.

Descriptors: *Toxicity, *Pentachlorophenol, *Mullet, *Carp, *Tilapia, Pesticide toxicity, Mortality, Metabolism, Spontaneous activity, Exercise, Fish.

The median lethal time (LT 50) at any one initial nominal concentration of PCP tested (1.0-4.0 mg/l), for example 3.0 mg/l, is found to be longest for Tilapia mossambica (175 minutes), followed by Cyprinus carpio (50 minutes) and Rhinomugil corsula (31 minutes) suggesting that the difference in resistance (survival) to PCP may be species-specific. When R. corsula was exposed to 0.1 and 0.133 mg/l PCP, the standard metabolic rate was elevated by 37 and 45% respectively at 30 C, when compared to control fish (112 mg/kg/hr). In carp, the metabolic rate showed an increase to begin with, but later decreased during the test period (20 days), but the random (spontaneous) activity was seen to slope down as the number of exposure days increased. During exercise (35 cm/s) the rate of oxygen consumption in the control and PCP treated Tilapia decreased with the duration of exercise (5 h), but the metabolic rate in the treated fish increased considerably. (Author's abstract)
W85-00990

COAL MINE DRAINAGE EFFECTS ON A LOTIC ECOSYSTEM IN NORTHWEST COLORADO, U.S.A.,

Chadwick and Associates, Littleton, CO.
J. W. Chadwick, and S. P. Canton.
Hydrobiologia, Vol. 107, No. 1, p 25-33, October, 1983. 3 Fig, 6 Tab, 25 Ref.

Descriptors: *Mine drainage, *Coal mines, *Trout Creek, *Colorado, *Aquatic life, Periphyton, Invertebrates, Fish, Water pollution effects, Algae, Species diversity, Strip mine wastes, Insects, Biomass, Abundance.

An aquatic biological survey was conducted in 1979-1980 to determine the effects of drainage from an active coal strip-mine on Trout Creek, in northwest Colorado. Sampling was conducted over four seasons at four stations for periphyton, benthic invertebrates and fish. Periphyton in Trout Creek changed in the relative abundance of algae divisions in no apparent relation to mining. Diatoms were the predominant divisions at all sites. Golden-brown algae were abundant in spring at the stations upstream and adjacent to the mine Blue-green algae were relatively important at stations upstream and downstream of the mine in winter. Benthic invertebrates exhibited a progressive increase in density, biomass and number of taxa from the upstream station to the downstream station. Shannon-Wiener diversity index for benthic invertebrates decreased slightly downstream of mine drainage but remained indicative of a clean water community. Aquatic insects (especially Trichoptera) were the predominant invertebrates at all stations. Analysis of functional groups of benthic invertebrates revealed importance of collector species at the lower sites while shredders were most important upstream of the mine. Unlike the invertebrates, fish exhibited slightly lower biomass at the station adjacent to the mine. The decrease was due to fewer salmonids. However, salmonid density and biomass increased substantially at the station just downstream of the mine. Non-game species (suckers and minnows) increased in numbers downstream and were most abundant at the lowest station. This coal strip-mine had little discernable adverse effects on the periphyton and invertebrates of Trout Creek. Fish populations did not appear to be significantly affected by the mine. Apparently, the presence of settling ponds and a buffer zone of unmined land between the mine and the stream helped to minimize adverse effects. (Author's abstract)
W85-00991

PRIMARY PRODUCTIVITY OF THE RIVER ELY, SOUTH WALES, U.K.,

University Coll., Cardiff (Wales). Dept. of Plant Science.
R. T. Esho, and K. Benson-Evans.
Hydrobiologia, Vol. 107, No. 2, p 141-153, November, 1983. 14 Fig, 4 Tab, 46 Ref.

Descriptors: *River Ely, *Wales, *Primary productivity, Chlrophyll a, Phytoplankton, Seasonal variation, Algae, Saprobity, Diatoms, Chlorophyta, Wastewater pollution, Animal wastes, Water pollution effects.

The present study was carried out on the non-tidal reaches of the River Ely, South Wales, from October 1979 to October 1980. The seasonal variations of the chlorophyll-a content of the phytoplankton was unimodal with one maximum in May and a minimum in December. The chlorophyll-a content varied from 0.277 to 41.259 mg/cu m. The primary productivity showed a bimodal seasonal distribution with two maxima in May and September and lower values throughout the remainder of the year, particularly in winter. The value for the primary productivity varied from 0.269 to 24.302 mg C/cu m/h. A positive correlation was obtained between chlorophyll-a content and primary productivity. The seasonal distribution of the dominant algal species and the saprobity of the River Ely were also studied. The diatom species almost showed a similar seasonal periodicity. Their concentrations were low during the winter months and high during most of the spring and summer months. Many of the dominant diatom species found in the phytoplankton populations were either considered by other authors as saprobic (Nitzschia palea) or as inhabitants of eutrophic waters (Gomphonema parvulum, Navicula cryptocephala and Synedra ulna). Chlamydomonas spp. were the most abundant green algae followed by Chlorella vulgaris. The effect of sewage effluent disposal and cattle excreta at three of the sampling sites might partly explain the present of high Chlamydomonas spp. populations at those sites. Physical factors (low flow rates, high transparency and water temperature) and organic pollution at some sampling sites seemed to play an important role in increasing the number of algal species during spring and summer.

non-tidal reaches of the River Ely were found
e beta-mesosaprobic above and below Station 5
alpha-mesosaprobic at the latter station and
efore, the river can be considered as polluted
Station 5 and mildly polluted at the others.
thor's abstract)
5-00996

SPONSES OF LAKE WATERS TO ORGAN-
MATTER ADDITIONS,
fornia Univ., Berkeley. Lawrence Berkeley

primary bibliographic entry see Field 2H.
5-00998

FECTS OF LOW CONCENTRATIONS OF
RTICULATES FROM PAPER MILL EFFLU-
T ON THE MACROINVERTEBRATE COM-
NITY OF A FAST-FLOWING STREAM,
annah River Ecology Lab., Aiken, SC.
T. Mayack, and J. S. Waterhouse.
lrobiologia, Vol. 107, No. 3, p 271-282, No-
ber, 1983. 4 Fig, 5 Tab, 62 Ref. DOE contract
-AC09-76SR00819.

criptors: *Sarnac River, *New York, *Pulp
paper industry, *Industrial plants, *Inverte-
es, Dissolved oxygen, Hydrogen ion concen-
ion, Biochemical oxygen demand, Water tem-
ature, Nutrients, Particulate matter, Substrates,
ht penetration, Seston, Benthos, Species diver-
, Water pollution effects.

effects of a paper mill effluent on the macroin-
tebrate community were assessed for the riffle
s of a large fast-flowing stream, the lower
hes of the Saranac River of northern New
k State, U.S.A. The effluent caused few
nges in dissolved oxygen concentration, pH,
hemical oxygen demand, temperature or nutri-
content; however, significant differences in
smitted light, concentrations of particulates
accumulated debris on the substrate were ob-
ed. A moderate decrease in invertebrate diver-
correlated with increased levels of particulates
substrate debris. An analysis of the response of
ertebrate functional groups revealed the efflu-
had little effect on the density of gathering
ector organisms. The functional groups most
erely reduced in density were the filtering col-
ors and scrapers. Predators showed a moderate
uction in density in response to the effluent.
e alterations in invertebrate densities were at-
uted largely to the alterations in seston and
strate caused by the introduction of particulates
nposed mainly of paper fiber and inert dye.
thor's abstract)
5-01003

FLUENCE OF MINERAL SALTS ON FE-
NDITY OF THE WATER FLEA (DAPHNIA
AGNA) AND THE IMPLICATIONS ON TOX-
TY TESTING OF INDUSTRIAL
ASTEWATER,
and G Bionomics, Wareham, MA. Aquatic
xicology Lab.
A. Leblanc, and D. C. Surprenant.
drobiologia, Vol. 108, No. 1, p 25-31, January,
4. 5 Fig, 5 Tab, 15 Ref.

scriptors: *Daphnia, *Toxicity, *Industrial
stewater, *Minerals, *Hardness, Sodium, Calci-
, Magnesium, Water pollution effects, Bioassay,
trient requirements.

e effects of mineral salts constituting water
rdness on fecundity of Daphnia magna were
essed. Of the salts tested, increased concentra-
ns of NaHCO3 and MgSO4 had no effect on
undity, CaSO4 significantly increased fecundity,
l KCl significantly reduced fecundity. The
mber of offspring produced per daphnid was
rrelative to the CaSO4 concentration at CaSO4
ncentrations between 91 and 2100 mg/L. The
ects of CaSO4 on daphnid fecundity could influ-
ce the interpretive outcome of industrial
stewater toxicity tests using this species when
e waste and dilution waters contain different
ncentrations of CaSO4. It is recommended that
ien performing these tests, dilution water be sampled at the intake site of the industry's water source, thus assuring initial comparability of the waste and dilution waters. The CaSO4 content of the water prior to and after industrial use should be determined to identify any alterations of CaSO4 concentration during use. Identification of CaSO4 concentration differences can aid in the interpretation of effects associated with the wastewater. (Author's abstract)
W85-01005

PRODUCTION OF FIVE GENERA OF CHIRONOMIDAE (DIPTERA) IN LAKE NORMAN, A NORTH CAROLINA RESERVOIR,
Duke Power Co., Huntersville, NC. Environmental Services Section.
T. J. Wilda.
Hydrobiologia, Vol. 108, No. 2, p 145-152, 1984. 2 Fig, 4 Tab, 30 Ref.

Descriptors: *Midges, *Population dynamics, *North Carolina, *Lake Norman, *Thermal pollution, Hydroelectric power, Reservoirs.

The production of five genera of chironomids collected at 4- and 8-m depths at four stations in Lake Norman, North Carolina, was estimated using the size-frequency method. To correct for multivoltinism, the estimates were adjusted by multiplying by 365/Cohort Production Interval. Body length dry mass least square regressions accounted for at least 85% of the variance for all genera except Cryptochironomus, where the regression accounted for 57% of the variance. When data from all littoral stations were combined for each genus, Tanytarsus had the highest production, followed by, in order of descending production values, Chironomus, Cladotanytarsus, Cryptochironomus, and Stempellina. The same pattern of production estimates was observed at sublittoral stations except that the estimate for Stempelina was greater than that for Cryptochironomus. The P/B ratios for Tanytarsus at littoral stations ranged from 119 to 176 and were higher overall than for any other taxon at either depth. The P/B ratios for all other taxa at littoral and sublittoral stations ranged from 50 to 118 with two exceptions. The P/B ratios for Chironomus were lower than those for any other taxa at littoral and sublittoral stations; the range of P/B values over both depths was 50 to 70. (Baker-IVI)
W85-01010

MAINTENANCE OF STRUCTURAL INTEGRITY IN FRESHWATER PROTOZOAN COMMUNITIES UNDER STRESS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
K. M. Hart, and J. Cairns, Jr.
Hydrobiologia, Vol. 108, No. 2, p 171-180, 1984. 2 Fig, 9 Tab, 35 Ref.

Descriptors: *Michigan, *Smith Mountain Lake, *Virginia, *Protozoa, *Stress, *Assimilative capacity, Ecosystems, Eutrophic lakes, Oligotrophic lakes, Copper sulfate, Population density, Species composition, Water pollution effects.

Aquatic ecosystem assimilative capacity is defined as the ability of an ecosystem to assimilate a substance or stress without degrading or damaging its ecological integrity, i.e., the maintenance of structure and function characteristic of that locale. The structural assimilative capacity of protozoan communities from nine lakes in the area of the University of Michigan Biological Station, Pellston, Michigan, and six stations at Smith Mountain Lake, Virginia, were studied in 1979 to determine if communities from lakes of differing trophic state differ in their ability to assimilate various amounts of copper sulfate, and to explore the possible influence of average density of individuals and/or qualitative differences in the types of species present on any observed differences in assimilative capacity. In both the northern Michigan and Smith Mountain Lake studies, a trend in response was demonstrated along the eutrophic-oligotrophic gradient; eutrophic communities had a greater structural assimilative capacity than did oligotrophic communities. The eutrophic communities have a greater proportion of species that are tolerant of low concentrations of copper and are more capable of assimilating this heavy metal with regard to structural integrity. Both mean species density and community composition appear to be important factors in the ability to maintain structural integrity. (Collier-IVI)
W85-01012

PHOSPHATE UPTAKE BY BLUE GREEN ALGAE IN VITRO AND IN A LAKE DURING AN ALGAL BLOOM: USEFUL APPLICATION OF A FORCE-FLOW RELATIONSHIP,
Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Limnologie.
For primary bibliographic entry see Field 2H.
W85-01015

INCIDENCE OF DEFORMED CHIRONOMID LARVAE (DIPTERA: CHIRONOMIDAE) IN SWEDISH LAKES,
National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab.
T. Wiederholm.
Hydrobiologia, Vol. 109, No. 3, p 243-249, February, 1984. 4 Fig, 1 Tab, 17 Ref.

Descriptors: *Water pollution effects, *Midges, *Heavy metals, *Sweden, Lakes, Water pollution effects, Larval growth stage, Industrial wastes.

Data on deformed mouth parts of chironomid larvae from 12 Swedish lake sites of various time periods are presented along with SEM pictures of some of these deformities. The incidence of chironomid larvae with deformed mouth parts was very low in subfossil material 100 years or more of age in material recently taken from unpolluted lakes. Deformities were slightly more abundant in slightly polluted lakes. High incidence of deformities was found in lakes heavily polluted by effluents from various industrial activities. Deformities occur in genera that are widely separate in their mode of living and taxonomic position but some genera seem to be affected much less often or not at all. The findings reported both here and in the literature indicate several heavy metals may give rise to abnormal occurrence of deformities, but the concentrations and other circumstances where this occurs must be further studied. (Baker-IVI)
W85-01021

MINERAL NUTRIENT DEMANDS OF THE WATER HYACINTH (EICHHORNIA CRASSIPES (MART.) SOLMS), IN THE WHITE NILE,
Khartoum Univ. (Sudan). Dept. of Biology.
L. A. Desougi.
Hydrobiologia, Vol. 110, No. 4, p 99-108, March, 1984. 13 Tab, 14 Ref.

Descriptors: *Water pollution effects, *Water hyacinth, *Plant growth, *Sudan, *Bahr el Ghazal River, Metals, Minerals, Nutrients, Nitrogen, Phosphorus, Potassium, Magnesium, Sulfur, Calcium, Iron, Manganese, Zinc, Copper, Molybdenum.

The possibility that the stunted growth of the water hyacinth in Bahr el Ghazal river in Sudan is influenced by nutrient elements is considered. Greenhouse experiments were carried out to determine the effects of deficiency and mineral nutrient addition of the growth of this plant. Water hyacinths were found to grow in 10%, 50%, 100%, and 200% Hoagland nutrient solution with an optimum growth at 50%. At 10% deficiency symptoms developed and at 200% damage effects appeared. Elemental deficiency studies demonstrated that deficiency of any macroelement leads to inhibition of growth measured as dry weight or mass production of either leaves or daughter plants. This inhibition of growth reached up to 50% compared to complete Hoagland solution. On investigating the nitrogen level effect on the growth of the plant, maximum growth was recorded at 21 mg/l nitrogen. With increasing phosphorus, all measures of growth used increased. The rate of increase was not proportional to the increase in phosphorus, but phosphorus deficiency was a limiting factor of growth and reproduction. Iron, by deficiency as well as in surplus, affected growth

and reproduction negatively. Maximum growth was recorded at 0.6 mg/l followed by 0.3 mg/l. (Baker-IVI)
W85-01032

ATRAZINE TOXICITY TO SUBMERSED VASCULAR PLANTS IN SIMULATED ESTUARINE MICROCOSMS,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
D. L. Correll, and T. L. Wu.
Aquatic Botany, Vol. 14, No. 2, p 151-158, October, 1982. 1 Fig, 2 Tab, 13 Ref. EPA grant R804536.

Descriptors: *Atrazine, *Phytotoxicity, *Submerged plants, *Estuarine environment, Microcosms, Aquatic plants, Herbicides, Photosynthesis, Simulation, Water pollution effects.

Widespread die-offs and a general decline in the populations of many species of submersed vascular plants have been observed in the upper and midreaches of Chesapeake Bay. One hypothesis for the cause is that agricultural herbicides transported into estuaries may be found in high enough concentrations to weaken plants sufficiently that their populations decline. Experiments were conducted to determine the toxicity of the herbicide atrazine under simulated estuarine conditions in microcosms. Photosynthesis in Potamogeton pectinatus and Zostera marina was inhibited by 650 micro g/l of dissolved atrazine, but was stimulated by 75 micro g/l. Photosynthesis in Zannichellia palustris was inhibited at both of these concentrations while in Vallisneria americana inhibition was significant at the higher concentration but minor at the lower concentration. Atrazine at 120 micro g/l in solution caused 100% mortality of Vallisneria within 30 days. At 12 micro g/l mortality of Vallisneria was 50% after 47 days and the production of new plants at the ends of runners and leaf area increase of survivors were significantly reduced. Treatment with 3.2 micro g/l had relatively minor effects and results from exposure to 1.3 micro g/l were indistinguishable from controls. There is every reason to be concerned that herbicides such as atrazine may be seriously affecting submersed vascular plant populations in estuaries. (Moore-IVI)
W85-01082

EFFECTS OF COPPER CHELATE ON PHOTOSYNTHESIS AND SOME ENZYME ACTIVITIES OF ELODEA CANADENSIS,
Technische Hochschule, Aachen (Germany, F.R.). Lehrstuhl fuer Landschaftsokologie und Landschaftsgestalung.
R. Rabe, H. Schuster, and A. Kohler.
Aquatic Botany, Vol. 14, No. 2, p 167-175, October, 1982. 5 Fig, 17 Ref.

Descriptors: *Elodea, *Copper, *Phytotoxicity, *Nitrilotriacetic acid, Chelating agents, Photosynthesis, Enzyme activity, Water pollution effects, Heavy metals, Aquatic plants, Fate of pollutants.

Chelating agents, especially nitrilotriacetic acid (NTA), are under consideration as substitutes for polyphosphates in detergents, and are already in use in some countries. In severely polluted running waters the large amounts of heavy metals in the sediments are expected to be remobilized by the chelating potential of NTA. Apical shoots of Elodea canadensis were exposed to different concentrations of Cu(II)-NTA for 21 days at copper levels corresponding to those in polluted waters. The net assimilation rate of the plants decreased as exposure time and copper concentration increased, whereas the activities of the enzymes, isocitrate dehydrogenase and glutamate dehydrogenase, first increased under slight or moderate stress, but decreased markedly after longer exposure and higher copper levels. Widespread use of chelating agents such as NTA may lead to damage to vegetation by releasing heavy metals from the sediemnts. (Moore-IVI)
W85-01083

TERRESTRIALITY IN THE CYPRINODONTID FISH RIVULUS MARMORATUS: POTENTIAL UTILITY IN H2S AND OTHER BIOASSAYS,
Charleston Coll., SC. Grice Marine Biological Lab.
For primary bibliographic entry see Field 5A.
W85-01089

ORGANAL DAMAGE CAUSED BY ALDICARB TO A FRESHWATER TELEOST BARBUS CONCHONIUS HAMILTON,
Kumaun Univ., Naini Tal (India). Dept. of Zoology.
S. Kumar, and S. C. Pant.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 1, p 50-55, July, 1984. 3 Fig, 10 Ref.

Descriptors: *Pesticide toxicity, *Water pollution effects, *Barbus, *Aldecarb, Fish, Agricultural chemicals, Toxicity, Carbamate pesticides,.

Immediately on exposure to the aldicarb solution the fish became slightly excited and swam erratically, becoming normal only 2 hr later. Morphological and histological examination of the gills revealed an immediate oversecretion of mucus in response to aldicarb treatment. Aldicarb produced only milder alterations in the histology of liver. After 2 days of treatment the liver capillaries were swollen and congested at several places, forming rounded to oval areas in between hepatic cells. The organ most affected was the kidney which suffered internal hemorrhage and congestion after 2 days. (Baker-IVI)
W85-01091

ACUTE TOXICITY OF CHROMATE, DDT, PCP, TPBS, AND ZINC TO DAPHNIA MAGNA CULTURED IN HARD AND SOFT WATER,
Goeteborg Univ. (Sweden). Dept. of Zoophysiology.
R. Berglind, and G. Dave.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 1, p 63-68, July, 1984. 3 Tab, 20 Ref.

Descriptors: *Hardness, *Toxicity, *Daphnia, Chromates, DDT, Zinc, Pentachlorophenol, Tetrapropylenebenzyl sulfonate, Heavy metals, Pesticides.

The toxicity of five chemicals was studied in D. magna cultured in either hard or soft water. The toxicity tests were made in reconstituted waters and the five chemicals to be tested were: p, p'-DDT, pentachlorophenol (PCP), tetrapropylenebenzyl sulfonate (TPBS), potassium bichromate (K2Cr2O7) and zinc sulfate. The hardness of the culture water did not affect the toxicity of PCP, K2Cr2O7, TPBS, or Zn, but DDT was more toxic to hard water cultured than to soft water cultured water fleas, especially after 24 hr. All soft water cultured water fleas died within the first 24 hr of the study. DDT was about 40 times more toxic in the soft compared to the hard dilution water. Thus the hardness of the water can affect the toxicity of certain chemicals. Culture conditions like water hardness and type of food can affect the acute toxicity of certain chemicals even if the exposure is made under identical conditions. (Baker-IVI)
W85-01092

5D. Waste Treatment Processes

LIQUID/SUSPENDED SOLID PHASE PARTITIONING OF POLYCYCLIC AROMATIC HYDROCARBONS IN COAL COKING WASTEWATERS,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. W. Walters, and R. G. Luthy.
Water Research, Vol. 18, No. 7, p 795-809, 1984. 4 Fig, 11 Tab, 37 Ref.

Descriptors: *Polycyclic aromatic hydrocarbons, *Coke plants, *Wastewater treatment, Partition coefficients, Suspended solids, Industrial wastewater, High pressure liquid chromatography, Gas chromatography, Mass spectrometry, Napthalene, Dibenz(a,h)anthracene, Effluents.

Polycyclic aromatic hydrocarbons (PAH) are pr
duced as a result of pyrolysis during coal conv
sion processing and have been identified in liq
effluents from coal conversion facilities. PAH
generally toxic and have been linked to carci
genic activity. Seventeen wastewater samples c
lected from five streams among two coke pla
were characterized by high pressure liquid ch
matography and gas chromatographic mass sp
trometry; wastewater streams included the amm
nia still influent, ammonia still effluent, and biol
ical oxidation effluent. Samples collected fr
these streams were separated into liquid and s
pended solid phases; each phase was analyzed
eleven PAH. Total wastewater concentrations
these compounds ranged from about 2000 micro
l in the ammonia still influent to 5-120 micro g/l
the biological oxidation effluent. Wastewater PA
were partitioned between liquid and suspend
solid phases; in most samples suspended solid pha
PAH accounted for approximately 80% or more
total wastewater PAH. Partitioning in the biolo
cal oxidation effluent stream was correlated wi
aqueous solubility and n-octanol/water partiti
coefficients. The ratio of a given PAH mass co
centration in the suspended solid phase (micro
kg of solid) to that in the liquid phase (micro g/l
of water) ranged from less than 100 for napthale
in the ammonia effluent stream to above 10,000,0
for dibenz(a,h)anthracene in the biological oxid
tion effluent stream. Wastewater treatment consi
ing of sedimentation, ammonia stripping, and bi
logical oxidation generally reduced liquid pha
PAH concentrations to the range of 1 micro g/l
less. Effective removal of wastewater suspend
solids will reduce total effluent PAH concentr
tions. (Collier-IVI)
W85-00554

ORGANIC WATER QUALITY AND OTHE FACTORS IN POULTRY PLAN WASTEWATER RENOVATION AND REUSI
Pittsburgh Univ., PA. Graduate School of Publ
Health.
J. B. Andelman, J. K. Wachter, S. Nolle, and J. M
Beck.
Water Research, Vol. 18, No. 7, p 843-853, 1984.
Fig, 8 Tab, 23 Ref.

Descriptors: *Food-processing waste
*Wastewater renovation, *Water reus
Wastewater treatment, Chlorination, Phthalate
Adipates, Fatty acids, Chloroform, Halides, Endo
toxins, Organic carbon.

A wastewater treatment and reclamation syste
has been constructed at a poultry slaughtering an
processing plant in Maryland which processe
60,000 birds/day and uses 1,300,000 l/day of treat
ed well water. Because of the lack of additiona
water of acceptable quality, the reclamation syste
was constructed which utilizes as its source th
chlorinated effluent from the second of two aer
ated lagoons. Reclaimed water could be mixed 50
50 with well water before conventional treatmen
for use in the plant. The main classes of organi
compounds which were identified in the renova
tion system were substituted phthalates and adi
pates and (methylated) fatty acids and their amid
derivatives. Those compunds confirmed in the ren
ovation system were at low concentratons an
have their probable origins in poultry wastes; non
of them are unusual, acutely toxic, or refractory
Chloroform concentrations were lower than
micro g/l throughout the renovation system. Tota
organic halide, total organic carbon and endotoxi
concentrations in the final renovated water wer
slightly high when compared to typical levels oc
curring in finished waters from other systems. A
treatment progressed, the contribution of com
pounds greater in molecular size than 400 Dalton
to organic carbon content decreased. Based o
these and previous results, there would not be a
undue health risk if the renovated water would b
recycled and reused for a trial period. (Collier-IVI
W85-00557

CHLORINATED PHENOLICS OF BLEACHE KRAFT MILL ORIGIN; AN OLFACTOR EVALUATION,

and Paper Research Inst. of Canada, Pointe
e (Quebec).
rimary bibliographic entry see Field 5A.
00559

REATMENT OF WATER SOFTENING
WASTEWATER SLUDGES,
siana Water Resources Research Inst., Baton
ge.
rimary bibliographic entry see Field 5E.
00609

MUDAGRASS GROWN WITH MUNICI-
WASTEWATER,
na Agricultural Experiment Station, Tucson.
of Plant Sciences.
rimary bibliographic entry see Field 3C.
00680

ROGEN PEROXIDE IN MUNICIPAL,
DFILL AND INDUSTRIAL EFFLUENT
ATMENT,
L. Fraser, and A. F. E. Sims.
ent and Water Treatment Journal, Vol. 24,
, May, 1984. 3 Tab, 8 Ref.

riptors: *Wastewater treatment, *Hydrogen
ide, Oxidation, Gas scrubbing, Effluents,
onitrile, Leachates, Landfills, Lagoons, Indus-
wastes, Sulfide, Hydrogen sulfide, Phenols,
maceutical industry.

rogen peroxide is a relatively strong chemical
nt and in addition provides a direct source of
en. Oxidation potentials are given in compari-
with other oxidants. In the United Kingdom
e sulfate levels of 250 to 500 mg/l have devel-
in sludge due to sulfate enrichment of sewage
a water, hydrogen peroxide has been injected
the sludge stream during primary tank des-
ng. In practice, usually between 2 and 5 moles
ogen peroxide:1 mole sulfide in sludge are
ired for effective treatment. Hydrogen perox-
s used for controlling odor in lagoons, for
rolling microbial growth in streams and han-
industrial effluents from cellophane manufac-
food manufacture, oil refinery wastes, tar
leries, paint stripping effluents, pharmaceuti-
nanufacturers, tin plating of steel, acrylonitrile
ufacture, heat treatment salts, and photograph-
luents. (Baker-IVI)
00684

FILM FOULING OF RO MEMBRANES -
NATURE AND EFFECT ON TREATMENT
WATER FOR REUSE,
ge County Water District, Fountain Valley,

. Ridgway, C. A. Justice, C. Whittaker, D. G.
, and B. H. Olson.
nal of the American Water Works Associa-
Vol. 76, No. 6, p 94-102, June, 1984. 12 Fig, 1
30 Ref.

criptors: *Water reuse, *Reverse osmosis,
stewater treatment, Membrane processes,
nbrane fouling, Bacteria, Films, Municipal
ewater, Secondary wastewater treatment,
rine.

dence indicates that microorganisms present in
rse osmosis feedwater rapidly attach to the
aces of cellulose diacetate membranes used for
ineralization of pretreated, secondary munici-
effluent. These fouling bacteria irreversibly
ere to the RO membrane surfaces by producing
e amounts of extracellular slime, possibly of
opolysaccharide or glycoprotein composition.
ppears that microorganisms colonize low chlo-
membrane surfaces in three distinct stages: an
al, exponential growth phase, a slower increase
acterial numbers, and a slow decline during the
ainder of membrane operation. High concen-
ions of combined chlorine in the feedwater do
prevent adhesion of bacteria to the surfaces of
chlorine membranes. Temporal succession is
dent in the kinds of microoganisms populating
low chlorine membrane surfaces. Increased
ntities of bacteria, and biochemical indicators such as total protein and carbohydrate at the membrane surfaces, were directly related to a progressive decline in membrane water flux. Continuous exposure to a high concentration of chloramines did not adversely affect the mineral rejection characteristics of high chlorine membranes. The structural integrity of high chlorine membranes was destroyed by exposure to a free available chlorine residual of 10-15 mg/L. (Baker-IVI)
W85-00712

WATER POLLUTION CONTROL FOR UNDERGROUND COAL GASIFICATION,
Wyoming Univ., Laramie. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W85-00717

RAINFALL AND OVERLAND FLOW PERFORMANCE,
R. F. de Figueiredo, R. G. Smith, and E. D. Schroeder.
Journal of Environmental Engineering, Vol. 110, No. 3, p 678-694, June, 1984. 16 Fig, 4 Tab, 11 Ref.

Descriptors: *Overland flow, *Land disposal, *Wastewater treatment, *Rainfall, Biochemical oxygen demand, Suspended solids, Rainfall runoff, Soil erosion, Municipal wastewater, Effluents.

In an effort to develop a better understanding of the effect of rainfall on overland flow land treatment process performance, studies were conducted at indoor pilot facilities and full-scale field facilities. Rainfall was found to affect the performance of an overland flow land treatment system used for the treatment of municipal wastewater. Effluent BOD5 concentrations during rainfall events were only slightly higher than values observed during normal operation without rainfall and were well below the 30 mg/L level. Effluent suspended solids concentrations during rainfall events were generally greater than 30 mg/L, but solids were mostly inorganic and the observed concentrations were generally less than in rainfall runoff from control slopes that did not receive wastewater. The elevated concentrations observed during rainfall were believed to be largely the result of nonvolatile solids eroded from exposed earthen ditch banks. Lining of ditches may reduce the total suspended solids concentration on effluents during rainfall to levels less than 30 mg/L. Mass discharges of BOD5 and suspended solids increased significantly above normal operating values, and the increase was directly correlated with rainfall intensity and duration. The finding of particular importance to regulatory officials is that effluent quality from overland flow slopes during rainfall events is generally of better quality than that of rainfall runoff from vegetated slopes that do not receive wastewater whether or not wastewater is being applied. (Moore-IVI)
W85-00721

KEY TO EFFECTIVE I/I CONTROL,
Westech Engineering, Inc., Salem, OR.
C. H. Steketee, and T. L. Heinecke.
Public Works, Vol. 115, No. 6, p 88-92 and 106-107, June, 1984. 1 Fig, 4 Tab.

Descriptors: *Inflow, *Sewer infiltration, *Rehabilitation, Salem, Oregon, Manholes, Pipeline joints, Service laterals, Sewer systems.

The sewer system in Salem, Oregon is severely overloaded during winter wet weather months. The leaky sewer system bypasses raw sewage, floods basements and overtops manholes several times each winter. In 1981, as part of an extensive study of infiltration and inflow (I/I) in the southern part of Salem, the decision was made to conduct pilot rehabilitation efforts in an area named the Skyline Rehabilitation Area. Leaking mainline joints were grouted, leaking manholes were drilled and grouted, and service laterals were systematically repaired. The average I/I reduction of seven completely rehabilitated sections was 97.4%. Rehabilitation of just mains and manholes produces more erratic results. In two sections where only mains and manholes were made watertight, I/I flows decreased 43% in one section and increased 208% in the other. In all, I/I flows within the entire rehabilitation area were reduced by 90%. (Moore-IVI)
W85-00739

BEDEN BROOK INTENSIVE STREAM SURVEY, SPRING/SUMMER, 1982: INTENSIVE SURVEY NO. 823404,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
For primary bibliographic entry see Field 5A.
W85-00817

UPPER LAMINGTON RIVER INTENSIVE SURVEY, INTENSIVE SURVEY NO. 803404.
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
For primary bibliographic entry see Field 5B.
W85-00819

MUSCONETCONG RIVER INTENSIVE SURVEY REPORT 803401,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
For primary bibliographic entry see Field 5B.
W85-00821

EVALUATION OF THE SAN DIEGUITO, SAN ELIJO, AND SAN PASQUAL HYDROLOGIC SUBAREAS FOR RECLAIMED WATER USE, SAN DIEGO COUNTY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
J. A. Izbicki.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4044, August, 1983. 131 p, 34 Fig, 9 Tab, 39 Ref.

Descriptors: *Alluvial aquifer, *Groundwater, *Impaired water quality, *Saline water intrusion, Semiarid lands, Wastewater, *Water reuse, *Reclaimed water, *California, San Diego County, San Pasqual, San Dieguito, San Elijo.

A study was made to determine the suitability of three small hydrologic subareas in San Diego County, California, for reuse of municipal wastewater. Ground-water quality has been impacted by agricultural water use, imported water use, changes in natural recharge patterns, seawater intrusion, and intrusion of ground water from surrounding marine sediments; therefore, ground water is of limited value as a water-supply source. Reclaimed water use is feasible and expected to improve ground-water quality, creating a new source of water for agricultural use. (USGS)
W85-00839

EFFECTS OF HEAVY METALS ON WATER HYACINTHS (EICHHORNIA CRASSIPES (MART.) SOLMS),
Delta State Univ., Cleveland, MS. Center for Alluvial Plains Studies.
S. H. Kay, W. T. Haller, and L. A. Garrard.
Aquatic Toxicology, Vol. 5, No. 2, p 117-128, May, 1984. 3 Fig, 4 Tab, 33 Ref.

Descriptors: *Water hyacinth, *Heavy metals, *Biological wastewater treatment, Lead, Copper, Cadmium, Plant growth, Wastewater treatment, Phytotoxicity.

Water hyacinths, because of their rapid growth rate and known tendency to accumulate nutrients and potentially toxic water pollutants, have been considered for use in the removal of pollutants from sewage effluents. The effects that these pollutants can have on plant growth and primary productivity have not been included in studies of pollutant removal. Water hyacinths were exposed for 6 wk to solutions containing 0-5 mg/l Pb, Cd, or Cu. Analyses of the initial culture solutions showed that the concentrations of Pb, Cd, and Cu were about 80, 89 and 97%, respectively, of the calculated concentrations prior to the introduction

of water hyacinths. The proportion of the initial Pb, Cd, and Cu remaining in solution decreased to ll, 60 and 30%, respectively, after 3 wk and 4, 44 and 41% respectively, after 6 wk. The total plant accumulation of Pb, Cd, and Cu accounted for 31, 43, and 38% respectively of the metals lost from solution after 3 wk and 62, 64 and 50% respectively after 6 wk. Lead had no visible effects on water hyacinths at any level of exposure. Plants exposed to > 0.5 mg/l Cd or > 2.0 mg/l Cu were slightly chlorotic after 10 days, and were completely chlorotic and visibly stunted after three weeks. Exposure to Cd or Cu at concentrations greater than 0.5 or 1.0 mg/l, respectively, caused growth reductions of > 60% after 3 wk. At Cd or Cu concentrations of 5.0 mg/l, growth was reduced about 80% after 3 wk and 90% after 6 wk. Flower and leaf development was severely curtailed. Lead had no significant effect on relative growth rate. These data support other findings that water hyacinths have the ability to absorb toxic substances including heavy metals from polluted waters. The toxicity of Cd and Cu to water hyacinths would necessitate the continual replacement of dead plants. (Baker-IVI)
W85-00880

TOTAL REMOVAL OF COLIFORMS AND E. COLI FROM DOMESTIC SEWAGE BY HIGH-RATE POND MASS CULTURE OF SCENEDESMUS OBLIQUUS,
Environmental Survey Lab., Tamil Nadu (India).
S. Sebastian, and K. V. K. Nair.
Environmental Pollution (Series A), Vol. 34, No. 3, p 197-206, June, 1984. 4 Tab, 16 Ref.

Descriptors: *Biological wastewater treatment, *Coliforms, *Scenedesmus, Bacteria, Municipal sewage, Domestic wastes, Hydrogen ion concentration, Wastewater treatment, Stabilization ponds.

Batch, continuous and intermittent flow systems were used to evaluate removal efficiencies of coliforms and Escherichia coli from domestic sewage by high-rate pond mass culture of S. obliquus. Batch culture experiments showed total removal of E. coli within 4 days. In control ponds E. coli was detected even on the tenth day. In these ponds Scenedesmus obliquus was not inoculated, and natural growth was allowed to take place. The findings confirmed reports in the literature which concluded that pH values above 9.4 were responsible for E. coli removal; pH values were always higher than 9.4 on the third day, reaching a maximum of 11.1 around the fifth day in batch culture systems. Semi-continuous flow cultures systems were operated under three dilution rates. The total removal of E. coli was not achieved even at a dilution rate of 0.25/day, even though pH values above 10.0 were observed. Under intermittently fed systems, two dilution rates, 0.5/day and 0.25/day with respective feeding intervals of 1 and 2 days, were studied. Total removal of E. coli was noted at a dilution rate of 0.25/day. The findings proved that a contact time of 2 days at pH 11.0 is adequate for total removal of E. coli from high rate algal ponds. (Baker-IVI)
W85-00906

INDIRECT EFFECTS OF CHLORINATED WASTEWATER ON BACTERIOVOROUS PROTOZOA,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
S. G. Berk, and J. A. Botts.
Environmental Pollution (Series A), Vol. 34, No. 3, p 237-249, June, 1984. 4 Fig, 2 Tab, 21 Ref.

Descriptors: *Water quality control, *Wastewater treatment, *Bacteria, *Protozoa, Coliforms, Irradiation, Chlorination, Ciliates, Population dynamics.

Comparisons were made among ciliate population growth of chlorinated Escherichia coli, irradiated E. coli, live Pseudomonas sp., and irradiated Pseudomonas sp. Certain ciliated protozoa can use dead bacterial cells as a food source, although the resulting secondary productivity is decreased compared with growth on living bacterial food sources. Chlorine treatment of bacteria did not appear to be a key factor in the suppression of ciliate population growth, as no differences were observed when either chlorinated or irradiated bacteria were provided as food. The mechanism of inhibition of population growth is as yet unknown. Both irradiation and chlorination affect the structure of bacterial molecules. This may be important to the nutrition of ciliated protoza, since all species require purines, and several species cannot synthesize pyrimidines de novo. Leakage of cytoplasmic contents from dead cells may also contribute to their decreased nutritional value. (Baker-IVI)
W85-00908

GENERALIZED MODEL OF AEROBIC BIOLOGICAL TREATMENT,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. A. Vavilin.
Ecological Modelling, Vol. 17, p 157-173, 1982. 10 Fig, 14 Ref.

Descriptors: *Model studies, *Aerobic treatment, *Biological wastewater treatment, Filtration, Trickln filters, Rotating discs, Wastewater treatment, Model studies.

A unified modelling approach for the aerobic treatment of liquid sewage in aeration tanks, trickling filters and rotating discs is suggested. The processing of numerous experimental data has shown that there are general regularities in the biological treatment process independent of reactor type. Particular models of treatment processes given previously by various researchers correspond to certain forms of the generalized model. The use of routine models leads as a rule to systematic error as high level and crude treatments of multicomponent liquid sewage follow differing laws. (Baker-IVI)
W85-01115

5E. Ultimate Disposal Of Wastes

SPREAD OF POLLUTANTS FROM HARBOUR SLUDGE DEPOTS,
Laboratorium voor Grondmechanica, Delft (Netherlands).
M. Loxham, and F. Weststrate.
Water Science and Technology, Vol. 16, No. 3-4, p 623-633, 1984. 8 Fig, 1 Tab, 10 Ref.

Descriptors: *Spoil banks, *Landfills, *Water pollution control, *Sludge, Harbors, Groundwater pollution, Mathematical models, Adsorption, Diffusion, Path of pollutants.

The sludge from dredging harbors can be used as raw material for other activities, can be used in civil engineering projects or can be dumped. Both the landfill option, and the civil techniques option for the final disposal of contaminated harbor sludge involve the isolation of the sludge from the environment. For short time scales, engineered barriers such as a bentonite screen, plastic sheets, pumping strategies etc. can be used. For long time scales the effectiveness of such measures cannot be counted upon. It is thus necessary to be able to predict the long term environmental spread of contaminants from a mature landfill. A model is presented that considers diffusion and adsorption in the landfill site and convection and adsorption in the underlaying aquifer. The adsorption behavior and the molecular diffusion coefficient of the sludge are the key parameters involved in the near field. The term adsorption coefficient is loosely taken so as to include all effects that actually control the pore water composition. If the long term integrity of such a landfill is to be improved, then attention should be directed towards influencing these processes and in particular the molecular diffusion coefficient. The near field safety analysis is usually the input into the far field study and the actual, practical targets are often kilometers removed from the near field target itself. A strong dilution effect is usually found for the far field. (Moore-IVI)
W85-00572

GEOHYDROLOGY OF THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, LOS MEDANOS AREA, SOUTHEASTERN NE MEXICO,
Geological Survey, Albuquerque, NM. Water R sources Div.
For primary bibliographic entry see Field 2F.
W85-00594

CO-TREATMENT OF WATER SOFTENIN AND WASTEWATER SLUDGES,
Louisiana Water Resources Research Inst., Bat Rouge.
J. E. Bowie, and C. A. Gautreaux.
Available from the National Technical Informati Service, Springfield, VA 22161 as PB84 19579 Price codes: A04 in paper copy, A01 in microfich Completion Report, May 1982. 46 p, 6 Fig, 8 Ta 2 Append. Project No. OWRT A-048-LA (Contract/Grant No. 14-34-0001- 0120.

Descriptors: Water softening, Sludge, Wastewat sludge, Thickening, Dewatering, *Sludge trea ment, *Sludge softening, *Louisiana, Lafayett Sludge disposal, Gravity thickening.

Water softening and wastewater treatment proces es both produce large quantities of sludge. It w hypothesized that mixing the softening sludge an wastewater sludge would produce a sludge of i termediate quality more suitable for thickening an dewatering than either sludge treated separatel The study revealed that mixing the sludges r duced final sludge volumes in the range of 4 t 52%. The ratios of softening sludge to wastewat sludge solids was the key factor influencin volume reductions. Total solid balance indicate that negligible dissolution and precipitation o curred upon mixing of the sludges. Slight increas in alkalinity and total hardness were observed i the supernate. Co-treatment of the softening sludg with the wastewater sludge reduced BOD5 an suspended solids in the supernate in the range of 2 to 87%. The improvement was due to improve solids capture. Belt press thickening was accom plished by the addition of a cationic polyelectro lyte to softened and aerobically digested sludg mixtures. A 4% net increase in cake solids wa observed when 20% by volume softening sludg was added to aerobically digested sludge with 160 mg/l polymer dosage. A hypothetical econom ic analysis for the city of Lafayette, Louisian (population 80,000), indicated a 16% daily haulin savings by transporting the water softening sludg to the wastewater treatment plant for gravit thickening and final disposal rather than separat gravity thickening sludge disposal.
W85-00609

LANDFILL DESIGN PROTECTS SOLE SOURCE AQUIFER,
J. L. Roberts, and J. A. Susan.
American City and County, Vol. 97, No. 12, p 28 29, December, 1982. 1 Fig.

Descriptors: *Landfills, *Sludge disposal, Design criteria, Aquifers, Groundwater management, Linings, Biscayne Aquifer, Wastewater facilities, Water pollution prevention.

As part of a plan for a threefold expansion of its North District Regional Wastewater Treatment Plant, Broward County, Florida, purchased a 182 acre site immediately west of the plant to serve as a landfill for the plant's solid residuals. The site is a relatively flat, sandy parcel of land that overlays the Biscayne Aquifer, the sole source of potable water for the area. The final design calls for a synthetic liner and an extensive leachate collection system to protect the aquifer from contamination, not just during the landfill's 20 year active lifespan, but beyond. The development plan includes several landfill areas and a dewatering area. Each fill area is about 800 feet by 900 feet, enclosed by a 10 ft high perimeter dike. The interior slopes of the perimeter dike and the bottom of the fill area are covered with impermeable liner. Each landfill area is divided into eight drainage cells, each about 300 feet by 160 feet. The bottom of each cell has a one percent slope to a low point in the center. Leachate and storm drainage are removed through perforated drain pipe placed in lined trenches beneath a

tive layer of sand. The pipes are embedded
arse gravel, which is surrounded by filter
to prevent sand and sludge solids from enter-
e gravel or the drainage pipe. Three pipe
es underlie each cell. Landfill access roads
nstructed on a sand subgrade covered by a
f filter fabric and 20 inches of gravel topped
sprayed bituminous sealcoat. After the land-
s been filled to the top of the 10 foot higher
r dike, an upper fill area will be constructed
he completed area. When the upper area has
completely filled to the proper elevation, a
ayer of cover will be placed to a compacted
of 18 inches. Ground cover and plantings
en be placed on all exposed areas to stabilize
il. The top of the fill area ultimately may be
s a park or sports field. (Baker-IVI)
00624

IZATION OF MUNICIPAL
TEWATER AND SLUDGE ON LAND,
onmental Protection Agency, Washington,
Office of Research and Development.
Gleason, III, J. E. Smith, Jr., and A. L. Page.
cle, Vol. 25, No. 4, p 26-30, May-June, 1984.
8 Ref.

iptors: *Land disposal, *Reviews, Systems
, Management, Risks, Metals, Bacteria,
water disposal, Sludge disposal, Municipal
s, Organic compounds.

vements in systems design, management and
ssessment in the past 10 years clearly demon-
the technological feasibility and economic
ness of land treatments. In 1983, 203 invited
chers and practitioners of land treatment
all areas of the United States and abroad
bled in a workshop to evaluate advances
in land application of municipal wastewater
ent plant effluents and sludges during the
ecade. Since 1973 more than 1,000 new land
ent systems have begun in the United States.
derable progress has been made in the design
d treatment systems. Advancements made in
reas of pathogenic organisms, organic con-
ants, metals, and institutional constraints are
ved. (Baker-IVI)
00679

E PROBLEMS FOR A WATER AUTHOR-
CAUSED BY TOXIC METALS IN TRADE
UENTS,
hire Water Authority (England). Southern

Thompson, and B. F. Prior.
nt and Water Treatment Journal, Vol. 24,
p 196-200, May, 1984. 1 Fig, 9 Tab, 12 Ref.

iptors: *Heavy metals, *Sludge disposal,
l disposal, Wastewater treatment, Industrial
s, Yorkshire Water Authority, England,
, Cadmium, Chromium, Copper, Mercury,
l, Lead, Zinc, Economic aspects.

volume of liquid sludge which is produced at
age treatment works only corresponds to 1-
f the total flow of sewage. If this sludge
ins excessive quantities of metals, the treat-
and disposal costs can be significantly in-
ed. It is generally assumed that at least 80%
st toxic metals present in crude sewage ulti-
y becomes attached to the sewage sludge.
total production and the various disposal
s for the sludge produced at the Yorkshire
r Authority for 1979/1980 is tabulated. Over
of the sludge was recycled to land. At
nt, Blackburn Meadows sewage treatment
s' sludge is the only sludge in the Southern
on that is not suitable for recycling to land
se of high concentration levels of potentially
elements. Therefore the treatment and dis-
cost of Blackburn Meadows sludge is signifi-
y higher than that of any other major works
e division because of the complex disposal
. The majority of traders discharging effluents
is area containing high metals concentrations
now installed pretreatment plants. One com-
carrying out mainly silver plating installed an
rolytic cell. Ion exchange methods are also
It is unlikely that the economic recovery of toxic metals from contaminated sludge will ever be feasible. It would be much easier to recover the metal from the trade effluent prior to discharge into a large volume of sewage. (Baker-IVI)
W85-00685

SLUDGE MANAGEMENT SURVEY, (FOX RIVER VALLEY, WISC.),
Fox Valley Water Quality Planning Agency, Neenah, WI.
For primary bibliographic entry see Field 5G.
W85-00834

LOW-LEVEL RADIOACTIVE-WASTE BURIAL AT THE PALOS FOREST PRESERVE, ILLINOIS: GEOLOGY AND HYDROLOGY OF THE GLACIAL DRIFT, AS RELATED TO THE MIGRATION OF TRITIUM,
Geological Survey, Urbana, IL. Water Resources Div.
J. C. Olimpio.
Available from Sup. of Documents, GPO, Wash., D.C. 20402. USGS Water-Supply Paper 2226, 1984. 34 p, 15 Fig, 6 Tab, 13 Ref.

Descriptors: *Radioactive waste, Burial site, *Glacial drift, Groundwater flow, *Tritium plume, *Illinois, Argonne National Laboratory, Palos Forest Preserve.

A tritium plume is migrating through glacial drift beneath the world's first low-level radioactive waste burial site near Chicago, Illinois. The edge of the plume, or front, where tritium concentration levels exceed 10 nanocuries per liter of water, has moved 40 meters downward through the drift to the underlying dolomite bedrock. Since 1973, tritium concentration levels up to 14 nanocuries per liter have been measured in water samples collected from a forest preserve bedrock well 360 meters down gradient from the burial site. This report describes the hydrology and geology of the burial site, named Plot M, and the factors which control tritium migration. Plot M is underlain by stratified clay- and silt-rich sediments that contain thin, interstratified sand lenses. Field- and laboratory-derived values of drift hydraulic conductivity vary little (0.000001 to 0.00000001 centimeters per second) and the variation in the geologic properties of the drift suggest that the bulk hydraulic conductivity of the upper strata is higher than that of the lower strata. The principle factors that limit tritium migration at Plot M are the small volume of buried, tritiated waste and the thickness, density, and low hydraulic conductivity of the drift. (USGS)
W85-00865

COMPARISON OF THE MICROTOX AND DAPHNIA TEST FOR THE EVALUATION OF INDUSTRIAL EFFLUENTS (COMPARAISON DES TESTS MICROTOX ET DAPHNIE POUR L'EVALUATION DE LA TOXICITE AIGUE D'EFFLENTS INDUSTRIELS),
Centre des Sciences de l'Environment, Metz (France). Lab. de Toxicologie.
For primary bibliographic entry see Field 5A.
W85-00907

5F. Water Treatment and Quality Alteration

TREATING AND MONITORING CORROSION AND SCALE IN DISTRIBUTION SYSTEMS,
Calgon Corp., Pittsburgh, PA.
B. P. Boffardi, and G. W. Schweitzer.
Water Engineering and Management, Vol. 131, No. 5, p 48-50, May, 1984. 1 Fig.

Descriptors: *Water distribution, *Corrosion control, *Scaling, *Water quality control, Monitoring, Corrosion, Phosphates, Calcium, Sodium, Silicates.

Scale and corrosion contribute to generally decreased efficiency of an entire water distribution system. Relatively low levels of polyphosphates in the presence of calcium ions were found to develop a thin protective film on metal surfaces. This protective film greatly decelerated the corrosion process. In using polyphosphates for corrosion inhibition, the process is treating metal surfaces and not the water itself. The main function of the water is to carry the inhibitor to the metal surfaces. A sodium-zinc glassy phosphate containing only 8% zinc was found to be 5-10 times more effective against corrosion than the original sodium phosphate glass. The small percentage of zinc not only accelerates protective film formation but also forms a more complete and more protective film. Polyphosphate treatment prevents scale deposition on metal surfaces by altering the crystalline structure of the scale. An important benefit derived from the use of polyphosphate, particularly in well water systems, is the prevention of red or black water due to the presence of iron and manganese ions. Sodium silicates have been used for many years as corrosion inhibitors in water distribution systems. For silicates to function as inhibitors some initial corrosion must occur to form the protective film, which is actually a mixture of corrosion products and siliceous gel. An integral part of any treatment program for potable water systems is corrosion monitoring. (Baker-IVI)
W85-00551

SILAGE EFFLUENT DIGESTION BY AN UPFLOW ANAEROBIC FILTER,
University Coll., Galway (Ireland). Dept. of Microbioloby.
M. Barry, and E. Colleran.
Water Research, Vol. 18, No. 7, p 827-832, 1984. 5 Fig, 1 Tab, 26 Ref.

Descriptors: *Silage effluent, *Anaerobic digestion, *Anaerobic filters, Biochemical oxygen demand, Farm wastes, Chemical oxygen demand, Methane, Land disposal, Wastewater treatment.

Silage is the material produced by the controlled fermentation of a crop of high moisture content. The BOD of silage effluent ranges from 40,000 to 90,000 mg/l; silage effluent is generally regarded as one of the major agricultural pollutants of water courses. Efficient anaerobic digestion of silage effluent was achieved by a 3-day hydraulic retention in an upflow anaerobic filter. The filter was a laboratory scale unit containing a limestone chip support matrix. At loading rates ranging from 7.8 to 14.2 kg COD/cu m active volume/day, the average COD removal obtained ranged from 86-89% with a TOA removal of 82-88%. The methane content of the biogas produced ranged from 81 to 88%. The rate of COD conversion to CH4 was independent of the loading rate under the conditions tested and the observed efficiency averaged 0.357 cu m CH4(STP)/kg COD introduced to the reactor. The reactor tolerated considerable variation in influent pH without any apparent decrease in digestion efficiency. Passage of raw silage effluent through an anaerobic filter at short hydraulic retention times reduces the pollution potential of the waste by 85-90% yielding a low strength effluent which could be safely disposed of by land-spraying or by irrigation without danger of grass scorching or serious pollution of adjacent watercourses. A reactor which is in routine use for pig slurry digestion may be utilized for silage effluent digestion on a seasonal basis. (Collier-IVI)
W85-00556

WATER PLANT FOR THE 21ST CENTURY.
For primary bibliographic entry see Field 6B.
W85-00623

REMOVING ORGANICS FROM GROUNDWATER THROUGH AERATION PLUS GAC,
Rockaway Township Water Dept., NJ.
R. J. McKinnon, and J. E. Dyksen.
Journal of the American Water Works Association, Vol. 76, No. 5, p 42-47, May, 1984. 7 Fig, 1 Tab.

Descriptors: *Water treatment, *Groundwater pollution, *Activated carbon, *Aeration, Organic compounds, Groundwater management, Drinking water, Rockaway Township, New Jersey, Ethers, Trichloroethylene.

The Rockaway Township, New Jersey water utility installed a granular activated carbon system to remove ethers and trichloroethylene that suddenly began contaminating its groundwater supplies. The system was installed expeditiously and performed well, but the carbon became exhausted within shorter and shorter periods of time. The solution was to add an aeration system prior to GAC treatment to extend the useful life of the carbon. In July of 1983 the system was taken off line due to the excellent performance of the aeration system and because of reduced influent levels of the ether compounds. This permitted additional pumping of the supply wells as a result of reduced head loss. The primary concern about taking this action was the possibility of bacteria building up in the stagnant environment of the carbon, which, as an integral part of the system, must be maintained so that it can be put online immediately. Options were to drain and chlorinate the carbon, drain it and chlorinate heavily before use, drain it and treat it with a high-pH solution before use, or continually pump 1.2 L/s of aeration treated water through it. A small amount of water flowing through the carbon, combined with regular monitoring, would be the most effective method. (Baker-IVI)
W85-00700

GROUNDWATER SUPPLY SURVEY,
Environmental Protection Agency, Cincinnati, OH.
J. J. Westrick, J. W. Mello, and R. F. Thomas.
Journal of American Water Works Association, Vol. 76, No. 5, p 52-59, May, 1984. 2 Fig, 14 Tab, 7 Ref.

Descriptors: *Groundwater pollution, *Organic compounds, *Water systems, Drinking water, Trihalomethanes, Volatile compounds, Trichloroethane, Tetrachloroethylene, Dichloroethylene, Dichloroethane.

The results of the US Environmental Protection Agency, Office of Drinking Water, sampling and analysis of volatile organic compounds (VOCs) in finished water supplies that use groundwater sources are discussed. Concentrations of 29 VOCs in addition to five trihalomethanes and total organic carbon from 945 water supplies were measured. The five most frequently found compounds other than trihalomethanes were trichloroethylene, 1,1,1-trichloroethane, tetrachloroethylene, cis- and/or trans-1,2-dichloroethylene, and 1,1-dichloroethane. Approximately half of the samples were taken from a random list of water systems, which were subdivided into two sets of systems - those serving fewer than 10,000 persons and those serving more than 10,000 persons. The nonrandom samples were taken from systems selected by the states, using groundwater sources that were likely to show VOCs in drinking water. Large systems in the random sample had a significantly higher frequency of occurrence of VOC contamination than small systems and were also more likely to have higher levels of contamination. (Author's abatract)
W85-00702

CHRYSOTILE ASBESTOS IN CALIFORNIA SURFACE WATERS: FROM UPSTREAM RIVERS THROUGH WATER TREATMENT,
California Inst. of Tech., Pasadena. Dept. of Engineering Science.
For primary bibliographic entry see Field 5B.
W85-00704

INORGANIC CHLORAMINES AS DRINKING WATER DISINFECTANTS: A REVIEW,
California Univ., Irvine. Program in Social Ecology.
R. L. Wolfe, N. R. Ward, and B. H. Olson.
Journal of the American Water Works Association, Vol. 76, No. 5, p 74-88, May, 1984. 3 Fig, 6 Tab, 208 Ref.

Descriptors: *Chloramines, *Disinfectants, *Drinking water, *Reviews, Toxicity, Carcinogenicity, Water treatment, Bacteria, Viruses, Protozoans, Chlorination, Methemoglobinemia.

Chloramination is the subject of renewed investigation by the water treatment industry as an alternative to chlorination. The advantages of using chloramines for disinfection include: increased stability of residuals; a reduction in certain odor problems caused by chlorination; and relative chemical inertness towards trihalomethane precursors. Chloramines are the least expensive of the major alternative drinking water disinfectants. Potential disadvantages of chloramines include: interference by certain nitrogenous organic compounds; toxicity to aquatic organisms; the production of methemoglobin in hemodialysis patients exposed to chloramines; and lack of adequate information on carcinogenicity. Laboratory studies have demonstrated that chloramines are considerably less effective than chlorine for inactivating bacteria, viruses, and protozoans. The inability of laboratory experiments to predict the effectiveness of chloramines in drinking water systems suggests the need for alternative test assays that would more closely reflect disinfection in field settings. Since the issues of microbicidal efficiency and potential health hazards have not been settled, the widespread use of chloramines should await the results of further tests. (Moore-IVI)
W85-00705

CONSUMER PANELS MONITOR TASTE OF WATER IN ROTTERDAM,
Ministerie van Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands).
B. C. J. Zoeteman, E. De Greef, H. Van Oers, E. P. Koster, and J. J. Rook.
Journal of the American Water Works Association, Vol. 76, No. 6, p 75-77, June, 1984. 5 Fig, 5 Ref.

Descriptors: *Water quality control, *Taste, *Consumer panels, *Rotterdam, *Netherlands, Odor, Drinking water, Public opinion, Chlorine, Trihalomethanes, Organic carbon.

The difficulty of assessing whether consumers find the taste of delivered water offensive was addressed in the Netherlands by requesting the aid of a large panel of consumers for one year. The perceptions of the panel resulted in identifying a means of complying with the revised World Health Organization guidelines stating that drinking water should not be offensive for most of the consumers served. The consumers were more tolerant of detected tastes in water than were small panels of in-house tasters. The reliability of results from consumer panels is considered. With the availability of relatively reliable taste data it was possible to investigate which process variables correlated with differences in taste of water. The taste of the raw water was significantly correlated only with the taste of Berenplaat drinking water. For the Kralingen plant water, taste was negatively associated with water temperature and positively associated with residual chlorine. Neither type of drinking water showed a correlation between the taste of water and the concentration of total organic carbon or trihalomethanes. (Baker-IVI)
W85-00708

JORDAN MEETS WATER SUPPLY CHALLENGES,
Stanley Consultants, Inc., Muscatine, IA.
L. L. Pruitt, and R. L. Thoem.
Journal of the American Water Works Association, Vol. 76, No. 6, p 84-86, June, 1984. 5 Fig.

Descriptors: *Water supply development, *Water demand, *Jordan, *Amman, Drinking water, Water demand, Water treatment, Costs.

A new water system for the Amman, Jordan, metropolitan area will be completed in early 1985. The surface water supply is taken from a canal at an elevation of 230 m below sea level and pumped in a series of steps to a treatment plant near the city at an elevation of 1040 m above sea level. The 121 ML (32 mgd) initial capacity of the system will approximately double the supply currently available for the city's nearby 1 million inhabitants. Water will be diverted from the Jordan Valley irrigation canal to an intake pump station, which discharges the water to storage tanks that provide presettling of the raw water. Four booster pump stations then lift the raw water to the treatment plant site. Another pump station provides the fin lift to the terminal reservoir located on hig ground just outside Amman. Water then flows b gravity to an existing reservoir in Amman. Sever unusual features of the project include a rugge steep terrain making construction difficult; sever seismic conditions which are equal to or greate than those found in the state of California; a larg diameter high pressure pipeline crosses majo faults; pump stations require extremely high heac at moderate sized flows; a major electrical trans mission and distribution system was designed t serve the significant new power load; and a com plete telemetry network was installed for syster monitoring and control. A life cycle cost analysi indicates this project will supply potable water t the Amman region at a unit cost of about U. $0.80/cu m. (Baker-IVI)
W85-00710

HOW SAFE ARE ORGANIC POLYMERS I WATER TREATMENT,
Societe Lyonnaise des Eaux et de l'Eclairage, Pari (France).
J. Mallevialle, A. Bruchet, and F. Fiessinger.
Journal of the American Water Works Associa tion, Vol. 76, No. 6, p 87-93, June, 1984. 11 Fig, Tab, 24 Ref.

Descriptors: *Water treatment, *Drinking water, *Polymers, Polyacrylamide, Coagulants, Turbidity, Water quality control, Mutagenicity, Public health, Chlorination, Ozonation.

The polymer under study was a copolymer of acrylamide and sodium acrylate with an average molecular weight of 10 g. Acrylate accounts for 10-12% of the total composition of the anionic polymer. Major impurities in the commercial product include the monomers acrylamide, acrylate, hydroxypropionitrile, and traces of isobutyronitrile. Studies were designed to consider ozonation by-products, chlorination by-products, adsorption, mutagenicity and pilot plant operations. The use of the polyacrylamide copolymer as a coagulant aid at a maximum dosage of 500 microg/L introduces only trace amounts of organic compounds from the commercial product into finished drinking water. The Ames tests showed that only the addition of acrylamide would increase mutagenicity. Ozonation removed all of the organic compounds from water, mostly by transforming them into other forms of organic carbon. By-products appear to be innocuous, except those from acrylic acid. The effectiveness of this polymer was based on final turbidity and did not reflect the potential beneficial effects on sludge handling and disposal. Adsorption tests show the polymer is weakly adsorbed, and it is not expected to affect subsequent adsorption processes in a treatment plant adversely. (Baker-IVI)
W85-00711

REMOVAL OF DIELDRIN FROM WATER BY ACTIVATED CARBON,
University of Southern California, Los Angeles. Dept. of Civil Engineering.
M. Pirbazari, and W. J. Weber, Jr.
Journal of Environmental Engineering, Vol. 110, No. 3, p 656-669, June, 1984. 10 Fig, 1 Tab, 28 Ref.

Descriptors: *Water treatment, *Activated carbon, *Dieldrin, Pesticides, Organic compounds, Insecticides, Drinking water, Adsorption.

The effectiveness of activated carbon for removal of dieldrin from water is highlighted by fixed-bed adsorber results indicating that for an influent concentration as high as 30 micrograms/L, an EBCT of 15 min, and a hydraulic loading of 1.4 gal/sq ft/min, effluent concentrations were below 0.4 micrograms/L for the entire period of the test, 7.5 months. Removal efficiencies appear to be adversely affected by background organic substances such as humic acids. Several possible mechanisms may be responsible for observed competitive adsorption and displacement effects: background organics may displace adsorbed dieldrin from the carbon surface; these organics may compete with dieldrin for available sites on the carbon surface; preformed

c dieldrin complexes in the feed may pass
h the column unadsorbed; organic-dieldrin
exes formed within the column may elute
he column; or there may be some combina-
f these effects. Further study is required to
ine the relative significance of each of these
l mechanisms. Activated carbon is a more
ve adsorbent than XE-340 for removal of
n from water, at least for the systems investi-
in this study. (Baker-IVI)
0720

ER PLANT SERVES TWO MASTERS,
mee, Porter and Seeley, Ann Arbor, MI.
Maass, K. Neffe, and R. M. Bachteal.
Works, Vol. 115, No. 6, p 86-87, June, 1984.

iptors: *Water treatment facilities, *Industri-
er, *Drinking water, Water treatment, Lake
, Potable water, Cost analysis.

e the installation of a new 48-mgd facility last
Dow Chemical and Dow Corning used raw
from Lake Huron for plant processes and
ased water from the city for laboratory and
y purposes. In the 1970s the company
d treated, filtered water for plant operations
the same time as the city needed to expand
pacity of its water treatment plant. A study
nade of the cost of building one system vs
f building two, one for industrial and another
table water. The results indicated that a 15%
s could be achieved by constructing one
Total cost of the project was $26 million.
roject included updating the existing 12 mgd
ipal treatment plant and building new facili-
r a total treatment capacity of 48 mgd. An
tionally high degree of treatment was select-
he levels of turbidity, hardness, chlorides,
de and sulfate were of particular concern.
le operation was essential to avoid adding
de, chlorine, and phosphates to the industrial
water, while retaining the capability of
g these elements to the potable grade. Fil-
water with or without chemical addition can
ore be produced as needed. Measures were
aken to ensure energy conservation methods.
oximately 75% of the heat from exhaust sys-
s captured and used for building heat, instead
ng discharged to the atmosphere. A thermal
n recovery coil in the dehumidifier serving
ipe gallery area also saves $5,000 a year in
ting costs. The new water treatment plant is
ted to serve the combined needs of the city
ndustries well into the 21st century. (Baker-

00738

PARING THE DATA BASE FOR A WATER
WORK ANALYSIS,
Walker Engineers, Inc., Bellevue, WA.
Jochim, and W. E. Davis.
c Works, Vol. 115, No. 6, p 93-95, June, 1984.
, 2 Tab.

riptors: *Systems analysis, *Water distribu-
Seattle, Washington, King County, Hydraulic
les, Data base.

County Water District No. 104 serves a large
corporated area of King County, Washington,
ed 20 miles northeast of Seattle. In 1983 a
ough hydraulic analysis was made of the water
bution system in order to identify improve-
s needed to correct low system pressures,
maximum use of its storage reservoirs, and to
lop a phased capital improvements program
uture water system needs. Preparation of an
rate data base was recognized as a critical
ent of the project. Various computer models
evaluated and a model best suited to meet
fic project requirements was selected. A hy-
lic profile of the existing distribution system
nasizes the wide variation of topography and
aulic complexity of the district. Variations in
nd elevation of over 450 ft make it necessary
perate the water system in five major pressure
. The data base as formed included informa-
on per capita consumption as well as usage
ds. These trends included average daily demand, peak demands, and diurnal demands. Schematization and nodal assignments were also included in the data base. (Baker-IVI)
W85-00740

TOTAL CAPABILITY IN WATER TREATMENT,
R. Hill.
Water Services, Vol. 88, No. 1059, p 178-179, May, 1984. 5 Fig.

Descriptors: *Water quality, *Water treatment, Water demand, Water use, Organic compounds, Suspended solids, Dissolved gases, Hardness.

The quality of water produced by a treatment plant will be determined by the use to which the water is to be put on leaving the plant. A total dissolved solids content of 500 mg/l represents a purity of 99.95% and while the human body can cope with this level of contamination, it is frequently inadequate for industrial use. The development of water treatment technology for industry has concentrated on the elimination of the twin scourges of heat transfer; scale and corrosion. Hardness removal by precipitation was discovered in the mid nineteenth century but still has applications today. In most industrial applications, however, it has been supplanted by ion exchange techniques such as base exchange and dealkalization. Use of deionization systems in counterflow regeneration is now a well established technique giving proven water quality and running cost improvements. The process can produce water of 99.9999% purity. (Baker-IVI)
W85-00759

POLYCHLORINATED BIPHENYL CONCENTRATIONS IN THE HUDSON RIVER WATER AND TREATED DRINKING WATER AT WATERFORD, N.Y.,
Geological Survey, Albany, NY. Water Resources Div.
R. A. Schroeder, and C. R. Barnes.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4188, 1983. 13 p, 5 Fig, 2 Tab, 12 Ref.

Descriptors: *Polychlorinated biphenyls, *Water treatment, Drinking water, Activated carbon, *Hudson River, *New York, Waterford.

Past discharge of PCBs into the Hudson River has resulted in contaminant concentrations of a few tenths of a microgram per liter in the water. Waterford is one of two large municipal users of the Hudson River for drinking-water supply. The treatment scheme at the Waterford plant, which processes approximately 1 million gallons per day, is similar to that of most conventional treatment plants except for the addition of powdered activated carbon during flocculation. Comparison of PCB concentrations in river water and intake water at the plant to concentrations in treated drinking-water samples indicates that purification processes remove 80 to 90 percent of the PCBs and that final concentrations seldom exceed 0.1 microgram per liter. No significant difference was noted between the removal efficiencies during periods of high river discharge, when PCBs are associated with suspended sediment, and low discharge, when PCBs are generally dissolved. (USGS)
W85-00835

COMPARISONS OF DEVICES FOR AERATING INFLOW OF PIPES,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
J. M. Moore, and C. E. Boyd.
Aquaculture, Vol. 38, No. 1, p 89-96, April, 1984. 2 Fig, 2 Tab, 11 Ref.

Descriptors: *Aquaculture, *Aeration, *Aerators, Dissolved oxygen, Carbon dioxide, Well water, Fish farming.

Aeration is widely used in fish cultures and many types of aerators have been tested for effectivness. Wells are often used as water supplies for aquaculture; this water is usually devoid of dissolved oxygen (DO) and sometimes contains high concentrations of carbon dioxide (CO2). Water was treated with sugar and ammonium nitrate fertilizer to encourage microbial activity which reduced DO concentration to 0.05 mg/L and supersaturated the water with CO2 to concentrations varying between 75 and 170 mg/L. This water, used for testing, was a reasonable facsimile of well water. Eleven different devices for aerating water discharged from pipes were evaluated for effectiveness in increasing DO and decreasing CO2 concentrations. All devices were more effective than a straight pipe in oxygenating water and provided DO concentrations above 4 mg/L. DO concentrations above 6 mg/L resulted with Tee and Ell aspirators and with a half-open gate valve. The gate valve had the greatest oxygen transfer rate. Although the aerators removed as much or more CO2 than they added O2, none was efficient in removing CO2; concentrations were only reduced by 3.7 to 13.4 mg/L (2.2 to 8.6% of the initial values). (Collier-IVI)
W85-00946

5G. Water Quality Control

IMPACT OF DETERGENT PHOSPHORUS BANS ON RECEIVING WATER QUALITY,
Procter and Gamble Co., Cincinnati, OH. Environmental Safety Dept.
For primary bibliographic entry see Field 5C.
W85-00558

SPREAD OF POLLUTANTS FROM HARBOUR SLUDGE DEPOTS,
Laboratorium voor Grondmechanica, Delft (Netherlands).
For primary bibliographic entry see Field 5E.
W85-00572

TECHNIQUES FOR REDUCING CONTAMINANT RELEASE DURING DREDGING OPERATIONS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
M. R. Palermo, R. L. Montgomery, and G. L. Raymond.
Water Science and Technology, Vol. 16, No. 3-4, p 635-642, 1984. 2 Fig, 2 Tab, 7 Ref.

Descriptors: *Dredging, *Water pollution control, Resuspension, Cutterheads, Dragheads, Dustpan dredges, Clamshell buckets, Tampa, Florida, James River, Virginia, Kepone, Sediment contamination.

Conventional dredges are not specifically designed or intended for use in dredging highly contaminated material. However, dredges are the logical, and perhaps only, means of removing contaminated sediments that may be found in waterways. Some modification to equipment and/or dredging techniques could result in their use for that purpose with minimal adverse impact on the environment. A method has been developed for predicting resuspension and release of contaminants using various types of dredging equipment and techniques and to improve and/or develop new equipment and techniques for dredging highly contaminated sediments. The investigation includes an evaluation of the resuspension of solids and potentially toxic constituents in the immediate vicinity of operating cutterheads, dragheads, and clamshells. A dredging demonstration on the James River, Virginia, compared the performance of a conventional cutterhead and a modified dustpan dredge operating in sediments contaminated with Kepone. Demonstrations comparing performance of conventional and watertight clamshell buckets were conducted in the Tampa, Florida area. The watertight clamshell does appear to reduce the amount of resuspended sediment in the upper water column, as compared to a conventional open clamshell. The dustpan head shows little advantage over conventional cutter-head suction dredges. The basic sampling methodology developed is valid and can provide valuable insights into the sediment resu-

spension characteristics of dredge types. (Moore-IVI)
W85-00573

INTERACTION BETWEEN GROUNDWATER AND SURFACE WATER REGIMES AND MINING-INDUCED ACID MINE DRAINAGE IN THE STOCKETT-SAND COULEE COAL FIELD,
Montana Coll. of Mineral Science and Technology, Butte.
For primary bibliographic entry see Field 5B.
W85-00583

SEASONAL DISTRIBUTION AND AGGREGATION BEHAVIOR OF GOLDFISH (CARASSIUS AURATUS L.) IN EASTERN WASHINGTON LAKES: NEW TECHNOLOGY FOR CONTROL OF GOLDFISH POPULATIONS BASED ON THEIR BEHAVIORAL ECOLOGY,
Eastern Washington Univ., Cheney. Dept. of Biology.
For primary bibliographic entry see Field 8I.
W85-00610

LANDFILL DESIGN PROTECTS SOLE-SOURCE AQUIFER,
For primary bibliographic entry see Field 5E.
W85-00624

NUTRIENT BUDGET OF LAKE BOSTALSEE (SAARLAND) WITH PARTICULAR REFERENCE TO PHOSPHORUS AND NITROGEN (DER NAHRSTOFFHAUSHALT DES BOSTALSEES (SAARLAND) UNTER BESONDERER BERUCKSICHTIGUNG DES PHOSPHORS UND STICKSTOFFS),
Parma Univ. (Italy). Ist. di Ecologia.
U. Zaiss.
Archiv fur Hydrobiologie, Vol. 100, No. 2, p 189-205, 1984. 11 Fig, 2 Tab, 25 Ref.

Descriptors: *Lake Bostalsee, *West Germany, *Nutrients, *Phosphorus, *Nitrogen, *Lake restoration, Primary productivity, Wastewater pollution, Dissolved oxygen, Hydrogen sulfide, Water quality, Transparency.

In the new artificial Lake Bostalsee the nutritional composition of water and primary production were determined during the course of seasons in 1979. Two years before this investigation sewage from two villages had been introduced into the lake for several months from a broken sewage pipe under the lake. Although the lake had recovered from this overfertilization it exhibited high production rates and a hypolimnion free of dissolved oxygen but rich in hydrogen sulfide. This was due to morphometric conditions (mean depth: 6.3 m) and a high phosphorus loading which reached 0.42 g P/sq m/a and derived mainly from the streams running into the lake. In order to diminish the internal fertilization, hypolimnetic waters were removed through the bottom outlet of the lake regularly in the second half of the year. This therapy showed first improvements of the water quality up to 1983 monitored by transparency measurements. (Author's abstract)
W85-00629

EFFECT OF IMPOUNDMENT AND RIVER DIVERSION ON PROFUNDAL MACROBENTHOS OF SOUTHERN INDIAN LAKE, MANITOBA,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
A. P. Wiens, and D. M. Rosenberg.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 4, p 638-648, April, 1984. 3 Fig, 8 Tab, 40 Ref.

Descriptors: *Benthos, *Southern Indian Lake, *Manitoba, *Dam effects, *Diversion, Environmental effects, Standing crop, Nutrients, Profundal zone, Suspended solids, Flooding, Reservoirs, Postimpoundment.

Profundal macrobenthos in Southern Indian Lake, Manitoba, were surveyed to determine effects of hydroelectric manipulations in 1972 (preimpoundment), 1977 (postimpoundment), and 1979 (postdiversion). Lakewide average standing crops increased following impoundment and decreased by 3 yr after impoundment. Regional changes in standing crops usually could be related to additions of nutrients leached from flooded vegetation, additions of particulate organic matter resulting from shoreline erosion, and changes in integral primary production and suspended solids concentrations before and after impoundment. Greater increases in standing crops of macrobenthos in shallower compared with deeper depth zones of the lake after flooding were attributed to preferential deposition of organic materials in the shallow areas of the lake. Mean standing crops of macrobenthos were higher in regions through which the Churchill River flowed than in regions isolated from the flow before and after impoundment. After diversion, greatest decreases in standing crops occurred in isolated regions, whereas those of regions in the flow declined much less or increased. Responses of the most abundant taxa of macrobenthos (Pontoporeia brevicornis grp., Chironomidae, Oligochaeta, Sphaeriidae) differed in many ways from those recorded for other new reservoirs. Pontoporeia brevicornis grp. remained the most abundant benthic organism, there was no evident succession of macrobenthic taxa, and a high diversity of profundal species was maintained. These results, together with the slight changes in standing crop observed after flooding, indicated only a marginal impact on macrobenthos caused by the low-level flooding of Southern Indian Lake. (Author's abstract)
W85-00638

TECHNIQUES FOR PROTECTING GROUNDWATER QUALITY,
Geraghty and Miller, Inc., Tampa, FL.
J. J. Geraghty.
Journal of the American Water Works Association, Vol. 76, No. 5, p 34-37, May, 1984. 6 Fig.

Descriptors: *Groundwater pollution, *Water quality control, Plumes, Drinking water, Drainage, Pumps, Domestic wastes, Water pollution sources, Path of pollutants.

Achieving the ideal goal of large scale protection of groundwater quality cannot be accomplished over the short term. In spite of all efforts made to date, contaminants from millions of sources still seep in an uncontrolled way into the groundwater systems, generating plumes that represent threats for groundwater supply systems. A broad educational effort aimed at the public and at the owners and operators of potential sources of contamination could be a useful tool for protecting groundwater resources. Large segments of the general population still have not recognized how their own activities have contributed to the problem. Various containment concepts for plumes of contamination have been considered and are described including impoundment behind physical barriers and impoundment by hydraulic methods. (Baker-IVI)
W85-00698

CONTROLLING ATTACHED BLUE-GREEN ALGAE WITH COPPER SULFATE,
Southern California Metropolitan Water District, Los Angeles.
M. J. McGuire, R. M. Jones, E. G. Means, G. Izaguirre, and A. E. Preston.
Journal of the American Water Works Association, Vol. 76, No. 5, p 60-65, May, 1984. 9 Fig, 17 Ref.

Descriptors: *Algal control, *Water quality control, *Lake Mathews, *California, Algae, Copper sulfate, Methylisoborneol, Drinking water, Cyanophyta, Reservoirs, Taste, Odor.

Concentrations of 2-methylisoborneol forced the shut down of Lake Mathews, a critical southern California water supply reservoir in 1980-81. An algae control measure developed as a result of this shut down was used to correct taste and odor problems appearing in the reservoir in 1982. The application of 26,760 kg of copper sulfate, applied from a boat equipped with a modified agricultural spreader, eliminated growths of blue green algae in five days. The closed loop stripping analysis (CLSA) technique was employed and found to be useful to isolate the locations of earthy musty odorants and to direct the application of the algicide to growths of attached blue green algae. Scuba divers visually identified attached blue green algae growths that were producing earthy musty odorants and evaluated the effectiveness of applied copper sulfate granules. Samples collected at historical and newly established sites, followed by CLSA analysis, gave sufficient warning to implement an algae control program. Successful control of the attached blue green algae problems at Lake Mathews made it possible to keep this critical water supply reservoir in service during high demand periods. (Baker-IVI)
W85-00703

HARDHOF GROUNDWATER COMPLEX IN ZURICH,
Zurich Water Supply (Switzerland).
M. Schalekamp.
Journal of the American Water Works Association, Vol. 76, No. 6, p 78-83, June, 1984. 11 Fig, 2 Tab.

Descriptors: *Water resources development, *Groundwater, *Zurich, *Switzerland, Water treatment, Drinking water, Aeration, Monitoring, Chlorine dioxide, Activated carbon, Water treatment facilities, Water quality control, Artificial recharge.

The Hardhof groundwater treatment plant is located in an urban area of Zurich, Switzerland and incorporates features that protect the water quality and also provide open landscaped areas for public use. To protect the well field catchment area, the entire site surrounding it was designed as a protective zone. The groundwater was separated from built up areas by diverting water from the Limmat into the recharge basins. An existing abattoir was closed and demolished. Agricultural production was discontinued. Existing houses, fuel storage depots, sewer lines, and roadways on the site were demolished. Bus transportation was replaced by extending tramway lines. The surface of the entire area of 250,000 sq m was sealed with a 2 m thick layer of clay. About 160,000 sq m of the area was landscaped, sports fields were built, and a drainage system was installed that connects directly with the wastewater system. A drainage system for storm runoff was connected with the municipal sewage system. Protective measures against sabotage were installed at all facilities. The surface water used as the groundwater recharge is preoxidized, aerated, treated with GAC, and slow filtered. Provisions were made for continuous monitoring of the security system, temperature of the water, and raw and clean water quality; measurement of oxidants, chlorine dioxide, pH, redox potential, conductivity, UV extinction, and oxygen. Monitoring of water quality through fish test facilities is continuous. (Baker-IVI)
W85-00709

STREET SWEEPING AS A WATER POLLUTION CONTROL MEASURE: LESSONS LEARNED OVER THE PAST TEN YEARS,
Woodward-Clyde Consultants, San Francisco, CA.
J. D. Sartor, and D. R. Gaboury.
Science of the Total Environment, Vol. 33, p 171-183, February, 1984. 3 Fig, 5 Tab, 14 Ref.

Descriptors: *Street sweeping, *Water pollution control, Water pollution sources, Path of pollutants, Urban runoff, Water quality management, Lead, Pollution load.

Street surfaces are both sources of urban runoff pollutants and pathways for the transport of pollutants originating from adjacent land areas. This view has led to the suggestion that street sweeping may be a valuable best management practice (BMP) for the control of urban runoff quality. Initial investigations beginning in the early 1970's indicated that changes in street sweeping practices could be beneficial in reducing urban runoff pollu-

response to this early research, the U.S. mental Protection Agency sponsored Na- Urban Runoff Program adopted a broad- sessment of street sweeping as one of its esearch elements. The key finding of street g research to date is that as a general, sed water quality best management prac- oes not appear to be effective in reducing ipe urban runoff pollution loads. Under e conditions, reduction of about 30% can ted, but more typical performance is in the % range. For certain constituents such as ere street surfaces are the overwhelming street sweeping can control well of 50% oads. There are other specific conditions treet sweeping can be effective. (Author's)
743

TIVENESS OF STREET SWEEPING IN RUNOFF POLLUTION CONTROL,
State Water Survey Div., Champaign.
ender, and M. L. Terstriep.
of the Total Environment, Vol. 33, p 185- ruary, 1984. 5 Fig, 2 Tab, 2 Ref.

tors: *Street sweeping, *Water pollution *Urban runoff, *Champaign, *Illinois, unoff, Metals, Nutrients, Particle size.

ch 1982, the Illinois State Water Survey ed a three-year study for the Illinois Envi- tal Protection Agency to determine the of municipal street sweeping on urban unoff quality. The project was part of the vide Urban Runoff Program sponsored by S. Environmental Protection Agency. In ign, Illinois, four urban drainage basins g separate sewers and ranging in size from 5 acres (6.5-22.3 ha) were instrumented for vent monitoring and sampling. Data collec- luded recording of precipitation and storm and sampling of runoff and atmospheric A telemetry system was developed and l to link the remote sampling sites to a nputer which automatically controlled the on and storage of data and the instruction pling. During 1980 and 1981, samples were d and analyzed for total concentrations of metals, and nutrients for 90 events. A street mpling program designed to measure the ads of material on the streets was conducted e same period. Determinations were made particle size distributions and constituent trations in the street loads. Municipal street g at different frequencies was practiced on ins during the monitoring period. The pro- used in data collection and the results d from the sampling programs are present- discussed. For the conditions monitored, sweeping is shown to be ineffective as a ement practice for urban storm runoff qual- trol. (Author's abstract)
0744

ENCE OF LONG-TERM TILLAGE AND ROTATION ON WATER EROSION,
Agricultural Research and Development , Wooster.
Van Doren, Jr., W. C. Moldenhauer, and G. lett, Jr.
ience Society of America Journal, Vol. 48, p 636-640, May-June, 1984. 3 Tab, 16 Ref.

ptors: *Soil erosion, *Tillage, *Crop rota- oybeans, Corn, Soil loss, Soil management, ted rainfall, Rainfall runoff.

ans (Glycine max. L.) apparently predispose to greater erosion by water than does corn ays L.) at equal residue cover. Most of the le data have been obtained from locations years or less history of a specific manage- This study measured soil loss during simulat- nfall from plots having an 18-yr history of ement to ascertain deviations, if any, from t expectations. The soil was a fine-loamy, mesic, Typic Fragiudalfs having an average of 3%. Tillage variables included no-tillage, plow 20 cm deep, and spring plow 20 cm ollowed by 10 cm deep disking or equivalent. Rotations were continuous corn or corn-soybeans. Kinetic energy of applied water was about 70% of natural rainfall at 63 mm/h rate. Runoff and soil loss were measured at 60-s intervals during the 30- to 60-min runs. Soil loss per unit of rainfall following either crop in the corn-soybeans rotation was 45% greater than from continuous corn, after accounting for differences in residue cover by use of the Universal Soil Loss Equation (USLE). Soil loss per unit of rainfall for land not tilled for 1 or over 20 years was 90% less than expected according to the current version of the USLE. (Author's abstract)
W85-00755

PINELANDS COMMISSION, NEW JERSEY, HYDROGEOLOGY ASSESSMENT.
Geraghty and Miller, Inc., Syosset, NY.
Report prepared for Betz, Converse, Murdoch, Inc., March 1980. 159 p, 11 Fig, 18 Plates, 43 Tab, 49 Ref.

Descriptors: *Areal hydrogeology, *Groundwater, *Land use, *Water quality, *Groundwater pollution, Geology, Septic tanks, Reservoirs, Well data, Aquifers, Groundwater management, *New Jersey, Pinelands.

This is a hydrogeological assessment of the New Jersey Pinelands ground-water. The overall ground-water quality in the Pinelands aquifers is excellent and the actual and potential sources of ground-water pollution are relatively few; however, there is some concern about septic tanks, surface impoundments, and spills. To assess ground-water quality in the Pinelands, published and unpublished documents were examined. Information on water quality was obtained from USGS and New Jersey Water Supply bulletins and from computer printouts of water quality data from a series of wells installed in the Mullica River Basin. The report describes hydrogeological data on the major aquifers in the Pinelands. The consultants recommend that a major effect be directed toward defining the areal extent and severity of existing or suspected ground-water contamination problems. Among the various options available for protecting ground-water quality are control alternatives such as enforcement of land-use restrictions in critical areas, imposition of restraints on each individual type of activity that can lead to ground-water contamination, and regulation of patterns of ground-water use. The development of the Pinelands area will force resource planners to confront a number of ground-water management issues related to population density and the likely activities associated with land uses, economic activities, and the requirements for increased physical infrastructure. (Fazio-Omniplan)
W85-00815

1980 WHIPPANY RIVER INTENSIVE SURVEY, INTENSIVE SURVEY NO. 803403,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
For primary bibliographic entry see Field 5B.
W85-00820

EXECUTIVE SUMMARY, WATER POLLUTION STUDIES, FOX RIVER VALLEY, WISCONSIN.
Killam (Elston T.) Associates, Inc., Millburn, NJ.
For primary bibliographic entry see Field 5B.
W85-00827

WETLANDS OF THE WINNEBAGO POOL: A DETAILED FIELD SURVEY AND MANAGEMENT RECOMMENDATIONS,
Fox Valley Water Quality Planning Agency, Neenah, WI.
M. L. Bohrer, and G. M. Keil.
Report, September 1982. 142 p, 6 Fig, 7 Tab, 19 Ref.

Descriptors: *Wetlands, *Surveys, *Ecosytems, *Hydrologic systems, *Local governments, Management planning, Flood control, Streamflow, Sedimentation, Water quality, Nutrients, Nitrification, Denitrification, Microbial degradation, Federal jurisdiction, State jurisdiction, Shore protection, Ponds, Ditches, Dikes, Water level, Barriers, Marshes, Phytoplankton, Plant populations, Water birds, Waterfowl, Birds, Mammals, Soil types, *Wisconsin, Fox River Valley, Winnebago Pool.

The wetlands adjacent to the shores of lakes and streams in the Fox River Valley of Wisconsin are the last vestiges of extensive acreage that was once predominant in the areas. This report inventories 90% of the lake-adjacent wetlands in the Winnebago Pool. The Fox Valley Water Quality Planning Agency supports protection of all remaining wetlands which have a direct and significant impact on water quality. The water quality and the hydrologic, wildlife, and aesthetic values of wetlands discussed provide a basis for such a goal. The Fox Valley has lost vast wetland areas through development, drainage, and the adverse effects of water level manipulation. The Agency recommends that local units of government take a more active role in wetlands management. The inventory of the wetlands of the Lake Winnebago Chain used two primary sources of information: field surveys and aerial photos. Secondary sources included soil surveys, the Agency's 1979 Marsh and Wetland Study, conversations with wetland owners, and U.S. Army Corps of Engineers maps from 1917-1921. The geographic and climatic factors are nearly the same for all the wetlands inventoried. Biological conditions are also similar because only three wetland types predominate in the region--emergent, scrub-shrub, and forested. These plant communities differ little between wetlands in the region. For this reason the individual wetland's descriptions describe the numerous physical variations in wetlands and surrounding watershed, which are largely attributable to the effects of man. (Fazio-Omniplan)
W85-00828

TROPHIC STATUS OF THE WINNEBAGO POOL LAKES,
Fox Valley Water Quality Planning Agency, Menasha, WI.
For primary bibliographic entry see Field 5C.
W85-00829

MARSH AND WETLAND STUDY, (FOX RIVER VALLEY, WISC.),
Fox Valley Water Quality Planning Agency, Neenah, WI.
For primary bibliographic entry see Field 2H.
W85-00831

WATER QUALITY MANAGEMENT PLAN, FOX RIVER VALLEY, WISCONSIN, ADDENDUM II: WASTELOAD ALLOCATION AND POLICY RECOMMENDATIONS FOR DISCHARGERS TO THE LOWER FOX RIVER FROM NEENAH-MENASHA TO DE PERE.
Fox Valley Water Quality Planning Agency, Menasha, WI.
Report, January 1982. 39 p, 3 Fig, 13 Tab.

Descriptors: *Water quality standards, *Waste load, *Discharge measurement, *Dissolved oxygen, *Management planning, Mathematical models, Baseline studies, Rivers, Municipal wastes, Industrial wastes, Instream aeration, Capital costs, Maintenance costs, Operating costs, Economic aspects, *Wisconsin, Fox River Valley.

This is an update of the wasteload allocations and policies portion of Chapter 4: Point Source Plan of the Water Quality Management Plan for the Fox River Valley, Wisconsin. Concerned with the impact of municipal and pulp and paper mill discharges into the Lower Fox River, the Wisconsin Department of Natural Resources undertook a mathematical modeling study to approximate the levels of dissolved oxygen that would exist in the river during various conditions with best practicable and secondary treatment systems in operation. The Fox Valley Water Quality Planning Agency used the model to develop wasteload allocations for dischargers. The Agency found that allocations based on a minimum of 5 mg/l dissolved oxygen would not pose severe economic or social hard-

ships on Valley dischargers and communities. The Agency formulated a baseline load for each discharger and established a reserve capacity for 4 municipal wastewater treatment plants. Additional end-of-pipe treatment to meet the final wasteload allocations as daily maximums would require over $11 million in annualized capital, operation, and maintenance costs. Thus, additional management options needed to be explored. Since the implementation of the wasteload allocations is contingent on the gathering of daily flow and temperature data and transmittal of this information to dischargers, the Agency recommended the Lower Fox River Dischargers Association be responsible for limited monitoring and reporting functions. (Fazio-Omniplan)
W85-00832

CHARACTERIZATION OF NON-POINT WASTE SOURCES, REPORT NO. 6: SUMMARY OF NON-POINT WASTE LOADS, (FOX RIVER VALLEY, WISC.),
McMahon Associates, Inc., Menasha, WI.
For primary bibliographic entry see Field 5B.
W85-00833

6

SLUDGE MANAGEMENT SURVEY, (FOX RIVER VALLEY, WISC.),
Fox Valley Water Quality Planning Agency, Neenah, WI.
G. M. Keil, and F. R. Strand.
Report, October 1979. 122 p, 10 Fig, 7 Tab, 36 Ref, 1 Append.

Descriptors: *Sludge, *Sludge disposal, *Sludge drying, *Management planning, *Municipal wastewater, Primary sludge, Municipal wastes, Sludge thickening, Heavy metals, Water quality standards, Comprehensive planning, Pulp wastes, Pulp and paper industry, Landfills, Land disposal, Waste disposal, Incineration, *Wisconsin, Fox River Valley.

The Water Pollution Control Act Amendments of 1972 (P. L. 92-500) mandate municipalities and industries to achieve a water quality standard that supports fish, shellfish, and wildlife and provides for safe water-related recreational activities. This requires at least secondary treatment of wastewaters; however, treatment often results in sludge. This report describes the quantities and characteristics of sludge generated by municipalities and industries in the Fox Valley Water Quality Planning Study Area, identifies sludge management practices that could adversely impact water quality in the region, and reviews existing methods of sludge treatment and disposal. The survey instrument was a questionnaire, with follow-up contacts to verify information. The survey identified 8 categories of sludge generators producing about 215,000 tons/year on a dry weight basis. The pulp and paper industry generates 73% of the sludge; municipal wastewater treatment plants, 15%. Sludge is a highly variable mixture of organic and inorganic materials combined with water, which makes up 95-99% of the raw sludge weight. Treatment by stabilization, thickening, conditioning, and dewatering results in a drier, less-odorous, easier to handle sludge. Sludge is disposed of in landfills or by incineration and landspreading. The most common problem was difficulty in locating and obtaining approval for new industrial sludge disposal sites. (Fazio-Omniplan)
W85-00834

ASSESSMENT OF STEADY-STATE PROPANE-GAS TRACER METHOD FOR REAERATION COEFFICIENTS - COWASELON CREEK, NEW YORK,
Geological Survey, Reston, VA. Water Resources Div.
N. Yotsukura, D. A. Stedfast, R. E. Draper, and W. H. Brutsaert.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4183, 1983. 88 p, 27 Fig, 11 Tab, 19 Ref.

Descriptors: *Reaeration, *Tracers, Open channels, Steady flow, *Propane desorption, Air-water interfaces, *Gas tracers, Wind velocity, Mass transfer, Cowaselon Creek, *New York.

Three tests were conducted in a straight 5.2-km reach of the Cowaselon Creek, Canastota, New York, in order to assess feasibility of the steady-state propane-gas tracer method as a means of estimating in situ reaeration coefficients. It is concluded that the steady-state method, which combines as instantaneous injection of dye tracer with a long-duration injection of propane tracer, is an operationally feasible field technique and provides a very reliable means of determining the propane desorption coefficient in steady-channel flow. The effect of wind shear on propane desorption coefficients was not detected in any tests, apparently due to the sheltering effect of high banks. The reaeration coefficient is estimated by applying a conversion factor determined from laboratory experiments to the gas desorption coefficient. (USGS)
W85-00838

INJECTION OF TREATED WASTEWATER FOR GROUND-WATER RECHARGE IN THE PALO ALTO BAYLANDS, CALIFORNIA, HYDRAULIC AND CHEMICAL INTERACTIONS--PRELIMINARY REPORT,
Geological Survey, Sacramento, CA. Water Resources Div.
S. N. Hamlin.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 82-4121, Sept 1983. 50 p, 19 Fig, 2 Tab, 35 Ref.

Descriptors: *Injection wells, Observation wells, *Aquifers, Clogging, Reclaimed water, *Saline water intrusion, Saline water barriers, Water quality, Hydraulics, *California, *Extraction wells, Palo Alto Baylands.

An injection-extraction well network in the Palo Alto Baylands along the San Francisco Bay, California, was designed to flush the shallow aquifer system of saline water and prevent further inland saline contamination. Clogging processes and solution migration in the vicinity of one injection well were studied. Cyclic evaporative concentration of bay water and infiltration have generated a concentrated ground-water brine. Montmorillonite and illite are the primary clay minerals present in the shallow aquifer system. X-ray diffraction analysis of these clays showed a marked increase in the d-spacing of the crystal lattice when native hypersaline pure water was replaced by injection water. Chloride:magnesium and chloride:potassium ratios in the aquifer system changed during injection, most likely due to ionic exchange reaction. Similar variations in chloride:boron, chloride:iron, and chloride:manganese ratios probably resulted from reduction-oxidation reactions. Ground-water quality appears to have been chiefly affected by the processes of dilution and dispersion. Extraction pump test data yielded a transmissivity value of 960 feet squared per day and a storage coefficient of 0.0005. Vertical permeability of the upper confining layer is 0.08 feet per day. (USGS)
W85-00840

EFFECTS OF RECHARGE FROM DRAINAGE WELLS ON QUALITY OF WATER IN THE FLORIDAN AQUIFER IN THE ORLANDO AREA, CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. R. Schiner, and E. R. German.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 82-4094, 1983. 124 p, 15 Fig, 13 Tab, 20 Ref.

Descriptors: *Groundwater recharge, *Injection wells, *Artificial recharge, *Drainage wells, Water pollution, Water chemistry, *Stormwater runoff, Wastewater, Correlation analysis, Hydrogeology, *Florida, Orlando area.

Approximately 400 drainage wells in the Orlando area inject, by gravity, large quantities of stormwater runoff that may or may not be suitable for most purposes without treatment into the same freshwater zones of the Floridan aquifer tapped fo public supply. The wells are used mostly to contro lake levels and dispose of urban storm runof Recharge from drainage wells compensates fo heavy withdrawals from the Floridan aquifer an helps maintain aquifer pressures that retard upwar saltwater encroachment. Sixty-five supply well and 21 drainage wells within a 16-mile radius o Orlando were sampled from September 1977 t June 1979. Most constituent concentrations wer slightly higher in water from drainage wells tha in water from supply wells. The most notabl differences were in bacteria colony count and tota nitrogen concentrations. With the exception o bacteria, water from drainage wells would genera ly meet the maximum contaminant levels estab lished by the National Interim Primary and Pro posed Secondary Drinking Water Regulations (USGS)
W85-00843

EFFECTS OF PUMPAGE, IRRIGATION RETURN, AND REGIONAL GROUND-WATER FLOW ON THE WATER QUALITY AT WAIAWA WATER TUNNEL, OAHU, HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
P. R. Eyre.
USGS Water-Resources Investigations Report 83-4097, 1983. 44 p, 19 Fig, 4 Tab, 15 Ref.

Descriptors: *Groundwater quality, *Irrigation return flow, Water quality control, *Ghyben-Herzberg groundwater lens, Oahu, *Hawaii, Regional analysis.

Waiawa shaft is a 1,700-foot long water tunnel which draws water from the top of the Pearl Harbor Ghyben-Herzberg ground-water lens Oahu, Hawaii. The application of brackish irrigation water to sugarcane fields overlying Waiawa shaft, combined with relatively low pumping rates at the shaft from 1978 to 1980, caused the chloride concentration of water produced by Waiawa shaft to rise to 290 milligrams per liter. Time-series analyses, pumping tests and analyses of water samples show that a zone of degraded water lies at the top of the lens. This zone is mixed in significantly different proportions with the underlying fresher water depending on the pumping rate at Waiawa shaft. The chloride concentration of water in the Waiawa shaft can generally be kept below 250 milligrams per liter for the next few years, if pumping rates of about 15 million gallons per day are maintained. The use of managed pumping to control the chloride problem over the long term is uncertain owing to the possible increase in chloride concentration of the irrigation water. Based on ground-water flow rates and analogy to nearby wells, the chloride concentration of Waiawa shaft's water will decrease to less than 100 milligrams per liter in 2 to 3 years if the use of brackish irrigation water is discontinued. (USGS)
W85-00850

MEASUREMENT OF THE REAERATION COEFFICIENTS OF THE NORTH FORK LICKING RIVER AT UTICA, OHIO, BY RADIOACTIVE TRACERS,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 5A.
W85-00853

SOUTH FLORIDA'S WATER DILEMMA: A TRICKLE OF HOPE FOR THE EVERGLADES,
For primary bibliographic entry see Field 2L.
W85-00905

GREAT LAKES RESEARCH: PAST, PRESENT AND FUTURE,
Amsterdam Univ., (Netherlands). Vakgroep Aquatische Oecologie.
For primary bibliographic entry see Field 4A.
W85-00916

CAPPING OF CONTAMINATED SEDIMENTS,

York Univ. Medical Center, NY. Inst. of ronmental Medicine.
O'Connor.
heastern Environmental Science, Vol. 3, No. 35-39, 1984. U.S. Army Corps of Engineers racts DACW51-80-R-0002 and DACW 39-82-, National Institutes of Environmental Health nces grant ES0026.

riptors: *Sediments, *Contamination, *Cap- *Japan, *Hiroshima Bay, *Osaka Bay, *Long d Sound, *New York Bight, Fate of pollut- Water pollution control, Benthos, Phospho- Nitrogen, Sludge disposal, Ocean dumping, banks, Environmental protection.

aminated sedimentary deposits can be capped carefully selected clean material so as to ce contaminant availabilty to such an extent acute or chronic toxicity as well as bioaccu- tion are reduced below required levels. The ce of capping material is prejudiced toward nents which will remain in place for a long d of time. Capping can isolate contaminants the benthic biota if the cap is sufficiently ; a cap of approximately 1 m thickness will ent burrowing benthos from penetrating the ted material. Three capping projects have carried out. Clean sand overlays, 0.3 m thick, placed atop bottom sediments heavily con- nated with sewage sludge in Hiroshima Bay n) and similarly contaminated surficial sedi- s in Osaka Bay were dredged to remove the ents. Subsequent monitoring of P and N re- from sediments in both sites determined that s in Hiroshima Bay were decreased markedly, e they were unchanged in Osaka Bay. For a ing project in Long Island Sound, two nds of dredged material were capped; one sand and one with cohesive silty material. caps successfully isolated the contaminated nent from the water column and neither was ched during a severe storm; the silt cap had severely eroded. Sediment contaminated with or cadmium were ocean-dumped in the New Bight in 27 m of water. The sediment was ed with a layer of uncontaminated fine- ed dredged material and then with a sand . The thickness of the cap was estimated at 1 After three years, little or no contaminant ement had occured. (Collier-IVI)
-00938

ULATION OF BULK HAZARDOUS CAR- S ON THE GREAT LAKES,
York Sea Grant Law Center, Buffalo.
Reis, and M. E. Gottfried.
heastern Environmental Science, Vol. 3, No. 0-56, 1984. 29 Ref.

riptors: *Great Lakes, *Shipping, *Ships, ironmental protection, *Hazardous materials, t Guard, Great Lakes Commission, Transpor- n, Water pollution prevention.

the demise of Great Lake-oriented commis- activity in the 1980s the regulatory function concern of the Coast Guard have become rtant in the identification, recognition and ction of the Great Lakes. Coast Guard regu- ns that affect the transport of cargoes general- d hazardous cargo specifically are analyzed to mine whether the Great Lakes are distin- ed from other water bodies in setting stand- for shipping, transport design and other ques- . Also examined is the question of whether the lations provide a pattern of regulation that s the potential needs of the Great Lakes to be ed differently than rivers and oceans. The ction of comprehensive data concerning ement of hazardous cargo on the Lakes is a equisite to the formation of any regulations ned specifically to protect the broader envi- ent of Great Lakes resources. The lack of data suggests that regulations already enacted cular to the Great Lakes may not be respon- to the policies and goals of Great Lakes pro- n. (Author's abstract)
-00940

MPARISONS OF DEVICES FOR AERAT- INFLOW OF PIPES,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
For primary bibliographic entry see Field 5F.
W85-00946

PERIPHYTON BIOMASS AND SPECIES COMPOSITION IN 21 BRITISH COLUMBIA LAKES: SEASONAL ABUNDANCE AND RESPONSE TO WHOLE-LAKE NUTRIENT ADDITIONS,
Department of Fisheries and Oceans, Vancouver (British Columbia). West Vancouver Lab.
K. S. Shortreed, A. C. Costella, and J. G. Stockner.
Canadian Journal of Botany, Vol. 62, No. 5, p 1022-1031, May, 1984. 7 Fig, 4 Tab, 34 Ref.

Descriptors: *Periphyton, *Biomass, *Species composition, *Oligotrophic lakes, *British Columbia, *Fertilization, Seasonal variation, Chlorophyll, Diatoms, Hydrogen ion concentration, Nitrogen, Phosphorus.

Periphyton communities on artificial substrates in 21 oligotrophic British Columbia lakes were sampled from 1978 to 1980. Periphyton biomass (ash-free dry weight (AFDW) and total chlorophyll (Chl)) and accumulation rates (milligrams AFDW per square meter per day) were among the lowest recorded from temperate oligotrophic lakes, averaging from 0.01 to 5.69 mg Chl/sq m, 0.04 to 2.86 g AFDW/sq m, and 1 to 47 mg AFDW/sq m/day. Diatoms were the dominant group in most lakes at most times, comprising over 70% of total periphyton biomass. Achnanthes minutissima and Tabellaria flocculosa were the most ubiquitous species in the study, and Eunotia spp. were common only in acidic humic-stained lakes. Of the physical and chemical factors measured in this study, pH appeared to be most important in regulating diatom species composition. In those lakes fertilized with nitrogen and phosphorus, periphyton biomass showed marked increases over untreated years, but the community species composition in most lakes remained similar between treated and untreated years. Comparisons between artificial and natural substrates showed that the same species were common on both substrates, although relative abundances varied. The littoral zone of most study lakes is small relative to the pelagic, and it is estimated that periphyton comprised $<$ 1% of average total algal biomass (as chlorophyll) and also represented $<$ 1% of estimated total annual carbon metabolism. (Author's abstract)
W85-00954

WATER RESOURCES DEVELOPMENT AND MANAGEMENT PLANS; PART 7: TIME VARIABLE EFFLUENTS IN WATER QUALITY COMPUTATIONS - AN ASPECT OF THE WATER QUALITY MANAGEMENT STUDY 'BEWIRTSCHAFTUNGSPLAN LEINE' (BEWIRTSCHAFTUNGSPLANE; TEIL VII: GUTEBERECHNUNGEN MIT ZEITVARIANTEN SCHMUTZWASSEREINLEITUNGEN - EIN TEILASPEKT DER PILOTSTUDIE BEWIRTSCHAFTUNGSPLAN LEINE),
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Siedlungswasserwirtschaft.
For primary bibliographic entry see Field 5B.
W85-00967

GROUNDWATER QUALITY: THE NEXT REGULATORY ISSUE,
K. Eikenberry.
EPA Journal, Vol. 10, No. 2, p 12-14, March, 1984.

Descriptors: *Groundwater management, *Water quality control, *Regulations, Federal jurisdiction, State jurisdiction, Legislation, Planning, Management.

The signs of increasing governmental support on groundwater quality control programs cut across federal and state government lines. Several western states have recently begun new groundwater protection initiatives under their water pollution laws. Nationally, Congress has under consideration a number of groundwater related bills among the most prominent of which is on establishing a National Groundwater Commission. The first element to be initiated in any water quality protection program is to determine the level of protection a water body is to receive in terms of quality. To make that determination, it is necessary to decide what beneficial uses are to be made of the water body. Thereafter, measurable receiving water quality criteria must be established to insure that the water quality is satisfactory for the intended use. The next element required of a state program is the inclusion of a range of regulatory and enforcement tools sufficient to insure that the standards will not be violated. Groundwater protection programs must be implemented effectively and soon. If a combination of federal and state government efforts is pursued in a spirit of goodwill, unitary state programs can effectively protect groundwater consistent with all legitimate national and state interests. (Baker-IVI)
W85-00980

ALTERATIONS IN THE ZOOPLANKTON COMMUNITY OF A FLY ASH TREATED LAKE,
Indiana Univ.-Purdue Univ. at Indianapolis. Dept. of Biology.
D. F. Spencer, H.-Y. Yeung, and R. W. Greene.
Hydrobiologia, Vol. 107, No. 2, p 123-130, November, 1983. 5 Fig, 5 Tab, 24 Ref. EPA grant R-801245-04-2.

Descriptors: *Lake Charles East, *Indiana, *Lake restoration, *Zooplankton, *Fly ash, Environmental effects, Cladocera, Copepods, Species diversity.

The zooplankton community in Lake Charles East, Indiana, was sampled from June, 1974 through September, 1977 as part of a lake restoration study. About 18,000 kg of lime and 1800,000 kg of ponded fly ash were added to the lake during May through August, 1975 to precipitate phosphate and seal the sediments. Annual mean species number (5.2-11.3) and annual mean species diversity (H', 0.9-1.3) were highest in 1976, the first year after treatment. By the second post-treatment year these variables had returned to pretreatment levels. Prior to treatment Cladocera were dominant during fall and early winter (Sept.-Dec. 1974), with Copepoda dominant in late winter and spring (Jan.-May 1975). After treatment Cladocera were dominant throughout the fall and winter (Nov. 1957-May 1976). Copepoda were again dominant in August 1976. The short term effect of the treatment appeared to be termination of the latter part of the copepod annual cycle through elimination of aestivating copepodites in the summer and increased abundance of Cladocera during the winter and spring immediately following treatment. Community composition one year after treatment was similar to that observed prior to treatment. (Author's abstract)
W85-00995

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

PRIORITIES FOR RIVER RECREATION MANAGEMENT IN THE SOUTHERN APPALACHIANS,
Oregon Dunes National Recreation Area, Reedsport.
A. C. Smith, J. D. Wellman, J. W. Roggenbuck, and K. Killeen.
Southern Journal of Applied Forestry, Vol. 7, No. 4, p 185-190, November 1983. 1 Fig, 2 Tab, 14 Ref.

Descriptors: *Recreation, *Southern Appalachians, *Virginia, *Boating, *River management, Use limitations, Public access, Social aspects, Social needs, Crowding, Canoeing, Recreation demand, Recreation facilities.

The Southern Appalachians have river corridors of natural and esthetic interest, challenging whitewater, and high fishing quality. Users (can-

oeists) on scenic, mild whitewater rivers in Virginia were sent a mailback questionnaire early in 1980; 426 usable questionnaires were returned. An index of recreation specialization was developed to separate canoeists with high commitment to the sport (high specialists) from those who are least involved (low specialists). Virginia canoeists resembled other river floaters across the nation in assigning relatively high priority to litter clean-up and low priority to crowding and use limitations; they differed from others in the high emphasis they placed on access, water pollution control, and control of river development. For high specialists, the most important management task was improving their access to rivers; water pollution control was rated first by low specialists. A survey of public resource managers in the Southern Appalachians found that managers agree with canoeists in assigning high priority to access and recreational developments and in showing concern over recreationist/landowner conflicts. Based on the two surveys, crowding is generally not considered an important problem and widespread application of use limitations is not now appropriate. (Collier-IVI)
W85-00545

6

INTEGRITY OF INTERCONNECTED WATER SYSTEMS,
California Univ., Irvine. School of Engineering.
For primary bibliographic entry see Field 8B.
W85-00611

USE OF RAINFALL MODELS IN AGRICULTURAL PLANNING,
Reading Univ. (England). Dept. of Applied Statistics.
For primary bibliographic entry see Field 2B.
W85-01066

6B. Evaluation Process

WATER PLANT FOR THE 21ST CENTURY.
American City and County, p 23-27, November, 1982. 6 Fig, 1 Tab.

Descriptors: *Water resources development, *Water supply. *Planning, *Fairfax County, *Virginia, Potomac River, Water supply, Management, Drought.

Culminating a period of 10 years of planning, design, financing and construction, the Fairfax County Water Authority in Virginia has finally placed its 50-MGD, $81 million Potomac River water supply facility in operation. The facility is comprised of an intake, intake conduits, a raw water pumping station, a raw water supply main, a water treatment plant, treated water transmission main and a Potomac-Occoquan interchange transmission main. The facility is noteworthy as it is the first in Virginia to use the Potomac River as a source of water supply. This required a great deal of local, state, interstate and federal agency cooperation. The facility was funded entirely by the water authority's customers and the facility will play an important part in the development of a system in the area to avert future water shortages during drought periods through coordinated management of available water resources. (Baker-IVI)
W85-00623

SMALL-SCALE HYDROELECTRIC POWER FOR DEVELOPING COUNTRIES: METHODOLOGY OF SITE-SELECTION BASED ON ENVIRONMENTAL ISSUES,
Oak Ridge National Lab., TN. Environmental Sciences Div.
G. F. Cada, and F. Zadroga.
Environmental Conservation, Vol. 9, No. 4, p 329-337, Winter, 1982. 1 Fig, 22 Ref.

Descriptors: *Developing countries, *Hydroelectric plants, *Small hydropower, Evaluation, Environmental effects, Water resources development, Rural areas, Site selection.

Small hydroelectric projects, defined as including hydroelectric generating facilities with capacities of 1,000 kW or less, have great potential for elevating the standard of living and contributing to the economic growth of isolated rural communities especially in Third World countries. Environmental concerns can be factored into a site selection process both at the screening and feasibility stages. While many of the factors determining the suitability of a given site at the screening stage involve basic engineering or economic questions, fundamental environmental issues that should be addressed include an appropriate resource development strategy to accompany the project, the quality and quantity of water available to meet project needs, the presence of near by protected areas, habitats, or important species, and the adequacy of local support for environmental protection requirements of the project. During the feasibility study a small number of sites are examined in proper detail and the best are selected for development. It is important that site selection and impact evaluation be conducted by competent individuals with formal training and experience in an appropriate environmental field. (Baker-IVI)
W85-00647

REGIONAL AUTHORITIES SUPPORT SMALL WATER SYSTEMS IN THE AMERICAS,
Camp, Dresser and McKee, Inc., Arlington, VA.
D. Donaldson.
Journal of the American Water Works Association, Vol. 76, No. 5, p 62-67, June, 1984. 5 Fig, 1 Tab, 1 Ref.

Descriptors: *Water resources development, *Developing countries, Drinking water, Water supply, Water demand, Latin America, Planning, Education, Training, Management, Water systems.

The progressive steps that water and sanitation authorities have taken in Latin America from the 1950s are reviewed. As water sector programs are realized for smaller villages and dispersed populations, regional authorities are integrating their institutional activities to support such programs. This institutional experience in providing public water supplies for the Americas could be transferred to guide water projects in other regions of the world, as countries in Asia and Africa extend these services to smaller communities. Organizing drinking water sector efforts to encompass the major cities, secondary cities, and larger villages has not been an easy task. The urban programs were designed and operated for many years by public health engineers as social programs that made extensive use of public health promoters and educators to organize and supervise local activities and construction. Once the program left the public health sector, it lost these elements. A rurban program consists of hundreds to thousands of villages scattered all over a country. Rurban systems are usually operated, managed, and maintained by villagers who cannot read or write and who have little or no technical background. Program management and financing are new concepts to those managing them. In response to these problems the water sector of the 1980s has usually organized a unit within the regional or provincial authority whose function it is to coordinate the four specific activities of the rurban program so that they will be coordinated with the resources of the major and secondary cities. This includes community participation, use of mass production techniques, extensive user education programs, and the use of regional authority personnel to provide training and supervision of managers. (Baker-IVI)
W85-00706

REAL WORLD DESIGN: APPROPRIATE TECHNOLOGY FOR DEVELOPING NATIONS,
Camp, Dresser and McKee, Inc., Walnut Creek, CA.
R. D. G. Monk, T. Hal, and M. Hussain.
Journal of the American Water Works Association, Vol. 76, No. 6, p 68-74, June, 1984. 4 Fig, 3 Tab.

Descriptors: *Water resources development, *Developing countries, *Water treatment, *Water supply, Design, Water demand, Bangladesh, Chittagong.

Developing nations cannot afford mistakes i
area of water treatment and delivery. Design
engineering concepts must match a nation's a
to build, operate, repair, and pay for them. A
technology, labor-intensive water treatment
was designed for Chittagong, Bangladesh. It i
porates the use of local materials and labor,
energy use, and reduces imported techno
while surpassing World Health Organization
mum permissible guidelines. Specific informa
on this system is provided concerning its reli
ity, simplicity of design, mechanization, en
demand, use of local materials, flexibility,
quality goals, raw water testing, presettling b
chemical treatment, raw water pump stations
silting basins, rapid mixer, clarifiers, filters, sl
handling and disposal, high lift pump station
strumentation, and standby generator. (Baker-
W85-00707

PREPARING THE DATA BASE FOR A WA NETWORK ANALYSIS,
Bell-Walker Engineers, Inc., Bellevue, WA.
For primary bibliographic entry see Field 5F.
W85-00740

FISHERIES: PAST, PRESENT, AND FUTU IN THE GREAT LAKES,
Ontario Ministry of Natural Resources, Toro
Outdoor Recreation Group.
For primary bibliographic entry see Field 2H.
W85-00923

PRODUCTION FORGONE: AN ALTERNAT METHOD FOR ASSESSING THE CON QUENCES OF FISH ENTRAINMENT AND PINGEMENT LOSSES AT POWER PLA AND OTHER WATER INTAKES,
Fish and Wildlife Service, Kearneysville, W
Eastern Energy and Land Use Team.
P. J. Rago.
Ecological Modelling, Vol. 24, No. 1/2, p 79-August, 1984. 13 Fig, 5 Tab, 29 Ref.

Descriptors: *Entrainment, *Impingement, *
mortality, *Water intakes, Powerplants, Envir
mental effects, Biomass, Predators, Survival, C
puter models, Fish populations, Growth sta
Forecasting.

Losses of fish at power plant and other wa
intakes have immediate as well as future impa
Not only is fish biomass removed from the aqu
system, but also the biomass that would have b
elaborated by the cohort is not available to ot
predators. A simple biological production mo
was modified to allow projections of future
pacts associated with current losses of fish and
larvae. To compute these projections, it is assun
that short-term future responses will be similar
recent survival and growth rates, deductible fr
analysis of current population structure. T
model has several advantages over other approa
es. First, a dynamic population model need not
specified. Second, the relative importance of ich
yoplankton versus juvenile and adult fish los
can be compared directly. Third, the ecologi
effects of future losses can be addressed by cons
ering the predicted size-frequency destributio
Finally, the relative uncertainty of the forecast
be assessed. The effectiveness of two commo
used mitigation techniques was explored. Red
tions in entrainment-induced mortality were
sessed along with exclusion of adult fish using
size selective screening device. If entrained or
nisms contribute most to the production forgo
then reductions in entrainment mortality will
more effective than screening of adult fish. Ext
sive sensitivity analysis of the model indicated
relative importance of various growth and survi
parameters. Survival rates in the first year of l
were critical parameters. A computer program
FORTRAN) generates production forgone e
mates by age group, evaluates the efficiency
various mitigation measures and computes the s
sitivity of production forgone with respect to ea
parameter in the model. (Author's abstract)
W85-01025

Cost Allocation, Cost Sharing, ricing/Repayment

ER MAIN PROJECT SERVES EXPAND-HI-TECH AREA,
gh Public Utilities, NC.
rimary bibliographic entry see Field 8A.
00552

ITAN RIVER BASIN RESERVOIR EM HYDROELECTRIC FEASIBILITY DY: ROUND VALLEY AND SPRUCE RUN ERVOIRS.
erland County Planning Board, Bridgeton,
Jersey Water Supply Authority, Clinton,
mber 1982. 91 p, 5 Fig, 17 Tab, 3 Append.

riptors: *Water supply, *Reservoir operation, ibility studies, *Hydroelectric power, *Elec- transmission, River basins, Mathematical ls, Reservoir releases, Electric power rates, nistrative regulations, Electric power costs, ated costs, Construction costs, Costs, Cost sis, *New Jersey, Raritan River basin.

bility investigations determined that hydro- ic power generating facilities would be cost- ive at both the Spruce Run and Round y Reservoirs using 'wheeling', or transmission ectricity. Releases from Spruce Run and d Valley, with storage capacities of 11 and 55 n gallons, augment low flows in the Raritan Basin. Generation of hydropower at the voirs was computer simulated, utilizing a matical model which determines the daily e required from each reservoir to sustain the um required stream flows at key locations which provides a specified uniform daily supply for diversion from the Raritan River. r the present mode of making first releases Spruce Run Reservoir, and with water sales million gallons per day or less, hydroelectric ies would not be cost-effective at either the len Pumping Station or the South Branch way Creek Discharge Structure. With water at 160 million gallons per day, hydroelectric ies would be economically feasible at the Raritan Confluence Pumping Station with ive rates on the order of $.10 per kilowatt using the wheeling concept. Generation of r at Spruce Run Reservoir, with the electrici- nsmitted for use at other State or Authority ies may be economical, depending on the s of the Public Utilities Commission proceed- n wheeling. The two reservoirs in the north l portion of the state are owned and operated e State of New Jersey Water Supply Author- 'azio-Omniplan)
00826

ERTAINTY IN WATER RESOURCE NNING: AN ECONOMIC EVALUATION WATER USE REDUCTION ALTERNA-
Hampshire Univ., Durham. Water Resources rch Center.
Lindsay, and J. R. Powell.
able from the National Technical Information ce, Springfield, VA 22161 as PB84-202605, codes: A04 in paper copy, A01 in microfiche. rch Report 41, April 1983. 34 p, 5 Fig, 7 Tab, f. Project No. OWRT A-058-NH (2).

riptors: *Economic evaluation, *Water con- ion, *Water shortage, *Risks, Economic effi- y, *New Hampshire, Water supply, *Alterna- lanning, Water resources planning, *Water nd, Cost analysis.

study examines water consumption in the ntial sector for a New Hampshire communi- e study illustrates when and where monetary accrued to water cutbacks occur in the resi- l sector, the effect of seasonal demand on age costs is shown, and time is included as a y factor in assessing the costs of shortage of ng quantity amounts. The methodology de- ed gives a community an individually tailored range of costs and losses for varying sizes of percentage cuts in water demand over varying time periods. Rather than tie shortage penalty costs to size of shortage in linear fashion, or develop a shortage penalty cost function that is based on three different levels of shortage in three different towns, the individualism of the community is emphasized. If a town is planning to increase its water supply capacity, it can develop its own shortage cost function based on the range of losses that can be expected, along with including duration. These can be measured for each year into the future for which it is expected there will be a water shortage or artificially generated water cutbacks and compared to the costs of increasing supply. This study shows that the costs of a water cutback (shortage) are influenced by the time of year, the level of consumption, and the size and length of the water cutback. This investigation is very site specific with respect to consumption levels, rate structure, and the predominance of water use in the residential sector. However, this methodology can be utilized in any community that has a high residential water use level by planning for the timing, the size, and length of cutbacks in demand.
W85-00862

6D. Water Demand

INVESTIGATION OF THE CARRYING CAPACITY OF THE MONOCACY RIVER AS A SCENIC AND RECREATIONAL RESOURCE, VOLUME I. MARYLAND SCENIC RIVERS: THE MONOCACY RESOURCE SUMMARY REPORT,
Ionics, Inc., Watertown, MA.
For primary bibliographic entry see Field 6G.
W85-00607

AMOUNTS OF WATER REQUIRED BY IMPORTANT ECOSYSTEMS OF A RURAL LANDSCAPE,
Vysoka Skola Zemedelska, Brno (Czechoslovakia). Inst. of Forest Ecology.
For primary bibliographic entry see Field 2D.
W85-00625

RURAL WATER PLAN, (CUMBERLAND CO., N.J.).
Lloyd (T.) Associates, Philadelphia, PA.
Report, July 1969. 101 p, 21 Fig, 15 Tab.

Descriptors: *Rural areas, *Water policy, *Water use, *Water management, Regional planning, Water conservation, Population dynamics, Geologic formations, Housing, Farms, Land use, Catchment basins, Climatic data, Runoff, Groundwater movement, Recharge wells, Pump wells, Seawater, Aquifers, *New Jersey, Cumberland County.

This is the first of a series of studies that will result in a comprehensive water and sewer plan for Cumberland County, New Jersey. The rural water supply plan reviews the sources and present uses of water in the country and makes recommendatons to insure an adequate future supply. The figures presented in the report show that what has often been referred to as an inexhaustible supply of water is indeed exhaustible. Unless the public is made aware of this and sufficient demands for action are made to implement the proposals in the report, there may be a limited supply of water for the next generation. Alternatives suggested include: construction of reservoirs both 'on' and 'off' streams: construction of dams to prevent the tide from entering major streams, thus allowing formation of a fresh water reservoir; use of recharge wells to allow treated water to be returned to the aquifer from which it was obtained; returning uncontaminated water directly to the aquifer; zoning townships to provide the minimum lot size for on-site disposal as required by the State Health Department. For the most part, there is a generous amount of high quality water in Cumberland's underground reserves, which are constantly being recharged from above, from aquifer outcrop areas, and from streams. A few wells near the bay front have become contaminated by salt water encroachment. (Fazio-Omniplan)
W85-00824

URBAN WATER PLAN, (CUMBERLAND CO., N.J.).
Cumberland County Planning Board, Bridgeton, NJ.
Report, December 1970. 88 p, 21 Fig, 9 Tab.

Descriptors: *Urban planning, *Water policy, *Water use, *Water management, Urban areas, Water conservation, Metropolitan water management, Plumbing, Population dynamics, Catchment basins, Land use, Climatic data, Runoff, Aquifers, *New Jersey, Cumberland County.

This is the second of four reports aimed at developing a comprehensive water and sewer plan for Cumberland County, New Jersey. This report reviews the sources of water and the uses of water by individuals, businesses and industries, particularly in the tri-city area of Vineland, Bridgeton, and Millville. This plan is to help guide the County's growth up to and beyond 1988. The greatest water requirements for the future will be generated by the three cities, their surrounding areas, and the industrial operations within them. To meet this need a vast natural groundwater reservoir is easily accessible by wells anywhere in the tri-city area. However, water supply demands will increase sharply in the future to such an extent that, at full development, the County may be utilizing the huge amount of available precipitation recharge that comes to the area. Because of this possibility, several major water planning proposals and policies should be instituted. This municipal water plan is based on data compiled and evaluated by the County Planning Board. Some of it is readily available published data while other information is from unpublished sources, public and private agencies and private citizens. For the most part, the amount of high quality water in Cumberland's underground reserves is generous and is constantly being recharged from above via aquifer outcrop areas and streams. (Fazio-Omniplan)
W85-00825

SOUTHERN HILLS REGIONAL AQUIFER SYSTEM OF SOUTHEASTERN LOUISIANA AND SOUTHWESTERN MISSISSIPPI,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-00848

GROUND WATER IN NORTH MONTEREY COUNTY, CALIFORNIA, 1980,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-00851

UNCERTAINTY IN WATER RESOURCE PLANNING: AN ECONOMIC EVALUATION OF A WATER USE REDUCTION ALTERNATIVE,
New Hampshire Univ., Durham. Water Resources Research Center.
For primary bibliographic entry see Field 6C.
W85-00862

WATER FOR ENERGY IN THE NORTHEASTERN REGION OF THE UNITED STATES: LEGAL ISSUES AND CONCERNS,
Kansas State Univ., Manhattan. Coll. of Architecture and Design.
For primary bibliographic entry see Field 6E.
W85-00939

6E. Water Law and Institutions

PAST AND PENDING DECISIONS CONTROLLING SAN FRANCISCO BAY AND DELTA,
Bay Inst. of San Francisco, Tiburon, CA.
W. T. Davoren, and J. E. Ayres.

Water Science and Technology, Vol. 16, No. 3-4, p 667-676, 1984. 4 Fig, 16 Ref.

Descriptors: *San Francisco Bay, *California, *Water rights, *Estuaries, Saline water intrusion, Instream flows, Diversions, Legal aspects, Reservoirs, Environmental effects, Levees, Drainage, Economic aspects, Public policy.

The San Francisco Bay and Delta, the largest inland estuary of America's west coast, has been altered greatly by land and water development. To the detriment of estuarine processes and indicator species, upstream impoundments, diversions and pumped exports from the Delta have reduced river flows by 50% or more. Additional storage and diversion units are planned. Drainage projects are underway to transport land-derived salts from inland irrigated areas for discharge into the Bay's headwaters. Also, the threat of levee collapse in the Delta from erosion and subsidence advances yearly. Navigation, agriculture, recreation and fish/wildlife needs further complicate land and water management challenges in the Delta. The existence of vested legal and economic rights, based upon past successes in exploiting California's land and water resources, seems to be the biggest obstacle to the maintenance of the natural functions of San Francisco Bay and Delta. The State Water Project seeks 2.4 million cu m to fulfill annual contracts, and the federal Central Valley Project wants to stabilize its operations by expanding its key storage unit, Lake Shasta, from 4.9 million cu m to 17.1 million cu m. The State Water Project accepts a Delta obilgation for salinity repulsion; the Central Valley Project repulses the obligation. Both projects must help the deterioration Delta levees to help themselves. Innovative public policy which satisfies both water user's needs and environmental needs and which is based upon sound economic and equitable doctrines is a goal toward which all private and public sector interests should strive. (Moore-IVI)
W85-00577

LEGAL MEANS OF PROTECTING AQUIFERS,
DiCara, Selig and Holt, Boston, MA.
E. I. Selig.
Journal of the American Water Works Association, Vol. 76, No. 5, p 38-41, May, 1984, 2 Fig.

Descriptors: *Water quality control, *Groundwater management, *Legal aspects, Public utilities, Public rights, Legislation, Common law, Liability, Negligence, Nuisance, Regulations, Torts, Water law.

Prudent measures are outlined which a plaintiff utility should take in preparing and presenting evidence in suits filed to recover the costs of cleanup of contaminated underground water supply sources. Also considered are steps which should be taken in raising revenues to meet the immediate costs of additional water treatment while pursuing relief from the party responsible for the contamination. In pressing a suit, a utility may be aided by the rule of joint and several liability, which permits a plaintiff to recoup all losses from one defendant even though the latter is not solely responsible for the harm complained of. Difficulties arise in marshalling the facts needed to establish the identity of at least one party who was responsible for discharging contaminants in the affected watershed, and proving a causal connection between such discharges and contamination of the plaintiff's well field. A plaintiff water utility can always seek relief under the judicially created common law of torts and may also invoke state statutory provisions that codify or strengthen common law rules of tort liability. The plaintiff may also have causes of action under one or more federal statutes. (Baker-IVI)
W85-00699

WETLAND AND FLOODPLAIN PROTECTION AND THE FEDERAL-AID HIGHWAY PROGRAM,
Federal Highway Administration, Washington, DC.
E. V. A. Kussy.
Environmental Law, Vol. 13, No. 1, p 162-264, Fall, 1983. 445 Ref.

Descriptors: *Highways, *Construction, *Wetlands, *Floodplains, *Legal aspects, Environmental effects, Management, Planning, Legislation, Regulations.

Current relationships between the Federal-Aid Highway Program (FAHP) and the federal laws, regulations, and policies that provide for the protection and regulation of activities in wetlands and floodplains are reviewed. Additionally, since the FAHP is an old program and since many of the laws discussed here have been enacted or significantly expanded in scope since the mid-1960s, an attempt is made to show how the established program has accommodated new environmental safeguards. Physical relationships between highways and wetland and floodplain areas are addressed. The importance of mitigation measures in connection with highway construction in wetlands and floodplains is focused upon. The statutes authorizing the FAHP provide for the incorporation of mitigation features such as changes in project location and design, at various stages of project development. A discussion of the obligation to mitigate damages, the limit on that obligation, and the ways in which mitigation measures are funded, is also included. (Baker-IVI)
W85-00911

ENVIRONMENTAL LAW AND POLICY VERSUS THE HYDROCYCLE,
Minnesota Univ.-Duluth. School of Social Development.
A. E. Lind, and G. E. Glass.
Journal of Great Lakes Research, Vol. 10, No. 2, p 135-142, 1984. 2 Fig, 26 Ref.

Descriptors: *Hydrocycle, *Ecosystems, *Legal aspects, Acid rain, Rainfall, Precipitation, Atmospheric pollution, Management, Research, Planning.

In the United States especially, civil law is said to reflect two restraints inappropriate to the current state of knowledge. The first of these is that government is limited to reacting to episodic events or pressures. The second is that there are certain actions of man and his world that are governed by laws with which man either cannot or should not tamper. It has long been believed that natural law strictly limits man's sphere of collective, deliberate, and political actions. However, the view that civil law and social structure must address problems such as acid deposition on the basis of systematic relationships is supported by the contemporary state of knowledge, including scientifically supportable concepts such as the hydrocycle. Such a systematic approach must be carefully maintained in the policies which are to be articulated and programs which are to be adopted for the future. Research must be directed toward building a basis for such an approach. (Baker-IVI)
W85-00920

WATER FOR ENERGY IN THE NORTHEASTERN REGION OF THE UNITED STATES: LEGAL ISSUES AND CONCERNS,
Kansas State Univ., Manhattan. Coll. of Architecture and Design.
M. B. Lapping.
Northeastern Environmental Science, Vol. 3, No. 1, p 40-49, 1984. 4 Tab, 33 Ref.

Descriptors: *Water users, *Electric power production, *Legal aspects, *Water demand, Hydroelectric power, Cooling water, Riparian rights, Water law, Water rights, Recreation, Municipal water, Fishing industry, Institutional constraints.

Water is necessary to the generation of electricity through present conventional modes, whether these be based directly on water power (hydroelectricity) or use water for cooling purposes (nuclear and fossil fuel plants). Energy growth entails a correlative growth in the demand for water. Increasingly, however, finite water resources are subject to a variety of competing demands for other socially desirable uses. The resolution of these competing and often conflicting demands - i.e., the striking of a balance between energy growth and its associated water requirements and the water demands and requirements of recreation, municipal water systems, the fishing industry, other users constitutes a major policy issue for United States. All of the states in the northeast typically riparian jurisdictions in terms of wa law doctrine. The federal role is also critical to structuring of any institutional-legal understand of water resources issues as they relate to ener Likewise, a number of interstate and internatio issues and problems exist within the region, they must be better understood if we are achieve a clearer relationship between legal administrative institutions and our water energy concerns. (Collier-IVI)
W85-00939

LEGISLATORS PAUSE; ENGINEERS REFI CONTROL TECHNOLOGIES,
L. Catalano, and J. Makansi.
Power, Vol. 128, No. 5, p 17-24, May, 1984. Fig, 3 Tab.

Descriptors: *Acid rain, *Legislation, Decis making, Policy, Management, Water polluti control, Sulfates, Nitrates.

The major issue of the acid-rain problem in the is not whether emissions of sulfur dioxide a nitrogen oxides from the combustion of fossil fu in powerplants or automobiles eventually return earth in the form of sulfates and nitrates. Rath the issue is whether sulfate and nitrates drift fr their points of origin and cause damage to sensiti ecological resources in areas far removed fr fossel-fuel combustion. Both delayed and imme ate responses to acid pollution must be considere The basis for any control program should be t source/receptor relationship, or how much o source deposits on one receptor. Determining w should pay for acid-rain controls raises a host new questions, not relating to economics or s ence. Whatever the outcome of the funding deba utilities will bear the brunt of implementing a co trol program. Industrial production faces a pro lem should a stringent emissions program by quired. Short term and long term control strategi are considered. (Baker-IVI)
W85-00941

COMPARISON OF HOW THE UNITE STATES AND CANADA SET DRINKIN WATER REGULATIONS,
Massachusetts Univ., Amherst. Dept. of Publ Health.
E. J. Calabrese.
Regulatory Toxicology and Pharmacology, Vol. No. 4, p 417-427, December, 1983. 2 Tab, 3 Re

Descriptors: *United States, *Canada, *Regul tions, *Drinking water, Water quality standard Carcinogens, Risk assessment.

How the United States and Canada approach th process and implementation of drinking wat standards is critically examined. Despite many s milarities in their approaches to regulating drin ing water contaminants, there are a number important differences. The Canadian governme accepted the premise of the existence of epigeneti carcinogens and did not subject such outcomes t quantitative risk assessment procedures. The U Environmental Protection Agency (USEPA) di not make such a distinction between the 'type carcinogens'. The Canadians used the more co servative one-hit model for cancer risk determina tion while the USEPA used the usually somewh less conservative multistage model. Based o human health exclusively, the Canadian goverr ment stated that an acceptable risk was 1 cance per 2.5 million people per year (which equals 3. cancers per 100,000 people per 70-year lifetime). I contrast, the USEPA regulation was based o technology and feasibility, and had an associate cancer risk of approximately 4 per 10,000 peopl Such international comparisons provide a valuabl means to discern how others have attempted t solve similar problems and thereby provide a excellent opportunity to test the validity of one' own methodologies. (Collier-IVI)
W85-00942

Y OF STATE WATER QUALITY MONI-
G PROGRAMS,
ota Univ., St. Paul. Dept. of Forest Re-

nary bibliographic entry see Field 7B.
973

) INFORMATION SYSTEMS: NEEDS
MPROVEMENTS IN EASTERN INDIA,
l Center for Atmospheric Research, Boul-
.
vare.
mental Management, Vol. 8, No. 1, p 55-
. 3 Fig, 1 Tab, 83 Ref.

tors: *Developing countries, *India,
ng systems, *Flood forecasting, Rural
ubarnarekha River basin, Political aspects,
spects.

warning systems offer a large potential for
g human losses and property damage in
rone regions, but in developing countries
e large areas not covered by official fore-
and warning systems and such systems
reak down during those times when they
st needed. A large variety of often long-
ed message networks and prediction tech-
are known to function in flood-prone vil-
mmunities, yet little effort has been made to
r them or to work out the best possible mix
official and folk information systems. An
ation is made of the flood forecast and
system in the Subarnarekha River basin in
India. Five areas are analyzed: the hydro-
cal setting; the flood problem; the meth-
cal framework; the operation of the official
in the lower flood-prone reaches of the
nd the potential contribution of rural peo-
owledge to flood forecasting and warning.
l system must be tailored to an individual
with careful attenton givern to climatic,
ic, social, and political constraints. (Moore-

974

'S SWAN FALLS CONTROVERSY
'S TO NEW ERA FOR WATER RIGHTS,
ry.
on Age, Vol. 18, No. 3, p 30-31, November,
Fig.

tors: *Water rights, *Idaho, *Snake River,
Falls, * Irrigation water, Dams, Utilities,
lectric power, Water demand, Water use.

Power draws two-thirds of its power from
s located on the Snake River and its tribu-
Swan Falls is a middle dam on the system.
e of irrigation pumping, the peak demand
ver comes during the summer months. All
igation draws water from the river that
e used to generate power. To make up for
ss, the company started two coal fired gen-
plants in the 1970s. Consumers filed a com-
asking that Idaho Power be required to
its water rights on the Snake River, pro-
that power rates were rising because of the
ny's need for the coal-fired plants. In re-
the company filed a lawsuit with the Idaho
ne Court to determine if the utility had
able water rights. The court ruled that
ents made to get water rights operating
s for later projects do not affect Swan Falls.
Falls had rights to 8,400 cfs and the power
ny was within its rights protecting that flow.
er the company had relinguished that right
e it had allowed the flow to drop in the past
w question that must be settled. The best
solution appears to be an enhancement of
t water supplies through additional storage,
al recharging of the aquifer and conserva-
the distribution systems and on farms. Re-
g the legal issues, there are more than 2,000
rights holders who have not exercised their
and another 650 new water right fillings on
no action has been taken. (Baker-IVI)
1038

6F. Nonstructural Alternatives

INVENTORY AND ANALYSES OF INFORMATION FOR FLOOD PLAIN MANAGEMENT IN NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 4A.
W85-00617

6G. Ecologic Impact Of Water Development

SHORE PROTECTION - A TENSION FIELD BETWEEN TWO TYPES OF CONSERVATION,
Rijkswaterstaat-Deltadienst, Middelburg, Middelburg (Netherlands). Environmental Div.
For primary bibliographic entry see Field 8A.
W85-00562

ECOLOGICAL CONTROL OF ENGINEERING WORKS IN THE MARACAIBO SYSTEM,
Centre Oceanologique de Bretagne, Brest (France).
G. Rodriguez.
Water Science and Technology, Vol. 16, No. 3-4, p 417-424, 1984. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Lake Maracaibo, *Venezuela, *Gulf of Venezuela, *Engineering, *Environmental effects, Channel improvement, Silting, Dikes, Monitoring, Saline wedge, Saline water intrusions, Migration.

Lake Maracaibo occupies 12,000 sq km in Venezuela; the strait and bay connecting it to the Gulf of Venuzuela cover an additional 1,000 sq km. The lake has one of the largest concentrations of oil production in the world; this is the most important asset of the Venezuelan economy. The lake, estuary, and adjacent sea are also the site of important fisheries. Navigation channels between the lake and the gulf were built in the 1950's to improve access for the tankers which export a large fraction of the oil production. The main environmental concern at that time was that the increased depth of the channels would allow the saline wedge to penetrate into the lake. Detailed surveys of the biota did not detect any appreciable changes. Two alternative projects were later designed to protect the channel from heavy silting: a terminal dike to close the estuary and lateral dikes along each side of the navigation channel. A long-range study of the interchange of waters and organisms between the various components of the system showed that migratory processes played a considerable role, and it was decided to follow the second engineering alternative. A monitoring program was established to detect any long-term effects on the biota. No major effects due to the engineering works have been observed. (Collier-IVI)
W85-00564

SIMULATION OF ECOLOGICAL IMPACTS OF THE NEW OUTER-HARBOUR DEVELOPMENT IN ZEEBRUGGE,
Waterbouwkundig Lab., Borgerhout (Belgium).
P. Roovers, J. Ozer, J. P. Mommaerts, and Y. Adam.
Water Science and Technology, Vol. 16, No. 3-4, p 441-446, 1984. 4 Fig, 1 Tab, 7 Ref.

Descriptors: *Zeebrugge, *Belgium, *Harbors, *Environmental effects, *Simulation, Water pollution effects, Fate of pollutants, Wastewater pollution, Marine environment, Mathematical models, Hydrodynamics, Tidal effects, Heavy metals, Nitrogen.

The Belgian coastal water are strongly influenced by input from rivers and channels, due to the pecularities of the tidal and residual circulation in this part of the North Sea. In particular, the quality of the marine waters in the vicinity of Zeebrugge is largely affected by two effluents: the Leie River which contributes to the input of organic nitrogen; and the sewer outfall of Blankenberge, which releases considerable amounts of pollutants of domestic origin. The new outer-harbor in Zeebrugge is to be protected by jetties extending 1,750 m seaward. This development will alter the local distribution of tidal and residual currents. Such hydrodynamic changes will, in turn, affect the dispersion pattern of dissolved and particular matters in the vicinity of Zeebrugge. A mathematical model is presented, which simulates the dispersion, before and after outer harbor development, of dissolved organic matters, fecal bacteria and heavy metals, which are indicative of (respectively) domestic, human, and industrial pollution. Construction of the new outer-harbor would be beneficial for the surrounding marine ecosystem, but degradation of the water quality inside the outer-harbor will increase the eutrophication. Chronic formation of organic mud will occur, requiring intensive dredging of a material rich in organic matter and heavy metals. (Moore-IVI)
W85-00565

ENVIRONMENTAL IMPACT ASSESSMENT OF THE STRANGFORD LOUGH TIDAL POWER BARRAGE SCHEME IN NORTHERN IRELAND,
New Univ. of Ulster, Coleraine (Northern Ireland). School of Biological and Environmental Studies.
R. W. G. Carter, and P. J. Newbould.
Water Science and Technology, Vol. 16, No. 3-4, p 455-462, 1984. 4 Fig, 16 Ref.

Descriptors: *Environmental impact statement, *Barrages, *Tidal powerplant, *Northern Ireland, *Strangford Lough, Estuaries, Powerplants, Water resources development, Water quality control, Planning, Public opinion.

A tidal power barrage on Strangford Lough would supply about 10% of Northern Ireland's energy needs by the year 2000. Construction of such a barrage would have important ramifications on the natural history and amenity value of the area. The extreme lack of information on the Lough's environment makes it imperative that a research program be instituted well before engineering work starts. The Quoile Pondage, a western arm of the Strangford Lough, was cut off from marine influences by a flood alleviation barrage in 1957 and since that time water quality in the Quoile has worsened and bottom anoxia is widespread. Construction of a tidal barrage will trigger a chain reaction through the physical and biological systems of the Lough. Alterations will occur in sedimentation patterns, distribution of organisms and so on through the food chain. An overall adjustment in energetics is foreseen with perhaps a rapid drop in productivity followed by a slow recovery involving a reduced range of species. Relaxation and reaction times will vary enormously. It is doubtful if the modified system would attain dynamic stability within decades. While parallel studies on other tidal barrage impacts are useful, the speculative nature of much of the research makes them hard to apply. Since the proposals were made public in August of 1981 public reaction has been most hostile despite attempts to present a balanced viewpoint through public meetings and press releases. (Baker-IVI)
W85-00566

EFFECTS OF CONSTRUCTING A BARRAGE ACROSS THE TAWE ESTUARY,
Atkins Research and Development, Epson (England).
T. W. Broyd, A. G. Hooper, and R. S. W. M. Kingsbury.
Water Science and Technology, Vol. 16, No. 3-4, p 463-475, 1984. 8 Fig, 1 Tab, 5 Ref.

Descriptors: *Tawe, *Wales, *Environmental effects, *Barrages, Estuarine environment, Tidal effects, Fate of pollutants, Sedimentation, Navigation, Dredging, Water quality, Computer models, Model studies.

The Tawe river in south Wales discharges into Swansea Bay and is polluted by several outfalls and leachate from spoil banks. The high tidal range results in a tidal reach of some 4 km which at low

water exposes extensive areas of mudflats. A proposed barrage across the tidal reaches of the River Tawe was modelled to simulate its effect on the environment. Computer and physical models were prepared, tested and run for a variety of tidal and fresh water flow conditions. Field surveys to gather physical, chemical and biological information were performed as part of the overall study. The numerical models predicted hydrodynamic and pollutant behavior upstream of the barrage and sedimentation effects downstream. The physical model was used for navigational effects and for identifying problems during the construction phase. Under average conditions, the water quality would not deteriorate significantly and the barrage would not create pollution problems. The extreme conditions examined revealed potential problems due to algal blooms and during sewage works failure, but these were due to an unlikely combination of circumstances rather than as a direct result of the barrage. An increase in estuary sedimentation will occur if the barrage is built, but this will be insignificant in terms of the additional dredging effort required to maintain a navigable shipping channel. (Moore-IVI)
W85-00567

ENVIRONMENTAL EFFECTS OF FLOOD CONTROL IN THE YARE BASIN,
Rendel, Palmer and Tritton, London (England).
H. L. Wakeling.
Water Science and Technology, Vol. 16, No. 3-4, p 477-484, 1984. 3 Fig, 1 Tab, 3 Ref.

Descriptors: *Flood control, *Environmental effects, *Yare Basin, *England, Water pollution sources, Land use, Marshes, Groundwater levels, Eutrophication, Drainage, Cultivated lands.

The lower Yare basin (England) includes all the lowland areas of the rivers subject to tidal influence lying roughly within a circle of approximately 20 km radius centered upon Great Yarmouth. This area covers some 22,000 ha and encompasses a region known as The Broads, an area of scenic beauty. The lower Yare Basin has been subject to serious flooding caused by storm surges in the North Sea and by fluvial floods. The primary economic justification for flood prevention was found to arise from the conversion of poor quality marsh grazing land to arable or improved pasture once the risk of saline flooding was removed. The changes in land use in areas protected from flooding would have the following effects: a reduction in groundwater levels as a result of the improved drainage necessary for arable cultivation; enhanced use of fertilizers and possible herbicides which would result in the release of N from the soil to the drainage ditches; and water pumped from the drainage ditches into the rivers would exacerbate the eutrophication of the rivers. It must be remembered the the lower Yare Basin has been subject to considerable change through the influence of man during the past centuries. There is no natural landscape - only a continually evolving one. The question now is whether to stop this evolution, or to accept further development. (Moore-IVI)
W85-00568

IMPACT AND MITIGATION OF MAN-MADE CANALS IN COASTAL LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. E. Turner, K. L. McKee, W. B. Sikora, J. P. Sikora, and I. A. Mendelssohn.
Water Science and Technology, Vol. 16, No. 3-4, p 497-504, 1984. 3 Fig, 27 Ref.

Descriptors: *Canals, *Environmental effects, *Louisiana, Wetlands, Hydrology Saline water intrusion, Fisheries, Land loss, Construction, Overland flow, Soil compaction, Coastal areas.

Coastal landloss in the sedimentary deltaic plain of southern Louisiana is 0.8% annually and is rising geometrically with time. Landloss is directly correlated with man-made features, particularly canals. The local and indirect effects of canals are modified by the deltaic substrate, distance to the coast, and availability of new sediments. The local impacts are similar to those observed for mosquito ditching along the eastern Atlantic seaboard, even though the canals are typically 10 times larger than mosquito ditches. Some cumulative impacts of land losses are increased saltwater intrusion, loss of the capacity to buffer the impact of storms and fertilizers and diminished fisheries. The mechanism for the role of coastal engineering, particularly canal construction, probably involves an alteration in wetland hydrology, but a more complete understanding is presently lacking. Principles for modifying present canal construction projects are presented and include the rationale for: maintaining natural subsurface and overland waterflow patterns, reducing compaction by spoil banks, backfilling canals no longer needed, and the greater use of existing canal corridors in lieu of new canal construction. (Author's abstract)
W85-00569

ECO-ENGINEERING ASPECTS OF THE HEATED WATER DISPOSAL IN THE BLACK SEA,
Institutul Politechnic din Bucuresti (Romania). Dept. of Energetics.
For primary bibliographic entry see Field 5C.
W85-00570

TWO DIMENSIONAL WATER QUALITY MODEL APPLICATION FOR HONG KONG COASTAL WATERS,
Waterloopkundig Lab., Delft (Netherlands).
L. Postma.
Water Science and Technology, Vol. 16, No. 3-4, p 643-652, 1984. 8 Fig, 3 Tab, 7 Ref.

Descriptors: *Hong Kong, *Water quality, *Coastal waters, Mathematical models, Nitrogen, Phosphorus, Wastewater pollution, Coliforms, Biochemical oxygen demand, Dissolved oxygen.

Water quality modelling is presented as a means of quantification of environmental impacts of civil engineering projects in coastal areas. This is illustrated with an application concerning the operation of a replacement airport for Hong Kong in Lantau Bay. The water movement to be expected, after the planned reclamation, is calculated separately with the two dimensional depth averaged model WAQUA on a minute to minute basis. The multi-dimensional water quality model DELWAQ is implemented in a two dimensional depth averaged way too, with a time step of several minutes. It has been used to calculate concentrations of three nitrogen fractions, phosphorus, BOD, coliforms and oxygen deficit, due to wasteloads to be expected. Also tentative calculations of suspended solids were performed. Results are presented in contour graphs, 3-dimensional drawings and a movie of 3-d drawings. (Author's abstract)
W85-00574

ECOLOGICAL PROBLEMS RELATED TO THE LOIRE ESTUARY DEVELOPMENT,
Laboratoire Central d'Hydraulique de France, Maisons-Alfort.
B. Bellessort, J. M. Caillat, C. Brossard, and J. Bourgouin.
Water Science and Technology, Vol. 16, No. 3-4, p 653-658, 1984. 1 Fig.

Descriptors: *Water resources development, *Environmental effects, *Estuarine environment, *Loire Estuary, Water quality, Benthos, Wetlands, Sedimentation.

Within the framework of the Loire estuary development, the Nantes-Saint-Nazaire Port Authority initiated a set of studies to define compatibility between the possible estuary developments and conservation of living natural environment. The main points to be studied included: hydraulic and sedimentary phenomena in desk, field and model investigations; studies of water quality; and benthos, ichthyological and wet zone studies. Hydraulic and sedimentary studies indicated that the deepening of the channel from -10 m to -13.25 m was found to have little influence on tide propagation. Water levels hardly were modified by the bottom elevation change. It does influence current velocities which are drastically reduced in the deepened area, and consequently the mud deposi are sharply increased. In the lower estuary when with a -10 m channel, deposit values were low, th deepening leads to deposits of 1 to 1.5 m per yea (Baker-IVI)
W85-00575

ENVIRONMENTAL CONFLICTS IN A RAPIDLY GROWING COASTAL ECONOMY: THE CASE OF SOUTH FLORIDA,
Florida State Univ., Tallahassee. Dept. of Urba and Regional Planning.
A. A. Dzurik.
Water Science and Technology, Vol. 16, No. 3-4 p 659-666, 1984. 1 Tab, 13 Ref.

Descriptors: *Coastal engineering, *Florida, *Environmental effects, *Economic aspects, *Construction, Legislation, Wetlands, Estuaries, Power plants, Beaches, Barrier islands, Coastal zone management, Water resources development.

The coastal areas of South Florida contain hundreds of kilometers of beaches, barrier islands estuaries and coastal wetlands; they also hold mos of the state's major centers of population. As South Florida continues to grow rapidly, numerous environmental problems associated with coastal engineering projects must be addressed. In view of the conflicts common to rapidly growing, relatively affluent areas, it is prudent to protect and manage natural coastal and inland resources through environmental planning and engineering to help minimize serious conflicts, alterations, or losses. Environmental laws which are important in Florida include the Environmental Land and Water Management Act, Beach and Shore Preservation Act, and the Power Plant Siting Act. Notable examples of conflicts between development and the coastal environment include: construction on coastal wetlands; water supply requirements of rapid growth; nuclear power plant siting; and protection of beaches and barrier islands. There is a need to need to resolve such conflicts and to balance the requirements of coastal engineering projects with environmental protection. The trade-offs between the economy and the environment will depend on society's evaluation of the need for maintaining viable coastal and inland ecosystems as opposed to further development. (Moore-IVI)
W85-00576

RENEWAL AND USE OF THE MISSISSIPPI RIVER DELTAIC PLAIN,
Coastal Environments, Inc., Baton Rouge, LA.
J. L. van Beek, and S. M. Gagliano.
Water Science and Technology, Vol. 16, No. 3-4, p 699-705, 1984. 3 Fig, 18 Ref.

Descriptors: *Mississippi River, *Louisiana, *Deltas, *Wetlands, Resources management, Coastal zone management, Diversions, Land loss, Economic aspects, Social aspects, Saline water intrusion, Floods.

As a result of human intervention in the natural succession of delta complexes, physical and biological integrity of the Mississippi River deltaic plain is reduced to critical levels as indicated by an annual wetland loss of 100 sq km. Because of dependence of the socioeconomic system on the given natural setting and diversity, the documented acceleration of environmental change will severely affect economic and social conditions within the next century. Effects include flooding, saltwater intrusion, and loss of wetland-based resources. To abate forthcoming losses, a comprehensive resource protection and management plan must be developed and implemented. Such a plan must utilize to the fullest extent possible the Mississippi River resources of water and sediment through diversion and controlled delta building and must provide for protection of a permanent socioeconomic resource base. (Author's abstract)
W85-00579

DEVELOPMENT AND ECODISASTER: A LESSON FROM COCHIN BACKWATER SYSTEM,

ı Univ. (India). School of Environmental
.
ımary bibliographic entry see Field 5C.
0580

ICAL AND HYDROLOGIC ENVIRON-
'S OF THE MULBERRY COAL RE-
ES IN EASTERN KANSAS,
gical Survey, Lawrence, KS. Water Re-
s Div.
enny, H. E. Bevans, and A. M. Diaz.
ble from the OFSS, USGS, Box 25425, Fed.
enver, CO 80225. USGS Water-Resources
gations Report 82-4074, 1982. 50 p, 14 Fig, 6
Ref.

ptors: *Water quality, Coal mining, *Strip
Environment, Surface water, Groundwater,
logy, *Kansas, Mulberry Coal reserves,
des Cygnes River, Little Osage River,
Sugar Creek.

ble reserves of Mulberry coal underlie an
approximately 300 square miles of Miami,
and Bourbon Counties of eastern Kansas.
gh subject to State reclamation law, current
ojected strip mining of this relatively thin
am could alter and hydrologic environment
study area. Drained by the Marais des
s and Little Osage Rivers and their tributar-
s area is characterized by low relief and
ately impermeable soils. Streamflows are
sustained by ground-water discharge and
te widely due to climatic extremes and
f surface-water supplies. Because ground-
supplies are generally unreliable in quantity
ality, surface water is used to meet most
requirements in the study area. Primary used
ce waters are for domestic supplies, mainte-
f wildlife and recreational areas, and cool-
ds at LaCygne Power Plant. The prevailing
al type of the natural streamflow is calcium
nate, with concentrations of dissolved
generally less than 500 milligrams per liter
I near neutral. Additional streamflow and
quality data are needed to evaluate the pre-
characteristics of and the anticipated
s in the hydrologic environment as strip
proceeds within the study area. A network
-collection stations and a sampling scheme
een established to acquire this additional
ation. (USGS)
0595

TIGATION OF THE CARRYING CA-
Y OF THE MONOCACY RIVER AS A
C AND RECREATIONAL RESOURCE,
ME II. CHARACTERISTICS AND IN-
RETATIONS OF SELECTED SOCIAL
ENVIRONMENTAL CONSIDERATIONS
RTANT TO THE MONOCACY RIVER,
nd Univ., College Park. Dept. of Recrea-

Kuss, R. W. Kauffman, I. R. Hunter, M.
ey, and J. M. Morgan.
Resources Research Center Publication No.
cember 1982. 159 p, 10 Fig, 48 Tab, 6 Ref, 2
d. Project No. OWRT A-041-MD (2), Con-
Grant No. 14-34-0001-2122.

ptors: River basin development, River sys-
Rivers, Watersheds, Recreation, Boating,
, *Recreation demand, Stream fisheries, Ri-
land, *Riparian rights, Wildlife habitats,
g, *Surveys, *Maryland, *Monocacy River,
c river, *Carrying capacity.

onocacy River Valley of central Maryland
gnized as a significant cultural and historic
ce of national importance, and was designat-
scenic river by the state in 1977. This study
es the existing physical, biological and cul-
esouces of the river and valley; how differ-
ments of the public view the system and its
vation; makes an assessment of future de-
for river-oriented recreation in the counties
h which the river courses; and recommends
eptual plan for the preservation of the river
or. Findings reported in Volume II indicate
ne recreational potential of the system is
y restricted due to water pollution emanat-
ing from erosion and animal wastes. These conditions impose severe stress on what was an excellent warm water fishery. Strong support was given by riparian and non-riparian taxpayers toward converting the corridor to wildlife protection. Little support was expressed by the riparian landowners toward encouraging future recreational development. Primary problems centered on trespass, littering, vandalism, and hunting--problems also recognized by recreation users and non-riparian taxpayers as deterrents to further development of the system as a recreational resource.
W85-00606

INVESTIGATION OF THE CARRYING CAPACITY OF THE MONOCACY RIVER AS A SCENIC AND RECREATIONAL RESOURCE, VOLUME I. MARYLAND SCENIC RIVERS: THE MONOCACY RESOURCE SUMMARY REPORT,
Ionics, Inc., Watertown, MA.
F. R. Kuss, and I. H. Ballard.
Water Resources Research Center Publication No. 67, December 1982. 151 p, 19 Fig, 28 Tab, 14 Ref, 1 Append. Project No. OWRT-A-041-MD (1), Contract/Grant No. 14-34-0001-2122.

Descriptors: *River basin development, River systems, Rivers, Watersheds, Scenery, Geography, Geological surveys, Geomorphology, Ecosystems, *Soil profiles, Soil surveys, Soil types, Fish, Bass, *Stream fisheries, Water quality, Agricultural watersheds, *Stream pollution, *Maryland, Piedmont, *Monocacy River, *Carrying capacity, *Scenic river, *Recreation demand.

The Monocacy River Valley of central Maryland is recognized as a significant cultural and historic resource of national importance, and was designated as a scenic river by the state in 1977. This study describes the existing physical, biological, and cultural resources of the river and valley; how different segments for the public view the system and its preservation; makes an assessment of future demands for river-oriented recreation in the counties through which the river courses; and recommends a conceptual plan for the preservation of the river corridor. The first part of the study (Volume I) describes the physical geography of the Monocacy watershed, geomorphic characteristics of the river system, and characterizes the biologic communities associated with the river system. The Monocacy River Valley is primarily agricultural and is mostly in private ownership. It is located in the Piedmont Province of Maryland. Soils in the area are mostly stony or steep, shallow soils of mountain areas, and soils of colluvial foot slopes. Extensive data on the water quality of the Monocacy River system are presented. The biological communities in the watershed are undiversified because of the undiversified nature of the agricultural area through which it flows. The River is one of the nation's best smallmouth bass fisheries.
W85-00607

BRIEF STATEMENT ON THE HYDROLOGY OF THE SAMPIT RIVER AREA NEAR GEORGETOWN, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-00620

SOUTHERN INDIAN LAKE IMPOUNDMENT AND CHURCHILL RIVER DIVERSION,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
R. W. Newbury, G. K. McCullough, and R. E. Hecky.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 4, p 548-557, April, 1984. 7 Fig, 6 Tab, 11 Ref.

Descriptors: *Southern Indian Lake, *Churchill River Diversion, *Manitoba, *Environmental effects, Postimpoundment, Dam effects, Permafrost, Erosion, Shores, Water circulation, Water exchange, Diversion structures, Backshores, Lake shores.

The 242 000-sq km Churchill River basin extends across the northern half of Alberta, Saskatchewan, and Manitoba. In 1976, hydraulic control structures were completed to divert 75% of the natural river flow of 958 cu m/s across the drainage divide separating the Churchill and Nelson river basins in northern Manitoba. The diversion flows follow 300 km of tributary valleys southward to the Nelson River channel where a 30-yr, 10 000 MW hydroelectric scheme is being developed. The diversion was accomplished by damming the northern outlet of Southern Indian Lake, a 1977-sq km riverine lake on the Churchill channel (latitude 57 degrees N, longitude 99 degrees W). The dam caused a 3-m impoundment above the historical lake levels, which flooded 414 sq km of the backshore zone. Permafrost, or permanently frozen ground, is widespread in the uplands surrounding the lake. As bedrock occurred on only 14% of the postimpoundment shoreline, severe erosion of the frozen backshore deposits is now underway. A long period of instability is anticipated on lake shorelines and in river valleys affected by the altered hydraulic regime. Although the whole-lake water exchange time was increased by only 41% by the impoundment, the circulation patterns and exchange times in individual basins of the lake were changed dramatically when the Churchill waters were diverted at the southern end of the lake. The effects of the changing regimes on the aquatic habitats and fisheries of Southern Indian Lake have been investigated in pre- and post-impoundment studies undertaken by the Freshwater Institute of the Department of Fisheries and Oceans. (Author's abstract)
W85-00631

SHORELINE EROSION AND RESTABILIZATION IN THE SOUTHERN INDIAN LAKE RESERVOIR,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
R. W. Newbury, and G. K. McCullough.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 4, p 558-566, April, 1984. 9 Fig, 4 Tab, 13 Ref.

Descriptors: *Shores, *Erosion, *Restabilization, *Southern Indian Lake, *Manitoba, Permafrost, Melting, Lake shores, Undercutting, Wave action, Flooding, Environmental effects, Dam effects, Backshore, Reservoirs, Postimpoundment.

Prior to a 3-m impoundment in 1976, bedrock comprised 76% of the shoreline of Southern Indian Lake in northern Manitoba. This was reduced to only 14% of the shoreline as the water level rose above the wavewashed zone and flooded into the predominantly fine-grained, frozen overburden materials. Twenty monitoring sites were surveyed annually to determine rates of permafrost melting and solifluction and shoreline erosion. The sequence of shoreline erosion in permafrost materials was found to be cyclic, consisting of melting and undercutting of the backshore zone, massive faulting of the overhanging shoreline, and removal of the melting and fractured debris. Rates of shoreline erosion varied widely, depending on the exposure of the site to wave action and the composition of the backshore materials. At sites in fine-grained frozen silts and clays, representative of over three quarters of the postimpoundment shoreline, rates of retreat of up to 12 m/yr were observed. The total volume of shoreline materials removed varied from less than 1 to over 23 cu m/m shoreline length/yr. Clearing the forested backshore prior to flooding did not affect the erosion rates. The index of erosion based on the hindcast wave energy component perpendicular to the shoreline was 0.00035 cu m/t-m wave energy (0.036 cu m/MJ). The minimum period of restabilization of the shoreline based on the volume of backshore materials that must be eroded before bedrock conditions are reestablished was estimated to be 35 yr for three quarters of the shoreline surrounding the lake. (Author's abstract)
W85-00632

EFFECT OF IMPOUNDMENT AND DIVERSION ON THE SEDIMENT BUDGET AND

NEARSHORE SEDIMENTATION OF SOUTHERN INDIAN LAKE,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Western Region.
R. E. Hecky, and G. K. McCullough.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 4, p 567-578, April, 1984. 9 Fig, 9 Tab, 25 Ref.

Descriptors: *Southern Indian Lake, *Manitoba, *Dam effects, *Diversion, *Sedimentation, Environmental effects, Shores, Erosion, Clay, Bedload, Suspended sediments, Sediment budget, Lake shores, Reservoirs, Postimpoundment.

Shoreline erosion added an annual average of 4,000,000 t of mineral sediment per year to Southern Indian Lake (postimpoundment area, 2391 sq km) during the first 3 yr of impoundment. This erosion increased sedimentary input to the lake by a factor of 20. The lake retained 90% of this eroded material within its basin, and 80-90% of the retained material was deposited nearshore. Despite the production of extremely fine constituent particle sizes, eroding shorelines generated predominantly large clay aggregates, initially transported offshore as bed load. During bed load transport, abrasion of clay aggregates produced fine particles that became suspended. Over 80% of the suspended load is lost to outflows from the lake because the suspended load is primarily fine silt and clay-sized particles, most of which do not settle even under winter ice cover. The extensive nearshore clay aggregate deposits are temporary, and net deposition in these areas will change to net erosion when input of sediment from eroding shorelines ceases. The effects of shoreline erosion on the lake's sediment regime will persist for decades. (Author's abstract)
W85-00633

THERMAL AND OPTICAL CHARACTERISTICS OF SOUTHERN INDIAN LAKE BEFORE, DURING AND AFTER IMPOUNDMENT AND CHURCHILL RIVER DIVERSION,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Western Region.
R. E. Hecky.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 4, p 579-590, April, 1984. 8 Fig, 6 Tab, 24 Ref.

Descriptors: *Southern Indian Lake, *Manitoba, *Churchill River Diversion, *Dam effects, Environmental effects, Water temperature, Transparency, Light scattering, Light extinction, Suspended solids, Water depth, Optical properties, Reservoirs, Postimpoundment.

In 1976 Southern Indian Lake, a large, shallow, multibasin lake on the Churchill River in northern Manitoba, was impounded. The mean annual water level was raised 3 m over the historic mean level to divert 875 cu m/s by gravity flow from the lake into the Nelson River drainage. Five years of observation beginning 2 yr before the year of impoundment and continuing for 2 yr after impoundment indicate that lake temperatures, light available for photosynthesis, and Secchi disk transparencies have all declined. Increased mean depths, loss of riverine heat input because of diversion, and radiative losses because of back-scattering from increased concentrations of suspended solids have caused a significant 1-2 degrees C cooling of the different basins of the lake and increased the natural south to north temperature gradient during the lake's heating period. Winter temperatures also decreased significantly in South Bay, the point of diversion, because of increased inflow from a cooler region. Increases in light scattering caused by higher concentrations of suspended solids derived from shoreline erosion accounted for the most significant changes in vertical extinction coefficients and Secchi disk depths. Increased extinction of light and increased mean depth significantly reduced the mean water column light intensity of the mixed layer. These changes in the thermal and optical characteristics after impoundment occurred concurrently with significant changes in the impoundment's biological communities. (Author's abstract)
W85-00634

PRIMARY PRODUCTIVITY OF SOUTHERN INDIAN LAKE BEFORE, DURING, AND AFTER IMPOUNDMENT AND CHURCHILL RIVER DIVERSION,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Western Region.
R. E. Hecky, and S. J. Guildford.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 4, p 591-604, April, 1984. 7 Fig, 4 Tab, 45 Ref.

Descriptors: *Southern Indian Lake, *Churchill River Diversion, *Manitoba, *Primary productivity, Chlorophyll, Dam effects, Environmental effects, Light penetration, Turbidity, Suspended sediments, Phytoplankton, Reservoirs, Postimpoundment.

The primary productivity of seven regions of Southern Indian Lake and neighboring Wood Lake was measured during open-water seasons from 1974 to 1978. The lake had regional differences in chlorophyll concentrations and daily rates of integral primary production in 1974 and 1975 prior to impoundment of the lake. Regions receiving Churchill River flow tended to have higher chlorophyll concentrations and production rates than those regions marginal to the flow. Impoundment of the lake resulted in higher efficiencies of primary production in all regions, as indicated by higher light-saturated rates of carbon uptake per unit chlorophyll and by higher initial slopes of the hyperbolic light response relation of the phytoplankton. Many large basins of the lake had light penetration reduced by high concentrations of suspended sediment from eroding shorelines, while other areas had relatively unchanged light penetration. The increased efficiency of carbon fixation per unit chlorophyll resulted in higher rates of integral production in those regions where light penetration was not greatly affected. Daily rates of integral primary production in lake regions where light penetration had decreased markedly were not significantly different after impoundment because efficiencies of light utilization were higher. Comparison of the mean water column light intensities for those turbid regions with the values of I sub k (light intensity at the onset of light saturation) for phytoplankton indicated that these turbid regions are now light deficient on average. Phosphorus deficiency, as indicated by alkaline phosphatase activity per unit ATP, which was present before impoundment, has been eliminated as the mean water column light intensity declined below 5 mEinsteins/sq m/min. The light environment of a new reservoir can be a significant determinant of integral production, and predicting the consequences of impoundment on phytoplankton production requires accurate prediction of the light environment. (Author's abstract)
W85-00635

EFFECTS OF IMPOUNDMENT AND DIVERSION ON THE CRUSTACEAN PLANKTON OF SOUTHERN INDIAN LAKE,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
K. Patalas, and A. Salki.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 4, p 613-637, April, 1984. 31 Fig, 3 Tab, 33 Ref.

Descriptors: *Southern Indian Lake, *Manitoba, *Crustaceans, *Dam effects, *Diversion, Environmental effects, Copepods, Cladocera, Zooplankton, Species composition, Water temperature, Reservoirs, Postimpoundment.

The midsummer zooplankton communities in Southern Indian Lake were studied in six sampling surveys: one preimpoundment collection (1972), one collection when water levels exceeded the long-term high (1975), and four postimpoundment surveys (1977, 1978, 1979, 1980). In 1972, the crustacean plankton fauna of Southern Indian Lake was composed mainly of 15 copepod and 15 cladoceran species. At least 25 of these species were truly pelagic, while 5 were littoral. Cyclopoids comprised 46% of total crustacean abundance, calanoids 33%, and cladocerans 21%. Total abundance averaged 76 individuals (ind)/L, comparable to more southerly waters. Total crustacean abundances varied from 10 ind/L near the Chu
River inflow to between 100 and 200 ind/L
few well protected areas. From 50 to 100
occurred within the main body of Southern I
Lake. In 1975, an unusually high water year
mean plankton abundance was 61 ind/L. Fo
ing diversion in 1976, no dramatic changes i
cies composition were observed. The mean
dance of crustaceans decreased to 40-46
during the period 1977-80. No significant ch
occurred in areas adjacent to the Churchill
inflow, with pre- and post-diversion densities
35 and 36 ind/L, respectively. In the main
bodies north of the diversion route, abund
declined by 60% and biomass by 50%. A
degrees C drop in northern basin water tem
tures, related to diversion, reduced growth
by approximately 20% and resulted in 60% de
in crustacean production. Lakewide average
bers of cladocerans declined from 16 to 4 i
and the area of their distribution was red
particularly in northern regions of the lake fo
ing impoundment. Cyclopoids declined from
16 ind/L but showed no change in their dis
tion. The mean abundance of calanoids as a g
did not change, but the abundance and distrib
of individual species were variably alt
(Moore-IVI)
W85-00637

**BREAKDOWN OF CONIFER NEEDLE DE
IN A NEW NORTHERN RESERVOIR, SOU
ERN INDIAN LAKE, MANITOBA,**
Manitoba Univ., Winnipeg. DEpt. of Entomo
For primary bibliographic entry see Field 2H.
W85-00639

**INCREASES IN FISH MERCURY LEVELS
LAKES FLOODED BY THE CHURCH
RIVER DIVERSION, NORTHERN MANITO**
Department of Fisheries and Oceans, Winn
(Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5B.
W85-00640

**COLLAPSE OF THE LAKE WHITEFISH (C
EGONUS CLUPEAFORMIS) FISHERY
SOUTHERN INDIAN LAKE, MANITO
FOLLOWING LAKE IMPOUNDMENT A
RIVER DIVERSION,**
Department of Fisheries and Oceans, Winn
(Manitoba). Freshwater Inst.
R. A. Bodaly, T. W. D. Johnson, R. J. P. Fudg
and J. W. Clayton.
Canadian Journal of Fisheries and Aquatic Sci
es, Vol. 41, No. 4, p 692-700, April, 1984. 4 F
Tab, 22 Ref.

Descriptors: *Whitefish, *Southern Indian L
*Manitoba, *Churchill River Diversion, Lake
eries, Dam effects, Environmental effects, P
sites, Commercial fishing, Postimpoundment.

The lake whitefish (Coregonus clupeaformis)
ery of Southern Indian Lake (SIL) has underg
a general collapse since lake impoundment
Churchill River diversion in 1976. The fishery
substantial from its inception in 1941, with a m
annual whitefish catch of 333 500 kg over th
decades prior to lake impoundment. The white
catch prior to impoundment was composed alm
exclusively (> 99%) of light colored, export
quality fish that were only lightly parasitized v
the muscle cysts of Triaenophorus crassus.
market quality of the catch was maintained
selective fishing of certain lake basins and avoi
areas of the lake that were known to prod
lower quality fish. Catch per unit of effort
traditional fishing grounds declined soon after
poundment to about one-half preflooding lev
Total catches were maintained at or near pre
poundment levels by major increases in total ef
until 1982, when the whitefish catch fell to ab
one third of its preimpoundment mean. Fisher
also responded to declines in catch per unit
effort on traditional fishing grounds with a ma
geographic shift of effort into areas forme
avoided. As a result, darker colored, continen
(B) quality whitefish comprised from 12 to 72%

ummer catch in the 4 yr following impound-
. Dark whitefish are less marketable because
olor and because of higher rates of Triaeno-
is infestation. The mean Triaenophorus cyst
t in shipments has increased markedly since
undment and the lake was reclassified from
rt (A) to continential (B) classification in 1982.
n declines on traditional fishing grounds ap-
tly reflect the emigration of fish to other SIL
s and/or to adjoining water bodies. Prior to
impoundment, there were significant differ-
in glycerol-3-phosphate dehydrogenase allele
encies from whitefish samples taken from four
s of SIL and an adjacent unconnected lake,
hese differences were absent after impound-
It is hypothesized that these stock redistribu-
were triggered by physical changes in SIL
lake impoundment. (Author's abstract)
00641

**TIMPOUNDMENT WINTER SEDIMEN-
ON AND SURVIVAL OF LAKE WHITE-
(COREGONUS CLUPEAFORMIS) EGGS
OUTHERN INDIAN LAKE, MANITOBA,**
rtment of Fisheries and Oceans, Winnipeg
toba). Freshwater Inst.
P. Fudge, and R. A. Bodaly.
lian Journal of Fisheries and Aquatic Scienc-
ol. 41, No. 4, p 701-705, April, 1984. 3 Fig, 2
19 Ref.

iptors: *Southern Indian Lake, *Manitoba,
mpoundment, *Whitefish, *Fish eggs, *Sedi-
tion, Flooding, Dam effects, Environmental
s, Wave erosion, Suspended sediments,
ning.

ing of Southern Indian Lake for hydroelec-
ower development has resulted in extensive
erosion of glacio-lacustrine clay shore mate-
nd greatly increased suspended sediment
Winter sedimentation on spawning grounds
e whitefish (Coregonus clupeaformis) ranged
0.03 to 0.14 g dry wt sediment/cm. This
ited a layer 1-4 mm in depth. The sediment,
n organic content, was categorized as silty
The effect of this winter sedimentation on
al of whitefish eggs was tested at four sites
a range of winter sedimentation rates. Three
sites were whitefish spawning areas. Egg
al was significantly higher for eggs incubat-
cages designed to minimize exposure to sedi-
tion compared with survival in cages allow-
ll exposure to sedimentation. Winter sedi-
tion rates and whitefish egg survival were
vely correlated for cages designed to mini-
xposure to sedimentation, while egg survival
exposed cages was uniformly low. (Author's
ct)
00642

**ONSE OF A BOREAL NORTHERN PIKE
X LUCIUS) POPULATION TO LAKE IM-
NDMENT: WUPAW BAY, SOUTHERN
AN LAKE, MANITOBA,**
tment of Fisheries and Oceans, Winnipeg
toba). Freshwater Inst.
Bodaly, and L. F. W. Lesack.
ian Journal of Fisheries and Aquatic Scienc-
l. 41, No. 4, p 706-714, April, 1984. 7 Fig, 3
5 Ref.

iptors: *Pike, *Postimpoundment, *Wupaw
Southern Indian Bay, *Manitoba, Reproduc-
Environmental effects, Flooding, Growth,
od, Invertebrates, Water temperature.

ulation of northern pike (Esox lucius) in
w Bay, Southern Indian Lake, Manitoba,
onitored for 1 yr prior to impoundment of
e and for 5 yr after impoundment. Impound-
ad a pronounced but transient effect on pike
uctive success. The abundance of young-of-
ar pike in 1977, the 1st yr following im-
ment, was 4-10 times higher than in the
ing 3 yr. Flooded terrestrial vegetation was
ntly conducive to pike reproductive success
n the 1st yr after inundation. A strong 1977
lass was evident in gillnet catches 4 yr later.
ear-class was slower growing and in poorer
ion than other year-classes. The impound-
ment of Wupaw Bay had no discernible effect on the growth, condition, or mortality of the adult pike population, with the exception of changes ascribed to the presence of the large 1977 year-class. The growth of the adult pike population appeared to be limited by forage fish abundance, but variations in feeding on fish were largely unexplained and were probably due to natural variation. The year-to-year pattern of forage fish reproductive success could not be related to the timing of lake impoundment, but may have been related to summer water temperatures. Variations in feeding on invertebrates appeared to be due to postimpoundment increases in productivity, but these changes were insufficient to affect population parameters. Wupaw Bay surface area increased by only 9% as a result of lake impoundment, the smallest areal increase in the Southern Indian Lake reservoir. The influx of nutrients and flooded terrestrial vegetation was therefore much smaller than in other temperate reservoirs where increases in pike production have been observed. (Author's abstract)
W85-00643

POSTIMPOUNDMENT CHANGE IN FINANCIAL PERFORMANCE OF THE SOUTHERN INDIAN LAKE COMMERICAL FISHERY,
Treaty and Aboriginal Rights Research Center of Manitoba, Inc., Winnipeg.
M. W. Wagner.
Canada Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 4, p 715-719, April, 1984. 5 Tab, 6 Ref.

Descriptors: *Commercial fisheries, *Financial performance, *Southern Indian Lake, *Manitoba, *Postimpoundment, Dam effects, Whitefish, Economic aspects, Lake fisheries, Reservoirs.

Southern Indian Lake is located in north-central Manitoba, as part of the Churchill River system. Prior to 1976, Southern Indian Lake supported the largest commercial fishery in northern Manitoba. Commencing in August 1976 the lake was manipulated as part of the hydroelectric development of the Nelson River. Since impoundment, two economic surveys of the summer fishery have been carried out (1977 and 1980). These surveys revealed a decrease in cash flow per fishing enterprise of 66%, from $3362 to $1141 (1980$), so that by 1980 the average enterprise could not meet its capital costs. The reduction in cash flow was mainly attributable to decreased gross revenues, due to decreased catch per unit effort on traditional fishing grounds, an increase in the proportion of lower grade whitefish in the catch, and a decrease in the average number of days spent fishing per enterprise. Consideration of a freight subsidy paid to fishermen further accented the decrease in financial performance. It is projected that by 1981 economic viability had worsened further. Although this study was restricted to an analysis of postimpoundment data, its findings can be extended to the preimpoundment fishery. Any difference between preimpoundment and 1980 financial performance is at least equal to that found in this study. (Moore-IVI)
W85-00644

ENVIRONMENTAL IMPACT PREDICTION AND ASSESSMENT: THE SOUTHERN INDIAN LAKE EXPERIENCE,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
R. E. Hecky, R. W. Newbury, R. A. Bodaly, K. Patalas, and D. M. Rosenberg.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 4, p 720-732, April, 1984. 3 Fig, 2 Tab, 50 Ref.

Descriptors: *Environmental effects, *Prediction, *Southern Indian Lake, *Manitoba, Postimpoundment, Preimpoundment, Limnology, Reservoirs, Commercial fisheries, Dam effects, Churchill River Diversion.

The impoundment of Southern Indian Lake (SIL) and diversion from the lake of the Churchill River in northern Manitoba, Canada, were the subjects of two independent environmental impact statements. Subsequently, a case study measured change in the limnological and biological characteristics of the lake after development. Comparison of pre- and post-impoundment observations allows an assessment of the predictive capability that was applied to the lake by the preimpact statements. Predictions related to the physical environment, e.g. increased shoreline erosion, littoral sedimentation, higher turbidity, and decreased light penetration and visibility, were qualitatively correct; however, an unpredicted decrease in water temperature also occurred. Increase phosphorus availability and light limitation of primary production were also correctly forecasted in a qualitative manner. These aspects will be quantitatively predictable in future reservoirs because of studies at SIL and elsewhere. Biological responses above the primary trophic level were mostly not predicted or predicted incorrectly. Unpredicted changes that were especially significant to the fishery were rapid declines in the quantity and quality of whitefish (Coregonus clupeaformis) catch, increases in mercury concentrations in fish, and the need for extensive compensation programs to keep the fishery economically viable. Testable hypotheses to explain all unpredicted events have been formulated but require experimental verification. The paradigm of reservoir ecosystem development that is present in the literature requires reformulation if future environmental impact analyses of reservoirs are to be improved. (Author's abstract)
W85-00645

TO PREVENT ARIDIZATION, COMBAT SALINITY,
Moscow State Univ. (USSR). Dept. of Pedology.
V. A. Kovda.
Environmental Conservation, Vol. 9, No. 4, p 323-327, Winter, 1984. 13 Ref.

Descriptors: *Salinity, *Aridization, Deserts, Australia, Water resources development, Irrigation effects, Environmental effects, Desertification, Water management.

With some 8% of the world's land surface covered by absolute desert, and up to another 40% estimated to be covered or threatened by less extreme deserts or semideserts, it is clear that still increasing desertification imposes one of the most critical situations and hence important considerations for the future. Aridization and the more advanced stage of desertification of land result from the combined action of natural tendencies and ecological mistakes made by man in the course of his activities. The speed of the change can mean that in the space of one generation, useable land is turned into a desert area. While the widespread establishment of irrigation systems involving some 250 million hectares may help the situation in general, there are also very serious problems engendered by continuing irrigation, which is apt to be wasteful of fresh water. River water resources are becoming increasingly limited and artesian waters are too easily depleted or become brackish. With the high rate of evaporation in arid regions, salinization of the surface and uppermost soil horizon commonly ensues, and gradually penetrates to lower strata in which plants mainly root. Most existing irrigation systems lack the piping or consistent linking of water-bringing canals and the deep horizontal drainage ducts that are needed to evacuate excessive soluble salts. The ultimate disposal of the salt moreover, still causes problems when the sea cannot be used or salt-lakes be created for fish and waterfowl. Revegetation is becoming more and more widely practiced and some success is attending efforts to develop salt resistant crops in the United States, India, and Russia. (Baker-IVI)
W85-00646

ASSESSMENT OF URBAN DEVELOPMENT INTO COASTAL WETLANDS USING HISTORICAL AERIAL PHOTOGRAPHY: A CASE STUDY,
Wisconsin Univ.-Green Bay. Dept. of Regional Analysis.
W. R. Niedzwiedz, and S. S. Batie.

Environmental Management, Vol. 8, No. 3, p 205-214, May, 1984. 2 Fig, 6 Tab, 17 Ref.

Descriptors: *Wetlands, *Land use, *Environmental effects, *Virginia, *Accomack County, *Virginia Beach, *Urban development, Water resources development, Aerial photography, History, Salt marshes.

Virginia passed legislation to protect coastal wetlands with only limited information on the rate and location of past wetlands conversions. This information can be useful in the design of cost effective and flexible programs for wetlands management, particularly when such information is used in combination with studies of the socioeconomic values of wetlands. Photogrammetric and interpretive methods have been used to determine historical changes in wetlands use for Virginia Beach and Accomack counties in Virginia. These two study areas were chosen as they were representative of the main classifications of coastal counties: rural and urban. Aerial photographs were obtained of each area. Similar photographs were available for 1949, 1958, 1971 and 1974. In Virginia Beach a net change of all types of coastal wetlands acreage was a decrease of 384 acres from the original 1949 total of 9184. If only saltwater wetlands are considered, the change was a decrease of 882 acres from the 1949 total of 7557 acres. This is a percentage change of -11.7%. The predominant cause for change was urban associated - medium and light density residential uses, which accounted for the majority of wetlands conversions. Accomack County has experienced few changes in wetlands compared with the urbanized area of Virginia Beach. Accomack County's salt marshes and mudflats increased by 1% or 572 acres. The major development uses of altered wetlands were light density residential land. (Baker-IVI)
W85-00648

RELATION BETWEEN TROPICAL RIVERS AND THE TERRESTRIAL ENVIRONMENT AND THE EFFECT ON BOTH OF HUMAN INTERFERENCE (TROPISCHE FLUSSE IN IHREN BEZIEHUNGEN ZUR TERRESTRISCHEN UMGEBUNG UND IM HINBLICK AUF MENSCHLICHE EINGRIFFE),
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
H. Sioli.
Archiv fur Hydrobiologie, Vol. 95, No. 1/4, p 463-485, 1982. 9 Fig, 1 Tab, 30 Ref.

Descriptors: *Tropical rivers, *Human interference, *South America, *Land development, River basin development, Deforestation, Ecosystems, Diversity, Dams.

Rivers are renal systems of their catchment basins. Tropical rivers differ from those of higher latitudes by their more or less constant temperature over the course of the year; in the equatorial lowlands their water is warm, too. In the humid tropics, human interferences, for 'development' purposes, in the landscapes and the rivers have increased tremendously in the last decade. Deforestation, practiced on an extensive scale in all humid tropics, is disastrous not only for the directly affected terrestrial ecosystems but also for the rivers of those areas. The construction of dams in the great tropical river systems is nowadays equally in vogue, especially in South America. The most incisive and inevitable consequences of such interferences are described. Most deplorable is the annihilation of the diversity of life-forms which is highest in the humid tropics, since it runs counter to the basic principle of life and irreparably reduces the evolutionary genetic potential on earth. (Author's abstract)
W85-00775

MACROINVERTEBRATE ASSEMBLAGES IN CHANNELIZED AND UNCHANNELIZED SECTIONS OF THE BUNYIP RIVER, VICTORIA,
James Cook Univ. of North Queensland, Townsville (Australia). School of Biological Sciences.
K. G. Hortle, and P. S. Lake.
Australian Journal of Marine and Freshwater Research, Vol. 33, No. 6, p 1071-1082, 1982. 3 Fig, 4 Tab, 38 Ref.

Descriptors: *Bunyip River, *Victoria, *Australia, *Invertebrates, *Channeling, *Ecological effects, Physicochemical properties, Particle size, Detritus, Algae, Species diversity, Principle component analysis, Substrates.

The macroinvertebrate fauna of channelized and unchannelized sections of the Bunyip River in southern Victoria was investigated in 1979. There were no significant differences in the physicochemical characteristics of the water between the two sections. The three sites in the channelized section were deeper and narrower than the three sites in the unchannelized section. Two of the sites in the channelized section had significantly lower mean particle size and the most stable substratum. The amount of detritus and amount of algae did not differ significantly between sites. There were no significant and consistent differences in species richness, density and standing crop of macroinvertebrates between sites. A difference in the faunal composition of the sites was clearly evident in autumn only, but differences in diversity (H') and evenness (J') between sites were not consistent. The most important factor affecting density, standing crop and species richness on the basis of principal component analysis was substratum stability which, if decreased by channelization, is likely to reduce the abundance and species richness of resident macroinvertebrate assemblages. (Author's abstract)
W85-00788

EFFECTS OF WINTER HARVEST ON WATER AND SEDIMENT CHEMISTRY IN A STAND OF REED (PHRAGMITES AUSTRALIS),
Lund Univ. (Sweden). Limnological Inst.
L.-A. Hansson, and W. Graneli.
Hydrobiologia, Vol. 112, No. 2, p 131-136, May, 1984. 7 Fig, 3 Tab, 9 Ref.

Descriptors: *Sweden, *Lake Takern, *Reeds, *Water chemistry, *Sediment chemistry, Dissolved oxygen, Redox potential, Water temperature, Ammonium, Nitrate, Nitrite, Phosphorus, Litter, Mineralization.

Dry reed culms are mechanically harvested from lakes in Sweden during the period of ice cover; during this process, rhizomes and dormant bud shoots are not damaged. During late autumn, leaves, which make up about 25% of the reed biomass are shed and added to the sediment surface; during the February harvest, less than or ½ half of the previous years above ground production is removed. The effects of this harvest on water and sediment chemistry was studied in a shallow lake, Lake Takern, S. Sweden, dominated by closed, monospecific stands of Phragmites australis. The oxygen concentration and redox potential in the water, as well as temperature, showed regular diurnal fluctuations inside the reed stands. Ammonium and nitrate + nitrite did not exhibit diurnal fluctuations and differences between a harvested and unharvested reed area were small. Molybdate reactive phosphorus (MRP) concentration was higher in the unharvested area. Because the winter harvest caused an almost doubling of shoot production compared to the unharvested area, net addition of reed litter (leaves, stubble and culms) to the sediment of the harvested area was similar to that of the unharvested area. Removal of reed culms in winter has the largest effect on microclimate in spring, and the rate of mineralization and reducing intensity in the substrate are not immediately affected. Significantly higher summer standing crop of reed after harvest may have caused lower phosphate concentration in the water column and sediment interstitial water. (Collier-IVI)
W85-00794

WETLANDS OF THE NEW JERSEY PINELANDS: VALUES, FUNCTIONS, IMPACTS AND A PROPOSED BUFFER DELINEATION MODEL,
Rutgers - The State Univ., New Brunswick
Center for Coastal and Environmental Studies
C. T. Roman, and R. E. Good.
Final Report, June 1983. 123 p, 5 Fig, 18 Tab
Ref, 3 Append.

Descriptors: *Wetlands, *Model studies, *
use, *Decision making, Protection, Value,
sources management, Vegetation, Soil
Water quality, Flood control, Primary produ
ty, Secondary productivity, Aquatic hal
Wildlife habitats, Fish, Amphibians, *New J
Pinelands.

As mandated by federal and state legislatu
Comprehensive Management Plan (CMP) w
veloped to preserve and protect the unique
essential character of the New Jersey Pinel
designated in 1978 as the country's first Nat
Reserve. This study provides scientific backgr
information supporting the purpose of the C
wetland management program. The authors
pose a buffer delineation model designed to
in determining the minimum site-specific b
width needed to protect the ecological integri
the wetlands from proposed upland developt
Wetlands provide several values and functions
ceived as being beneficial to society and ess
to maintenance of ecosystem quality. Develop
activities that modify the wetland-watershed
drologic regime, that alter surface and ground
er quality, or that impose other detrimental
pacts have degrading effects on the structure
function of Pinelands wetlands and thereby
tribute to the regional loss of society-based
land values. The surface waters of Pinelands
lands and aquatic habitats are characterized by
nutrients, high acidity, and low suspended
ment levels. An evaluation of overall wetland
ity and an assessment of potential impacts pro
a basis for the proposed buffer delineation m
(Fazio-Omniplan)
W85-00813

**AQUATIC ECOLOGY OF THE NEW JER
PINELANDS,**
Lloyd (T.) Associates, Philadelphia, PA.
T. Lloyd, R. W. Hastings, J. White-Reiner, J. F
Arsenault, and C. Arsenault.
Report prepared for the New Jersey Pinel
Commission, February 1980. 102 p, 3 Tab, 105
4 Append.

Descriptors: *Ecology, *Surveys, *Acidic w
*Aquatic populations, *Algae, *Macroph
Aquatic animals, Aquatic plants, Macroinve
brates, Rivers, Fish, Watersheds, Streams, La
Bogs, Watershed management, Land use, W
management, *New Jersey, Pinelands.

This aquatic ecology study is one of the inputs
plan being prepared by the New Jersey Pinela
Commission to protect the Pinelands region.
study investigated life in the streams, lakes,
bogs of the Pinelands National Reserve/Pinela
area, which encompasses more than 2,000 sq
miles in Central and Southern New Jersey. I
concerning aquatic plants and animals were
tained from published and unpublished sources
by searching nearby collections. No field stu
were performed owing to the season and to buc
and time limitations. More than 350 species
algae, 62 species of aquatic macrophytes,
genera of macroinvertebrates, and 91 species
fish have been recorded in Pinelands streams.
tain taxa occur repeatedly in undisturbed strea
These are thought to characterize pristine wat
The unique character of Pinelands communitie
due to a combination of physical, chemical,
biological factors. The most successful species
those capable of tolerating acid waters. Pris
streams are typically acid (pH less than 6.0), lov
nutrients, darkly stained, and sluggish. The inv
tory identified four watersheds or portions of
tersheds that support characteristic Pinelands c
munities and therefore warrant protection. Twe
others should be investigated more thoroughly.
ensure the preservation of Pinelands aquatic c
munities, stringent land and water managem
measures are recommended. (Fazio-Omniplan)
W85-00814

ELANDS COMMISSION, NEW JERSEY, ROGEOLOGY ASSESSMENT.
ghty and Miller, Inc., Syosset, NY.
primary bibliographic entry see Field 5G.
-00815

PHIDE POOL AND LAKE MORRISON, ROMICTIC LAKES OF SOUTH-WEST TAS-NIA,
ania Univ., Hobart (Australia). Dept. of ny.
primary bibliographic entry see Field 2H.
-00871

UARINE DEVELOPMENT OF A REGU-ED RIVER IN A SUB-BOREAL CLIMATE: OUTARDES RIVER (NORTH COAST OF ST. LAWRENCE GULF, QUEBEC) (EVO-ION ESTUARIENNE D'UNE RIVIERE RE-ARISEE EN CLIMAT SUB-BOREAL: LA ERE AUX OUTARDES (COTE NORD DU FE DU ST-LAURENT, QUEBEC)),
t National de la Recherche Scientifique, Ri-ki (Quebec). Centre d'Oceanologia.
primary bibliographic entry see Field 2J.
-00956

ER RESOURCES DEVELOPMENT AND AGEMENT PLANS; PART 5: LEINE T PROJECT, OBJECTIVES OF NATURE SERVATION AS ECOLOGICAL VALU-N COMPASS FOR THE RIVERS OF THE E BASIN (BEWIRTSCHAFTUNGSPLANE; V: PILOTPROJEKT LEINE, ZIELVOR-LLUNGEN DES NATURSCHUTZES ALS LOGISCHER BEWERTUNGSRAHMEN DIE GEWASSER DES LEINEGEBIETES),
ersaechsisches Landesverwaltungsamt - Fach-erde fuer Naturschutz, Hanover (Germany,
Dahl.
che Gewasserkundliche Mitteilungen, Vol. o. 5/6, p 168-172, December, 1983. 3 Fig, 5

riptors: *Water resources development, er quality management, *Mathematical ls, River basin development, Leine Basin, gy, Vegetation effects, Physiographic bal-River basins.

e development of water resources plans and gement schemes, emphasis is placed on water ity and quality parameters and forecasts. In to include requirements for conservation of e vegetation in the Leine Basin, mathematical ls and water quality parameters were careful-nsidered along with other environmental fac-necessary for a comprehensive management The biocoenosis populating a river and its diate surroundings requires consideration of morphology and alluvial meadow parameters ter resources development plans. Assessment ter quality of the Leine River and its tributar-the basis of the present aquatic vegetation is in development of these management plans.
atley-IVI)
00965

LYSES OF THE MACRO-DRIFT FROM INLET-RAKE SHUTTER TO THE NU-R POWER PLANT OF WURGASSEN AT UPPER WESER RIVER (UNTERSU-NGEN UBER DIE ZUSAMMENSETZUNG RECHENGUTES AM KKW WURFGAS-OBERWESER),
ohseninia.
che Gewasserkundliche Mitteilungen, Vol o. 1, p 24-25, February 1984. 3 Fig, 1 Tab, 5

riptors: *Drift, *Entrainment, *Cooling *Upper Weser River, *West Germany, narus, River flow, Nuclear powerplants, De-Plankton, Sediments, Fish eggs, Hay, es.

al macrodrift collected at the rake shutter of Wurgassen nuclear powerplant totals approxi-mately 10,000 cu m. In 1977 and 1978, three 100-g wet samples/week were taken from the container in which drift is placed before being taken to the dump, after the contents had been thoroughly mixed. Four fractions were distinguished by specific density. The top fraction (I) consists primarily of Gammarus tigrinis. The proportion of this fraction in samples was dependent on river flow: it was small when flow was high and increased as river flow decreased. The opposite occurred with fractions II and III. Fraction II consisted of detritus, leaves, grass, feathers, and pieces of plastic, while fraction III was composed of organic, relatively large pieces like decaying wood, bark, stalks, fish eggs and scales, The composition of these fractions varied seasonally, with much hay in summer and leaves in fall. Fraction IV consisted of inorganic sediment such as gravel and sand. Its proportion was dependent on water flow. (Gish-IVI)
W85-00971

SEQUENTIAL SAMPLING: A COST-EFFECTIVE APPROACH FOR MONITORING BENTHIC MACROINVERTEBRATES IN ENVIRONMENTAL IMPACT ASSESSMENTS,
California Univ., Berkeley. Div. of Entomology and Parasitology.
V. H. Resh, and D. G. Price.
Environmental Management, Vol. 8, No. 1, p 75-80, January, 1984. 3 Fig, 3 Tab, 25 Ref.

Descriptors: *Environmental effects, *Sampling, *Invertebrates, Benthic fauna, Sequential sampling, Monitoring, Costs.

Sequential sampling is a method for monitoring benthic macroinvertebrates that can significantly reduce the number of samples required to reach a decision, and consequently, decrease the cost of benthic sampling in environmental impact assessments. Rather than depending on a fixed number of samples, this analysis cumulatively compares measured parameter values (for example, density, community diversity) from individual samples, with thresholds that are based on specified based on sequential sampling can provide clear-cut decisions as to whether a priori-defined changes in the measured parameter(s) have or have not occurred. As examples, sequential sampling programs have been developed to evaluate the impact of geothermal energy development on benthic macroinvertebrate diversity at The Geysers, California, and for monitoring the impact of crude oil contamination on chironomid midge (Cricotopus bicinctus (Meigen) and C. mackenziensis Oliver) population densities in the Trail River, Northwest Territories, Canada. (Author's abstract)
W85-00975

EFFECTS OF STREAM CHANNELIZATION ON EXPORTS OF NITROGEN AND PHOSPHORUS FROM NORTH CAROLINA COASTAL PLAIN WATERSHEDS,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
L. A. Yarbro, E. J. Kuenzler, P. J. Mulholland, and R. P. Sniffen.
Environmental Management, Vol. 8, No. 2, p 151-160, March, 1984. 4 Fig, 2 Tab, 25 Ref. North Carolina Water Resources Research Institute grants B-110-NC and B-084-NC.

Descriptors: *North Carolina, *Coastal plain watersheds, *Channelization, *Nitrogen, Phosphorus, Environmental effects, Nutrients, Landuse, Nonpoint pollution sources, Wetlands, Geohydrology, Stream morphology.

Nitrogen and phosphorus exports from channelized-stream watersheds were elevated over those from nearby natural swamp-stream watersheds. Nitrate exports were significantly greater from channelized-stream watersheds, and higher exports were attributed to faster groundwater drawdown, continual streamflow, and transformation of former floodplain to croplands following channelization. Exports of total organic nitrogen and total nitrogen were also significantly greater from channelized-stream watersheds. Differences in the exports of ammonium, filterable reactive phosphorus, and filterable unreactive phosphorus between the two watershed types were not detectable. Particulate phosphorus exports were significantly higher from channelized-stream watersheds, presumably because of greater erosion potential of nearby croplands and steep channel banks in the altered watersheds. The presence of nonpoint sources of pollution increased watershed exports of nutrients regardless of stream morphology. Examination of nutrient budgets for a portion of swamp floodplain at the base of one natural-stream watershed revealed that changes in local groundwater hydrology and stream morphology associated with channelization appeared to have greater effect on nutrient exports than simply the loss of bordering forested floodplain. (Author's abstract)
W85-00979

ALTERATIONS IN THE ZOOPLANKTON COMMUNITY OF A FLY ASH TREATED LAKE,
Indiana Univ.-Purdue Univ. at Indianapolis. Dept. of Biology.
For primary bibliographic entry see Field 5G.
W85-00995

PRODUCTION FORGONE: AN ALTERNATIVE METHOD FOR ASSESSING THE CONSEQUENCES OF FISH ENTRAINMENT AND IMPINGEMENT LOSSES AT POWER PLANTS AND OTHER WATER INTAKES,
Fish and Wildlife Service, Kearneysville, WV. Eastern Energy and Land Use Team.
For primary bibliographic entry see Field 6B.
W85-01025

NOTE ON SOME INVESTIGATIONS CARRIED OUT IN THE AREA OF THE SUDAN PLAIN TO BE AFFECTED BY THE JONGLEI CANAL,
Chelsea Coll., London (England). Dept. of Biology.
R. G. Bailey, and S. M. Cobb.
Hydrobiologia, Vol. 110, No. 4, p 45-46, March, 1984.

Descriptors: *Water resources development, *Environmental effects, *Sudan, Jonglei Canal, Aquatic life, Limnology, Environmental effects, Water supply development, Sudd Swamp.

The major purpose behind the Jonglei Canal in the southern Sudan is to conserve water for irrigation which would otherwise be lost to evaporation in the Nilotic Sudd swamps. Four investigations of the environmental effects of the scheme were carried out - three concerned with a range ecology survey and investigations of livestock and water supplies, while the fourth was concerned specifically with the aquatic ecology of the swamp. Two series of reports from these studies have been generated. (Baker-IVI)
W85-01028

FISHES AND FISHERIES OF LAKE NUBIA, SUDAN,
Fisheries Research Centre, Khartoum (Sudan).
For primary bibliographic entry see Field 2H.
W85-01033

SIGNIFICANCE OF NATURAL AND ANTHROPOGENIC SEDIMENT INPUTS TO THE SAGUENAY FJORD, QUEBEC,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Geoscience Centre.
For primary bibliographic entry see Field 2J.
W85-01053

7. RESOURCES DATA

7A. Network Design

ACID RAIN: THE DATA AND MONITORING NEEDS,
Council on Environmental Quality, Washington, DC.
G. L. Brady, and E. T. Lauch.

International Journal of Environmental Studies, Vol. 22, No. 3-4, p 183-193, 1984. 18 Ref.

Descriptors: *Acid rain, *Research priorities, *Monitoring, International agreements, Fate of pollutants, Water pollution effects, Policy making, Governmental interrelations.

The need for environmental monitoring has been recognized in the development of air and water quality management programs for many years. The problems of inadequate monitoring have also been recognized for many years. Yet, the lack of monitoring data is acutely evident in the area of acid rain and has seriously hampered efforts to develop responsible policies. This paper focuses on the types of monitoring data needed to address the question of acid rain, viz. terms of reference for acid rain monitoring, acid rain monitoring programs, recognition of needs and problems in air and water quality monitoring, and concluding comments. Because acid rain involves multiple pollutants with international transboundary effects in air, water, and land, a comprehensive, coordinated, and cooperative system of international monitoring is needed. Coordination must involve not only the international level, but interagency programs in the domestic governments as well. Recent experience with the development of monitoring systems provides hope for the future improvement of U.S. efforts to monitor environmental quality. (Author's abstract)
W85-00508

APPLICATION OF DIGITAL MAPPING TECHNOLOGY TO THE DISPLAY OF HYDROLOGIC INFORMATION, A PROOF-OF-CONCEPT TEST IN THE FOX-WOLF RIVER BASIN, WISCONSIN,
Geological Survey, Sioux Falls, SD. Water Resources Div.
G. K. Moore, L. G. Batten, G. J. Allord, and C. J. Robinove.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4142, 1983. 118 p, 14 Fig, 10 Tab, 9 Ref.

Descriptors: *Hydrography, *Synoptic analysis, *Spatial distribution, Computer programs, Parametric hydrology, Synthesis, Numerical analysis, Assessments, *Information system, *Digital mapping, Areal stratification, Surface generation, Data display, *Wisconsin, Fox-Wolf River basin.

The Fox-Wolf River basin in east-central Wisconsin was selected to test concepts for a water-resources information system using digital mapping technology. This basin of 16,800 sq km is typical of many areas in the country. Fifty digital data sets were included in the Fox-Wolf information system. Many data sets were digitized from 1:500,000 scale maps and overlays. Some thematic data were acquired from WATSTORE and other digital data files. All data were geometrically transformed into a Lambert Conformal Conic map projection and converted to a raster format with a 1-km resolution. The result of this preliminary processing was a group of spatially registered, digital data sets in map form. Parameter evaluation, areal stratification, data merging, and data integration were used to achieve the processing objectives and to obtain analysis results for the Fox-Wolf basin. Parameter evaluation includes the visual interpretation of single data sets and digital processing to obtain new derived data sets. In the areal stratification stage, masks were used to extract from one data set all features that are within a selected area on another data set. Most processing results were obtained by data merging. Merging is the combination of two or more data sets into a composite product, in which the contribution of each original data set is apparent and can be extracted from the composite. One processing result was also obtained by data integration. Integration is the combination of two or more data sets into a single new product, from which the original data cannot be separated or calculated. (USGS)
W85-00586

AUTOMATIC DILUTION GAGING OF RAPIDLY VARYING FLOW,
Geological Survey, Madison, WI. Water Resources Div.
M. D. Duerk.
Available from the OFSS, USGS, Box 26425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4088, October 1983. 17 p, 12 Fig, 3 Tab, 7 Ref.

Descriptors: *Discharge measurements, Discharge hydrographs, Rapid flow, *Varied flow, *Fluorometry, Fluorescence, Dye, Automated, Storm sewer, Urban hydrology, *Dye dilution gaging, Constant-rate injection, *Automated gaging.

Obtaining discharge ratings at urban gaging stations is often difficult. Results of using an automated constant-rate dye-dilution technique to measure discharge at two sites in Madison, Wisconsin, are presented. The sites selected have well-defined stage-discharge ratings, developed during previous hydrologic studies. One site is a 60-inch-diameter concrete storm sewer and the other a concrete-lined open trapezoidal channel. Equipment selected to automate the method included a portable automatic water sampler, four-channel event recorder; and for dye injection, a peristaltic pump. An electrical switching circuit was designed to coordinate the operation of the water sampler, injection pump, and four-channel recorder. During the data-collection period of 1 year, a total of 20 storms was monitored. The analyses showed that the discharges measured by dye-dilution techniques ranged from + or - 5 to + or - 10 percent of the discharges determined from ratings established by current-meter measurements. Larger differences were noted at the start of and on the rising limb of four hydrographs. Of the 20 storms monitored, 17 produced acceptable results. Peak discharges by the dilution method at the open-channel site ranged from 0 to 12 percent departures from the existing rating, whereas the peak discharge by the dilution method at the storm-sewer site ranged from 0 to 5 percent departures from the existing rating. (UGGS)
W85-00852

TECHNIQUES FOR EVALUATING SPATIAL AND TEMPORAL VARIABILITY IN SURFACE WATER QUALITY AS RELATED TO SOIL MOISTURE AND SUBSURFACE WATER FLUX IN FORESTED WATERSHEDS,
Nevada Univ., Reno. Dept. of Range, Wildlife and Forestry.
For primary bibliographic entry see Field 5B.
W85-00860

SNOWY RANGE OBSERVATORY: AN UPDATE AND REVIEW,
Wyoming Univ., Laramie. Water Resources Research Inst.
For primary bibliographic entry see Field 7C.
W85-00861

ADJUSTING ALGORITHM FOR ESTIMATED SUB-REGIONAL MEANS OF AREAL PRECIPITATION USING A REGIONAL MEAN OF KNOWN SIZE (ANGLEICH-VERFAHREN FUR GESCHATZTE TEILGEBIETS-NIEDERSCHLAGE BEI BEKANNTEM GESAMTGEBIETS-NIEDERSCHLAG),
Muenster Univ. (Germany, F.R.). Inst. fuer Geographie.
U. Streit.
Deutsche Gewasserkundliche Mitteilungen, Vol. 28, No. 1, p 11-16, February, 1984. 3 Tab, 4 Ref.

Descriptors: *Areal precipitation, *Rainfall, *Algorithms, *Iller Basin, Forecasting, Elevation, Estimating, Catchment basins, Spatial distribution.

Estimates of areal precipitation from point measurements in subcatchments of a larger basin were calculated using both conventional methods and with a new algorithm procedure. This algorithm method is more reliable in that it corrects an estimation error of using areal precipitation averages. The new method takes into account spatial structure of precipitation, sources of systematic error in estimation, and special regional effects. This adjusting algorithm for spatial disaggregation of regional data is applied to areal precipitation i the upper Iller Basin. Using mean elevation as controlling factor, rough precipitation estimate for optionally defined subcatchment can be cor rected to sum up a given areal mean of precipita tion for the whole catchment. The adjusting algo rithm works independently from the underlying spatial configuration and number of sub-regions This spatial disaggregation method can be applie to all kinds of numerical data which are defined i an areal context, such as runoff. (Wheatley-IVI
W85-00970

SPATIAL ANALYSIS OF ACID PRECIPITA TION DATA,
Environmental Monitoring Systems Lab., Re search Triangle Park, NC.
For primary bibliographic entry see Field 5B.
W85-01040

7B. Data Acquisition

USE OF SEASAT SYNTHETIC APERTURE RADAR AND LANDSAT MULTISPECTRAL SCANNER SUBSYSTEM DATA FOR ALASKAN GLACIOLOGY STUDIES,
National Aeronautics and Space Administration Greenbelt, MD. Hydrological Sciences Branch.
D. K. Hall, and J. P. Ormsby.
Journal of Geophysical Research, Vol. 88, No. C3 p 1597-1607, February, 1983. 7 Fig, 1 Tab, 14 Ref

Descriptors: *SEASAT, *LANDSAT, *Satellite technology, *Alaska, *Glaciers, Synthetic aperture radar, Multispectral scanner subsystem, Remote sensing, Dease Inlet, Ruth Glacier, Tokositna Glacier, Malaspina Glacier, Infrared imagery, Microwave imagery, Radar.

SEASAT synthetic aperture radar (SAR) and LANDSAT multispectral scanner subsystem (MSS) data of three areas in Alaska were studied in order to determine what hydrological information could be extracted using digital data from both sensors. The SAR operated at a wavelength of 23.5 cm (approximately 1.28 GHz), in the microwave range, in a horizontally like-polarized mode with a resolution of 25 m or better. The MSS provides 80 m resolution data in four wavelength bands: two in the visible region (0.5-0.6 micro m and 0.6-0.7 micro m), and two in the near infrared region of the spectrum (0.7-0.8 micro m and 0.8-1.1 micro m). The study areas were selected because of their geographic and physiographic diversity. The first study area is located in northern Alaska south of Dease Inlet and contains numerous oriented of thaw lakes. The second study area, located in the Alaskan Range in south central Alaska, encompassed the valley glaciers Ruth and Tokositna. The third area was a piedmont glacier on the southern coast of Alaska, the Malaspina Glacier. SAR and MSS subscenes of the thaw lakes and subscenes of the Malaspina Glacier were digitally registered. The location and identification of some older remnant lake basins were more easily determined in the registered data using an MSS/SAR overlay than in either SAR or MSS data alone. Separately both the SAR and the MSS data were useful for determination of surging glaciers based on their distinctive medial moraines, and LANDSAT data were useful for locating the glacier firn zone. In the analysis of the Malaspina Glacier scenes, the SAR data were useful for locating heavily crevassed ice beneath glacial debris, and LANDSAT provided information concerning the extent of the debris overlying the glacier. Together, the data set gave a good representation of the extent of the glacier and crevasse patterns. (Collier-IVI)
W85-00521

TOTAL PRECIPITABLE WATER AND RAINFALL DETERMINATIONS FROM THE SEASAT SCANNING MULTICHANNEL MICROWAVE RADIOMETER,
National Earth Satellite Service, Washington, DC
J. C. Alishouse.
Journal of Geophysical Research, Vol. 88, No. C3, p 1929-1935, February, 1983. 7 Fig, 8 Tab, 15 Ref

riptors: *SEASAT, *Microwave radiometers, cipitation, *Remote sensing, Gulf of Alaska, all, Satellite technology, Precipitable water, rithms.

e of the SEASAT scanning multichannel owave radiometer's (SMMR's) five frequen- 0.81, 1.43, and 1.66 cm) can be used to deter- the total precipitable water in the atmos-, the liquid water content, and the rainfall In addition, two distinct algorithms were used rive geophysical parameters. One algorithm is ression algorithm with coefficients initially ed from computations of brightness tempera- under a wide variety of conditions. The other thm is a nonlinear technique that produces a on by iteratively minimizing in a least squares the difference between observed brightness eratures and ones computed from a model on. Comparisons with surface observations diosonde observations from the Gulf of a SEASAT Experiment (GOASEX) and selected sources were made for both algo- s. Generally, very good agreement was found en satellite and radiosonde observations of precipitable water. An estimate of the preci- f radiosonde-derived total precipitable water nts was made. Comparisons of precipitation rence as determined from the SMMR and e observations also were made. In the trop- ry good agreement is found between satellite rface observations. In the mid-latitudes (Gulf aska) it is found that small cells of precipita- re often missed by the SMMR but larger tic scale precipitation is detected reliably. er-IVI)
0522

ENT METER CALIBRATION AND E-DIMENSIONAL DISPLACEMENT EF- S,
noessische Technische Hochschule, Zurich erland).
ubli, and M. Hegland.
l of Hydraulic Research, Vol. 20, No. 5, p 4, 1982. 7 Fig, 1 Tab, 5 Ref.

iptors: *Current meters, *Calibrations, *Dis- nent effects, *Potential flow theory, Bounda- ue problems, Fourier analysis, Flow meas- nt, Velocity.

nt meters are used to measure the velocity ution in conduits and open ducts. They are ted by towing them at a constant speed a rating channel with the water at rest. The t meters must be calibrated with the same f mounting used during field measurements he shape of the section of the mounting rod e distance of the propeller to the rod directly ce the rate of revolution of the current Current meters are mounted on a much suspension during the calibration than field measurements and a three-dimensional round the end of the suspension occurs. The ce of the three-dimensional effect of the ng rod on the flow velocity indicated by the t meter was analyzed by potential flow in a rating tank of 1 m depth and 1 m width distance of 10 m. The situation in the el corresponds to a boundary value problem. roblem is solved by using double Fourier o describe source density and potential. The y induced by the mounting rod is calculated region of the rotor of the current meter. The ce of the distance between the current and the end of the mounting rod is investi- or one channel geometry. A minimum sug- distance of the current meter from the end mounting rod is 0.3 m, in the case of tion profile 210 x 40 mm or on profiles of ne cord length. For small rating tanks, in- l accuracy can be achieved by estimation of ference between the results of calibration e actual setup and the supposed calibration nlimited tank. (Collier-IVI)
0526

STUDY: ESTIMATING ANTECEDENT IPITATION INDEX FROM HEAT CA- Y MAPPING MISSION DAY THERMAL ARED DATA,
Texas A and M Univ., College Station. Remote Sensing Center.
W. D. Rosenthal, J. C. Harlan, and B. J. Blanchard.
Hydrological Sciences, Vol. 27, No. 4, p 415-426, December, 1982. 11 Fig, 11 Ref.

Descriptors: *Remote sensing, *Antecedent Precipitation Index, *Washita basin, *Oklahoma, Soil water, Satellite technology, Surface temperature, Pastures, Infrared imagery, Storms.

Precipitation estimate accuracy from small-scale storms within the Great Plains is limited due to the sparse raingauge network; errors have led to erroneous predictions of floods in localized areas. Surface soil moisture conditions were estimated from day Heat Capacity Mapping Mission satellite thermal infrared data. From 13 to 29 July 1978, pasture day surface temperatures were related to corresponding antecedent precipitation index (API) values over the Washita basin in central Oklahoma. Moisture variations across the basin were high as a result of a storm which passed over areas of the basin on 21 July. At given raingauge sites, day pasture surface temperature differences between two dates were strongly related to API immediately after a storm (r sq = 0.68). The thermal infrared/API relationship was evident up to 7 days after a storm. To make a reliable estimate of API values greater than 1.5 cm, future thermal satellite overpass intervals should be between 1 and 7 days. (Moore-IVI)
W85-00689

AUTOMATIC SYSTEM FOR MEASUREMENTS IN SHALLOW LAKES,
Odense Univ. (Denmark). Biological Inst.
For primary bibliographic entry see Field 2H.
W85-00874

RAINFALL MEASUREMENT ACCURACY IN FACE: A COMPARISON OF GAGE AND RADAR RAINFALLS,
National Oceanic and Atmospheric Administration, Boulder, CO. Weather Modification Program Office.
A. G. Barnston, and J. L. Thomas.
Journal of Climate and Applied Meteorology, Vol. 22, No. 12, p 2038-2052, December, 1983. 9 Fig, 4 Tab, 27 Ref.

Descriptors: *Rainfall, *Measuring instruments, *Florida, *Rain gages, *Radar, Florida Area Cumulus Experiment, Weather, Prediction, Cloud seeding.

The agreement of radar with raingage rainfall measurements during the second phase of the Florida Area Cumulus Experiment (FACE-2) is examined. FACE-2 rainfall was measured in a 13000 sq km target area using 111 nearly uniformly distributed gages at an average density of 117 sq km per gage and using a WSR-57 radar adjusted daily with a dense raingage network distributed over 500 sq km. The radar versus gage agreement is studied in order to evaluate the accuracy of the unadjusted radar measurements and the effectiveness of the adjustment technique in improving the radar measurements. Implicit in the comparison is an assumption that the gage rainfalls are the relative standard of accuracy. Before gage adjustment of the radar rainfalls, mean differences between radar and gage target area rainfalls are slightly positive on dry days but become considerably negative on wet days. Following gage adjustment, the mean agreement generally is much improved. The day to day variation of the differences is not diminished after the adjustment. This is attributed to misrepresentations of the gage to radar rainfall ratio in the dense raingage network which are caused by the spatial variation of that ratio within the overall target area. With reasonable estimates of gage and radar measurement errors for various rainfall amount ranges, several useful studies could be pursued. Raingage sampling error results as a function of both rainfall amount and gage sampling density during FACE could be compared with results of similar independent research with Florida and non-Florida rainshowers. The probability of detection of seeding induced rainfall increases could be determined using either gages or radar measurements, given the inherent measurement errors. Measurement errors could be compared with natural meteorological rainfall variability in relative importance in obscuring the true effect of seeding. (Baker-IVI)
W85-00915

RIVER GAUGING BY ULTRASONICS/WORKSHOP REPORT KOBLENZ 1983 (BERICHT UBER DIE FACHLICHE AUSSPRACHE AM 14./15. SEPTEMBER 1983 IN KOBLENZ),
Bundesanstalt fuer Gewaesserkunde, Coblenz (Germany, F.R.).
W. Teuber.
Deutsche Gewasserkundliche Mitteilungen, Vol. 28, No. 1, p 1-11, February, 1984. 5 Fig, 1 Tab, 29 Ref.

Descripfors: *Gaging, *River flow, *Flow measurement, *Ultrasonic flow meters, Workshop, Flowmeters, Stream flow.

This workshop in the Federal Institute of Hydrology was organized with the objective of enabling operators of ultrasonic flow measurement stations to exchange experiences among themselves and with the manufacturing firms of ultrasonic devices. Discussion of problems relating to river gauging by ultrasonics revealed a number of areas of potential improvements in measuring techniques and application. A synopsis of research reports and discussions is presented. Potential new applications, verifiable data systems, and incorporation of new technology was included in the discussions at these meetings. Conclusions from these workshop sessions indicated that a permanent dialogue between manufacturers and users of ultrasonic river gauging equipment would be highly desirable. (Wheatley-IVI)
W85-00969

MEASUREMENT OF THE REDOX POTENTIAL IN GROUNDWATER (REDOX-MESSUNGEN IM GRUNDWASSER(II)),
For primary bibliographic entry see Field 5A.
W85-00972

SURVEY OF STATE WATER QUALITY MONITORING PROGRAMS,
Minnesota Univ., St. Paul. Dept. of Forest Resources.
J. A. Perry, R. C. Ward, and J. C. Loftis.
Environmental Management, Vol. 8, No. 1, p 21-26, January, 1984. 6 Fig, 1 Tab, 6 Ref.

Descriptors: *Water quality, *Monitoring, *State agencies, Budgeting, Surveys, Economic aspects, Invertebrates, Periphyton, Biological properties.

Budget changes, whether positive or negative, in water quality management agencies often mean a change in resources available for water quality monitoring. Many state agencies are currently facing monitoring budget cuts and, as a result, are reevaluating their monitoring programs. Such evaluations make use of a number of information sources, not the least of which are monitoring activities in other states. This article reports results of a survey of all fifty state water quality monitoring programs. Twenty questions were asked in the general areas of fixed-station monitoring, special studies, and biological monitoring. Each state was contacted by telephone at least twice during the survey. Fixed-station monitoring is conducted by 48 of 50 states. An average of 75 stations per state are sampled, generally on a monthly basis. There is a large variation in the way data are analyzed by the states; water quality indices and plots of concentration or loading over time are the most common methods. All but three states conduct special studies, but only seven repeat the studies on a regular basis. Special studies are generally problem specific as opposed to basin oriented. Biological monitoring is performed by 33 states; however, this is an area in which budget cuts are having a noticeable impact. In some cases, biological monitoring is being completely eliminated or suspended. Macroinvertebrate sampling is performed quarter-

ly to biannually by 50% of the states; 75% of the states that sample macroinvertebrates do so annually. Periphyton sampling is performed by 33% of the states. Over 50% of the states are in the process of revising, or have revised, their monitoring program during the past five years. However, only four states had a detailed rationale and operating procedure for the entire monitoring system. Results of the survey are, therefore, averages of existing monitoring programs. Average results do not necessarily represent ideal situations, but do give an indication of how states are coping with their monitoring responsibilities. (Author's abstract)
W85-00973

RAIN ESTIMATION FROM SATELLITES: AN EXAMINATION OF THE GRIFFITH-WOODLEY TECHNIQUE,
National Aeronautics and Space Administration, Greenbelt, MD. Lab. for Atmospheric Sciences.
For primary bibliographic entry see Field 2B.
W85-01041

MEASUREMENTS AND ESTIMATES OF POTENTIAL EVAPOTRANSPIRATION OVER EGYPT,
Meteorological Authority, Cario (Egypt).
For primary bibliographic entry see Field 2D.
W85-01059

NEW ELECTRONIC EVAPORATION AND RAIN MEASURING EQUIPMENT,
Eotvos Lorand Univ., Budapest (Hungary). Dept. of Atomic Physics.
L. Ambrus, E. Antal, and H. A. Karsai.
Agricultural Meteorology, Vol. 25, No. 1, p 35-43, September, 1981. 4 Fig, 4 Ref.

Descriptors: *Rainfall, *Evaporation, *Measuring instruments, Soil water, Water balance, Surface water, Pan evaporation.

The significance of evaporation measurements is surveyed from the point of view of agricultural meteorology and hydrology. Knowledge of the different evaporation processes is necessary not only for meteorological and hydrological theory, but also for practical decision making. For practical applications the areal evaporation data, the water requirement and consumptive use of water by the plant canopy, and the evaporation demand of the air are all often estimated from data of different types of evaporation pans. The different evaporation pans play a key role in the theoretical study of evaporation processes as well as in the practical application of evaporation data. Current methods of evaporation measurement are described. The principle of operation of the electronic evaporimeter is explained along with the functional set up of the electronic circuits and practical uses. (Baker-IVI)
W85-01062

AUTOMATING A CLASS A EVAPORATION PAN FOR SEMI-CONTINUOUS RECORDING,
Kansas Agricultural Experiment Station, Manhattan. Evapotranspiration Lab.
For primary bibliographic entry see Field 2D.
W85-01065

ECONOMICAL RECORDING TIPPING-BUCKET RAIN GAUGE,
Commonwealth Scientific and Industrial Research Organization, Armidale (Australia). Pastoral Research Lab.
For primary bibliographic entry see Field 2B.
W85-01067

PRESSURE TRANSDUCER FOR DETERMINING ATMOSPHERIC PRESSURE AND EVAPOTRANSPIRATION WITH A HYDRAULIC WEIGHING LYSIMETER,
Washington Univ., Seattle. Coll. of Forest Resources.
L. J. Fritschen, and J. Simpson.
Agricultural Meteorology, Vol. 26, No. 4, p 273-278. July, 1982. 3 Fig, 2 Ref.

Descriptors: *Measuring instruments, *Evapotranspirometer, *Atmospheric pressure, Evapotranspiration, Transducer, Evaporation, Lysimeter.

The construction and recording of pressure transducers for measuring atmospheric pressure and total pressure, i.e. a hydraulic weighing lysimeter, is described. The principle of operation consists of a variable concentric capacitor to control the frequency of oscillation of a free-running multivibrator. The sensitivity of the transducers was 84 Pa/Hz and 8 mm H2O/Hz. Techniques which would increase the resolution of atmospheric pressure to 0.7 Pa and of a standpipe to 0.06 mm H2O are discussed. The temperature coefficient of the transducers is about 0.5 Hz/C. A barometer and pressure transducer were installed at a field research site during the spring of 1981. They operated without difficulty throughout the summer and fall of 1981. One of the big advantages of the oscillator circuit is its lack of dependence upon stabilized input voltage. The sensitivity of the transducers may be improved by increasing the frequency of oscillation. Although the accuracy of these pressure transducers is not voltage dependent, it is highly dependent upon precise timing. For lysimetric purposes, the measurement of total pressure rather than differential pressure is more desirable. The total pressure measurement negates the need to maintain a very stable dummy standpipe, maintain a record of the dummy standpipe, and minimize temperature gradients along the standpipes. (Baker-IVI)
W85-01069

INEXPENSIVE BALANCE FOR MEASURING THROUGHFALL IN CEREALS,
Long Ashton Research Station (England).
D. R. Butler, and S. C. King.
Agricultural Meteorology, Vol. 27, No. 3-4, p 233-240, December, 1982. 6 Fig, 3 Ref.

Descriptors: *Measuring instruments, *Rainfall, *Throughfall, Interception, Canopy, Cereal crops, Saturation capacity.

The construction and electronics of a balance designed to measure throughfall in the inter-row of cereal crops with a resolution of less than 0.1 mm of water are described. To measure throughfall in the inter-row of cereal crops it is necessary to have a narrow receiving vessel, to resolve less than 0.1 mm of water and to produce a signal which can be easily recorded. In use the balances were located in the inter-rows with the bottom of the pans close to the ground. Six balances were used in a wheat field throughout the 1981 growing season. Results show the time course of rain, measured with a tipping bucket rain gauge, and the mean throughfall given by the average of the observations for all six balances. To obtain saturation capacity of the crop however, it is necessary to record throughfall until the rates of rainfall and throughfall are equal. The method of obtaining the saturation capacity of a crop canopy by recording throughfall with time would appear to be satisfactory for individual showers. With sufficient data, totals of rainfall and throughfall measured at the end of showers can be used to estimate the storage capacity of vegetation, but this method gives no indication of how much rain is needed to completely wet the canopy. Continuous monitoring should therefore give a more precise measure of the saturation capacity and additional information on the rate of wetting of the canopy. (Baker-IVI)
W85-01074

ERROR ANALYSIS OF AIRBORNE GAMMA RADIATION SOIL MOISTURE MEASUREMENTS,
National Weather Service, South Minneapolis, MN. Airborne Snow Survey Program.
For primary bibliographic entry see Field 2G.
W85-01075

IRRIGATION SCHEDULING - A VALID OPTION WITH MICROPROCESSOR-BASED CONTROLS,
Georgia Univ., Athens. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W85-01076

7C. Evaluation, Processing and Publication

APPLICATION OF DIGITAL MAPPING TECHNOLOGY TO THE DISPLAY OF HYDROLOGIC INFORMATION, A PROOF-OF-CONCEPT TEST IN THE FOX-WOLF RIVER BASIN, WISCONSIN,
Geological Survey, Sioux Falls, SD. Water Resources Div.
For primary bibliographic entry see Field 7A.
W85-00586

COMPUTER ROUTINES FOR PROBABILITY DISTRIBUTIONS, RANDOM NUMBERS, AND RELATED FACTORS,
Geological Survey, Reston, VA. Water Resources Div.
W. H. Kirby.
Available from the OFSS, USGS, Box 25425, Fed Ctr. Denver, CO 80225. USGS Water Resources Investigations Report 83-4257, (Revision of Open File Report 80-448), 1983. 14 p, 16 Ref.

Descriptors: *Computer programs, *Probability, Statistics, Random numbers, Probability distributions.

Use of previously coded and tested subroutines simplifies and speeds up program development and testing. This report presents routines that can be used to calculate various probability distributions and other functions of importance in statistical hydrology. The routines are designed as general-purpose Fortran subroutines and functions to be called from user-written main progress. The probability distributions provided include the beta, chi-square, gamma, Gaussian (normal), Pearson Type III (tables and approximation), and Weibull. Also provided are the distributions of the Grubbs-Beck outlier test, Kolmogorov's and Smirnov's D, Student's t, noncentral t (approximate), and Snedecor F. Other mathematical functions include the Bessel function, I sub o, gamma and log-gamma functions, error functions, and exponential integral. Auxiliary services include sorting and printer-plotting. Random number generators for uniform and normal numbers are provided and may be used with some of the above routines to generate numbers from other distributions. (USGS)
W85-00587

TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS ON NATURAL-FLOW STREAMS IN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-00589

WATER RESOURCES OF WESTERN DOUGLAS COUNTY, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-00590

SUMMARY OF GROUND-WATER PUMPAGE IN THE CENTRAL VALLEY, CALIFORNIA, 1961-77,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W85-00591

DATA MANAGEMENT SYSTEM FOR AREAL INTERPRETIVE DATA FOR THE HIGH PLAINS IN PARTS OF COLORADO, KANSAS, NEBRASKA, NEW MEXICO, OKLAHOMA, SOUTH DAKOTA, TEXAS, AND WYOMING,

logical Survey, Lakewood, CO. Water Re-
ces Div.
. Luckey, and C. F. Ferrigno.
ilable from OFSS, USGS, Box 25425, Fed.
Denver, CO 80225. USGS Water-Resources
stigations Report 82-4072, December, 1983.
p, 7 Fig, 2 Tab, 11 Ref.

criptors: *Data storage and retrieval, Data
essing, Computer programs, Colorado,
sas, Nebraska, New Mexico, Oklahoma, South
ota, Texas, Wyoming, *High Plains, Data
, *System 2000, Data generation.

High Plains Regional Aquifer System Analy-
as developed a regional water-resources (and
ed) data storage and retrieval system to orga-
and preserve areal interpretative data. The
m is general and can easily be adapted for
r studies. This report documents the High
s data base as well as the general system that
dependent of the High Plains area. The system
ilt around a hierarchically structured data base
isting of related latitude-longitude blocks. Var-
parameters in the data base are stored at
rent degrees of detail, with the finest detail
a block of 1 minute of latitude by 1 minute
itude (approximately 1 square mile). (USGS)
-00593

**INAGE AREAS OF SELECTED SITES ON
EAMS IN NORTH CAROLINA,**
ogical Survey, Raleigh, NC. Water Resources

. Meikle.
lable from OFSS, USGS, Box 25425, Fed.
Denver, CO 80225. USGS Open-File Report
11, 1983. 163 p, 2 Fig, 3 Tab, 6 Ref.

riptors: *Basin, *Drainage area, Topographic
*Hydrologic units, Quadrangle map, *North
lina, Chowan-Roanoke, Neuse-Pamlico, Cape
, Pee Dee, Santee, Savannah, Kanawha,
r Tennessee, Middle Tennessee-Hiwassee
r basins.

he past several years, drainage-area data have
determined for approximately 12,400 selected
on streams in North Carolina. Location infor-
on, including distance of nearby towns or
landmarks, latitude and longitude coordi-
, county in which the site lies, and the name
e latest topographic maps on which the site is
ed, are also provided. (USGS)
-00599

**ECTED GROUND-WATER DATA IN
TS OF GILLIAM, MORROW, AND UMA-
LA COUNTIES, OREGON,**
ogical Survey, Portland, OR. Water Re-
ces Div.
. Smith, C. A. Collins, and L. J. Olson.
S Open-File Report 83-34, 1983. 44 p, 4 Fig, 2

riptors: *Basalt, *Aquifer, *Groundwater,
hydrology, *Groundwater levels, *Data col-
on, *Oregon, Gilliam County, Morrow
nty, Umatilla County.

the last 20 years there has been a shift from
nd to irrigated agriculture in parts of Gilliam,
row, and Umatilla Counties in northeastern
on. Some irrigation water used in this area
ned from surface sources, but a significant
nt is obtained from wells. The principal aqui-
the area is the Columbia River Basalt Group.
s in the basalt are commonly drilled to depths
0 to 1,200 ft and many produce more than
gal/min. A cooperative ground-water model-
study by the U.S. Geological Survey and
on Water Resources Department has resulted
e compilation of data from drillers logs and
inspections for wells completed in the basalt
er. Water-level measurements have been made
me wells in the area since the 1950's. The
with longest periods of record are those that
part of a Statewide network of observation
measured by the U. S. Geological Survey
Oregon Water Resources Department. This
rt includes a table of well information, repre-
sentative hydrographs, and well location maps.
(USGS)
W85-00602

SURFACE WATER AND CLIMATOLOGIC DATA, SALT LAKE COUNTY, UTAH, WATER YEAR 1981, WITH SELECTED DATA FOR WATER YEARS 1980 AND 1982,
Geological Survey, Salt Lake City, UT. Water Resources Div.
H. F. McCormack, R. C. Christensen, D. W. Stephens, G. E. Pyper, and J. F. Weigel.
USGS Open-File Report 83-694, 1983. 586 p, 1 Fig, 6 Tab, 6 Ref.

Descriptors: *Surface water, *Water quality, *Storm runoff, *Precipitation, Storm rainfall, *Atmospheric deposition, Salt Lake City, Jordan River, Jordan Valley, *Utah.

Presented are water-discharge, water-quality, precipitation, and atmospheric-deposition data collected in Salt Lake County, Utah, during the 1981 water year. Also included are selected data collected during the 1980 water year that have not been previously published and selected data from the 1982 water year. Surface-water data consist of daily mean values of flow at 48 sites on natural streams, canals, and conduits. Water-quality data consist of chemical, biologic, and sediment analyses at 33 sites. Storm runoff data consist of 5- and 15-minute interval discharge data for selected storms at 36 sites. Precipitation data consist of daily totals at 22 sites. Storm-rainfall data consist of daily totals at 22 sites and 5- and 15-minute interval rainfall amounts of selected storms at 13 sites. Atmospheric-deposition data were collected at six sites. (USGS)
W85-00603

GROUND-WATER DATA FOR MICHIGAN--1982,
Geological Survey, Lansing, MI. Water Resources Div.
G. C. Huffman.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 83-753, 1983. 54 p, 5 Fig, 3 Tab, 98 Ref.

Descriptors: *Water resources, *Groundwater, *Groundwater hydrographs, Water levels, Water use, Water quality, *Data collection, *Michigan.

Water levels, locations, depths, and aquifers tapped are given for 117 observation wells. Tabulated data include extremes of water levels for 1982 and for the period of record, pumpage of most major ground-water users in the State, and water-quality data on selected wells. (USGS)
W85-00615

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN MONTANA, OCTOBER 1982 THROUGH SEPTEMBER 1983,
Geological Survey, Helena, MT. Water Resources Div.
R. S. Roberts.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Open-File Report 83-260, 1983. 44 p, 3 Fig, 2 Tab, 108 Ref.

Descriptors: *Data collection, *Project purposes, Water resources, Water quality, Surface water, Groundwater, *Montana.

The investigative efforts of the U.S. Geological Survey toward the water resources of Montana are described. Hydrologic information and knowledge of the water resources are gained annd disseminated principally by programs of (1) collecting hydrologic data on a continuing basis, (2) conducting water-resources appraisals of surface and ground water, (3) conducting supportive research in hydrology and related fields, (4) disseminating water data and results of investigations to the public, (5) coordinating acquisition of water data by Federal agencies, and (6) providing technical assistance in hydrologic fields to other government agencies. The Montana district of the U.S. Geological Survey conducts its hydrologic work through a headquarters office in Helena, a subdistrict office in Billings, and field offices in Helena, Fort Peck, and Kalispell. The district employs 67 people to work on 24 funded projects that are organized under the general categories of data-collection programs, problem-oriented studies, areal appraisals, coal-related studies, research projects, and hydrologic studies and research performed under a system of contracts to research organizations. (USGS)
W85-00616

PUBLIC-SUPPLY PUMPAGE IN WISCONSIN, BY AQUIFER,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 4B.
W85-00618

EFFECTS OF URBANIZATION ON THE MAGNITUDE AND FREQUENCY OF FLOODS ON SMALL STREAMS IN TENNESSEE - BASIC DATA REPORT NO. 3,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 4C.
W85-00619

WATER-QUALITY RECORDS FOR SELECTED RESERVOIRS IN TEXAS, 1976-77 WATER YEARS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 5A.
W85-00621

HYDROGEOLOGIC EVALUATION OF SELECTED STRATIFIED-DRIFT DEPOSITS IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-00842

MODIFICATION OF THE FINITE-DIFFERENCE MODEL FOR SIMULATION OF TWO-DIMENSIONAL GROUND-WATER FLOW TO INCLUDE SURFACE-GROUND WATER RELATIONSHIPS,
Geological Survey, Providence, RI. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-00845

ESTIMATING GENERALIZED FLOOD SKEW COEFFICIENTS FOR MICHIGAN,
Michigan Dept. of Natural Resources, Lansing.
For primary bibliographic entry see Field 2E.
W85-00849

SUSPENDED-SEDIMENT DATA IN THE SALT RIVER BASIN, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
W. R. Berkas.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, Colo. 80255. USGS Open-File Report 83-275, 1983. 38 p, 3 Fig, 2 Tab, 2 Ref.

Descriptors: *Hydrologic data collection, *Sediment concentration, Sediment discharge, Sediment yield, Particle size, *Suspended sediment load, *Missouri, Salt River basin.

Suspended-sediment data collected at six stations in the Salt River basin during 1980-82 are presented. The estimated average annual suspended-sediment load is 1,390,000 tons per year from a geomorphic examination, and 1,330,000 tons per year from periodic sampling at Salt River near Monroe City, Mo. The suspended-sediment load from the major tributaries of the Salt River during 1981 was 1,610,000

tons, which is larger than the estimated values due to above-normal rainfall and runoff. (USGS)
W85-00859

SNOWY RANGE OBSERVATORY: AN UPDATE AND REVIEW,
Wyoming Univ., Laramie. Water Resources Research Inst.
T. A. Wesche.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202597, Price codes: A13 in paper copy, A01 in microfiche. Water Resources Series No. 81, May 1982. 316 p, 2 Fig, 5 Tab. Project No. OWRT A-029-WYO (1), Contract/Grant No. 14-34-0001-0154.

Descriptors: *Climatic data, *Stream gages, *Hydrologic data, *Weather data collections, Hydrologic systems, Anemometers, Precipitation, Humidity, Temperature, Wind, Wind gages, Upper North Platte River Basin, Snowy Range, *Wyoming, Medicine Bow National Forest, Nash Fork Creek Drainage.

Wyoming WRRI has developed and maintained the Snowy Range Water Resource Observatory, an intensely instrumented subalpine research watershed in southeastern Wyoming, since the mid-1960's. The original goal behind the Observatory concept had been to foster and promote long-term study of the hydrologic cycle in a high mountain watershed and the interdisciplinary relationships of various portions of this cycle to other aspects of the environment, both physical and biological. This goal was well met until the mid-1970's. As research interests shifted more toward the energy development activities occurring in Wyoming, the Observatory underwent a period of stagnation and deterioration. Since 1979, the Observatory has been rebuilt in the hope of revitalizing interest in both basic and applied watershed research. This report presents a review of the Observatory and a summary of the hydrologic and climatologic data being collected there as a research tool.
W85-00861

8

8. ENGINEERING WORKS

8A. Structures

WATER MAIN PROJECT SERVES EXPANDING HI-TECH AREA,
Raleigh Public Utilities, NC.
J. R. Butler, and J. L. Roberts.
Water Engineering and Management, Vol. 131, No. 5, p 52-53, May, 1984. 2 Fig.

Descriptors: *Water mains, *Raleigh, *North Carolina, Water conveyance, Pipelines, Construction, Materials, Water supply, Soil properties, Water hammer, Steel, Prestressed concrete, Concrete, Iron, Pipes, Costs.

Raleigh, North Carolina is in the process of completing an ambitious expansion of its water system capacity, including installing 24,300 ft of 54 inch diam. water transmission main and 4,500 ft of 16 inch diam. high service water main. During the initial phase of final design, a subsurface soils investigation was conducted. The soils investigation established subsurface soil conditions along the pipeline route, set forth soil parameters for engineering considerations, and recommended construction procedures. Any potential for water hammer in the 54 inch transmission main was analyzed. A thorough evaluation of transmission main materials for the 54 in diam. line was made. Design standards were established which included: depth of cover, loads, operating and surge pressure, transverse deflection, thrust restraint and bedding conditions. Ductile iron, prestressed concrete cylinder, and steel transmission main construction were considered. Considerable time and effort was devoted to preparing the pipeline specification. The integrity of restrained joints was ensured by requiring the performance of a similar hydrostatic pressure test of two restrained joint pipes having the minimum wall thickness to be supplied on the project. Restrained joint pipe was required to be installed with no deflection at the joint. Construction began in February 1983 and will be completed this spring. The low bid of $4.5 billion is well under the allotted project budget and 20% below the engineer's estimate. (Baker-IVI)
W85-00552

ECOLOGICAL EFFECTS OF VARIOUS COASTAL DEFENSE SYSTEMS,
Western Australia Univ., Nedlands. Dept. of Civil Engineering.
R. Silvester.
Water Science and Technology, Vol. 16, No. 3-4, p 355-365, 1984. 9 Fig, 14 Ref.

Descriptors: *Coastal engineering, *Ecological effects, *Littoral drift, Headland control, Sandbars, Beach erosion, Groins, Beach renourishment, Longshore currents, Seawalls.

The interaction of storm waves with persistent swell from an obligue direction produces pulses of littoral drift which are of great significance in coastal engineering. The natural construction of offshore bars for beach protection should be aided by man by the provision of adequate sources of material. Groins have been found to be ineffective in protecting a shoreline suffering from erosion. Seawalls erode the seabed in front of and downcoast of them. Beach renourishment is a transitory solution to beach denudation. The best stabilization concept is that of headland defense of coasts which copies Nature in its attempt to minimize longshore drift. (Author's abstract)
W85-00561

SHORE PROTECTION - A TENSION FIELD BETWEEN TWO TYPES OF CONSERVATION,
Rijkswaterstaat-Deltadienst, Middelburg, Middelburg (Netherlands). Environmental Div.
R. J. Leewis, R. Misdorp, J. Al, and Tj. de Haan.
Water Science and Technology, Vol. 16, No. 3-4, p 367-375, 1984. 3 Fig, 2 Tab, 1 Ref.

Descriptors: *Netherlands, *Delta Area, *Lake Veere, *Lake Grevelingen, *Shore protection, Conservation, Decision making, Erosion control, Construction materials, Rock size, Toxicity, Lake shores, Beach erosion, Dykes.

Shore protection is an interference into the natural system around the border line between land and water. A tension field between two types of conservation, nature conservation and land conservation, is caused by the extremes of 'leave nature alone' and 'protect the land' and the possibilities in between. Estuaries in the Delta Area in South-West Netherlands have been closed off from the sea; former shoals and mud flats lying above ordnance level became permanently dry. The former building-up force, the current, has disappeared and the eroding force, the waves, now attack within a very small height range; the new land would have disappeared had man not provided it with various kinds of shore protection. The first estuary was closed off in 1960 and became a brackish lake, Lake Veere. Lake Grevelingen was formed later. Methods of shore protection for these lakes have become increasingly nature friendly. In approximate chronological order, they are: an asphalt-concrete mixture used to fix the shoreline; coarse gravel applied on the shore over a cloth base; a thin layer of shells on the shore which vegetation can anchor; sheet piling and wooden (Azobe) constructions; dams of coarse gravel 100 m from the shore; stimulation of reed growth by planting; building up of an offshore sandbar; floating constructions; and sand supplementation in depots. The best way of designing shore protection is to systematically go through the following phases: problem definition; choosing the system to be used; development of the design; realization; and maintenance. The size of stone applied to underwater parts of dykes affects both structural integrity and the abundance and diversity of underwater life. Toxicity of artificial stone types should be considered. (Collier-IVI)
W85-00562

SURGE SHAFT STABILITY WITH PUMPED-STORAGE SCHEMES,
Newcastle upon Tyne Univ. (England).
A. Anderson.
Journal of Hydraulic Engineering, Vol. 110, No. p 687-706, June, 1984. 8 Fig, 3 Tab, 19 Ref, Append.

Descriptors: *Pumped storage, *Stability, *Surg shafts, Surge tanks, Pumps, Junction losses, Shaf Turbines, Penstocks, Tailrace, Friction loss, H draulic engineering.

The stability of surge tanks is investigated takin into account the friction losses in the pipe, surg tank and the junction losses. Three surge sha stability problems are investigated for a surge sha layout. Pump operation is analyzed to establish th influence of a shaft on the surge behavior pumps. The influence of penstock and junctio losses on shaft stability in turbine operation a examined. The stability of tailrace surge shafts turbine operation is analyzed. All the results ob tained are for small amplitude oscillations and an increases in the required shaft area for stability ar in addition to those which may be required due t the effect of large amplitude (nonlinear) oscilla tions. The method of incorporating the junctio losses (i.e., approximating them by their stead state values) is valid for a small amplitude stud but for large surge amplitudes it will generally b necessary to take account of the variations of th loss coefficients with the flow ratios at the junc tion. (Author's abstract)
W85-00725

SIMPLIFYING STORMWATER DETENTION BASIN DISCHARGE CONTROL DETERMINATIONS,
Rockaway Township Water Dept., NJ.
R. J. McKinnon.
Public Works, Vol. 115, No. 6, p 68-69, June, 1984. 1 Fig.

Descriptors: *Storm runoff, *Detention reservoirs *Basins, Design criteria, Mathematical equations Outlet discharge, Flow routing.

To comply with the demand for better control o storm drainage, engineers are resorting to the use of stormwater detention basins that will permit controlled discharge of excess flows into existing wasteway systems. Discharge control is a vital part of the system. The procedure for dimensioning and sizing of detention facilities must necessarily begin with an inflow hydrograph based on available data and the determination of the quantity of outlet discharge allowed by existing facilities, natural constraints, and/or legal requirements. It is then necessary to route the typical storm through the basin. Two additional critical elements are needed to complete the design: the shape and size of the basin and the outlet control mechanism. The outlet control for small basins is typically a circular storm sewer pipe with a headwall. In attempting to simplify the solution of selecting a pipe size for a particular headwater depth, the empirical data from the nomograph were correlated with existing theory and used to develop readily usable mathematical formulas. (Baker-IVI)
W85-00735

SAFETY OF NON-FEDERAL DAMS: WHO'S RESPONSIBLE,
Soil Conservation Service, Washington, DC. Engineering Div.
J. S. Haugh.
Agricultural Engineering, Vol. 65, No. 1, p 18-20, January, 1984.

Descriptors: *Dam safety, *Jurisdiction, Dam stability, Federal jurisdiction, State jurisdiction, Public policy.

One of the biggest problems in the area of dam safety today is that many of the states have not accepted their rightful role and responsibility to assure the safety of non-Federal dams. The need for adequate state dam safety programs is stressed and some of the actions that the SCS (Soil Conservation Service) is taking are cited to support and encourage strong state dam safety programs.

tatements have been issued by SCS declar-
support for strong state dams safety pro-
Authority to deny assistance for installing
ns in a state that does not have, or is not
toward, a strong program has been empha-
CS also has the authority to require local
or the state to develop Emergency Action
or new Class c (high hazard) dams. SCS
the power to require specific notifications
d to land use downstream of Class a and b
d moderate-hazard) dams. (Baker-IVI)
944

CIENT WELL MAY BE TRUE CULPRIT
H COST OF PUMPING WATER,
lner.
n Age, Vol. 17, No. 9, p 12-13, May/June,
Fig.

tors: *Wells, *Well efficiency, *Pumping,
g tests, Cost analysis, Pumps, Efficiency,
ment, Design criteria, Well screens.

logy has advanced in determining pumping
cy, but the efficiency of the well often goes
ed. Many wells operate at 25 to 30% effi-
while 80% can be achieved through design-
ell correctly. Increasing costs of fuel have
major factor in the move toward well
cy updating. A well screen plays the most
nt part in development as it must permit
ucted access to the formation for that de-
ent or backwashing action. It is very diffi-
expect good development in slotted pipe
of the limited open area (3 to 5 %). It is
ficult through screens of louver or bridge
ign (11-17% open area) because the slots
ched in a design that does not permit
m direct access to the formation for devel-
. A pumping test will tell if the pumping
evel in the well itself is true to what it is just
the casing. This will determine well effi-
The test should run 24 hr with measure-
aken at predetermined times to plot data at
e well being tested and the observation
creen design, proper selection of gravel
nd borehole diameter will all affect the
o develop the well and will determine cost
cy. (Baker-IVI)
034

HER TAKES BULL BY HORNS; BUILDS
R PLANT AND CONVERTS TO PIVOTS,
mary bibliographic entry see Field 4A.
035

Hydraulics

FLOW UPSTREAM OF VERTICAL
E GATES,
a Univ., Edmonton. Dept. of Civil Engi-
.
aratnam, and J. A. Humphries.
l of Hydraulic Research, Vol. 20, No. 5, p
7, 1982. 6 Fig, 2 Tab, 7 Ref.

ptors: *Sluice gates, *Velocity distribution,
ure distribution, Fluid mechanics, Hydrau-
ddies, Hydrodynamics, Upstream, Hydraulic
.

haracteristics of the flow immediately up-
of a vertical sluice gate located perpendicu-
cross the full width of a glass-sided rectan-
channel were studied to see if it would be
e to develop some simple relations for pre-
the main flow characteristics for practical
he surface eddy was studied by injecting dye
e flow from a hypodermic needle. The ve-
profiles upstream of the gate were measured
calibrated pitch probe. Holes, connected to
ometer board, were drilled in the channel
the upstream side of the gate to measure the
re field. The accelerating flow under the
auses a pressure defect on the bed which
s a distance of 5a (where a is the gate
g) upstream of the gate. As the water flows
he gate, the velocity profiles change from an
uniform velocity distribution upstream to an almost uniform velocity distribution at the vena contracta downstream from the gate through some interesting configurations. The thickness of the surface eddy at the gate is about 0.28 times the depth of the approaching flow (H1); its length in terms of the square root of (surface tension/(mass density of water x acceleration due to gravity)) is a function of mainly a/H1. Near the thin upstream end of the surface eddy, the flow inside the surface eddy was laminar whereas near the downstream end of the surface eddy, the flow was very turbulent but the dye stream still showed the extent of the recirculation region. (Collier-IVI)
W85-00524

INTEGRITY OF INTERCONNECTED WATER SYSTEMS,
California Univ., Irvine. School of Engineering.
R. Schinzinger, L. D. Nyirenda, A. Peiravi, and M. Saeb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 195817, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center Completion Report, Univ. of California, Davis, October 1983. 33 p, 7 Fig, 8 Tab, 14 Ref, 1 Append. Project No. OWRT-A-086-CAL (1).

Descriptors: *Water conveyance, *Disasters, *Water supply systems, Aqueducts, Conveyance structures, Flow systems, Networks, Network design, Pipes, Systems engineering, Water distribution, Water transport.

Various theoretical and applied network theory approaches for assessing the reliability of water delivery systems are examined including signal flow methodology and connectivity as well as structural integrity in a utility-type power system network. Problems of topological and flow reliability and associated sensitivity analyses are discussed. Various criteria are applied to identify critical and structurally important components, including a method of calculating frequency of system failure. Various concepts are illustrated by simple examples. (Snyder-California)
W85-00611

BEHAVIOUR OF A CONVERGING-CHANNEL BREAKWATER; THEORY AND EXPERIMENT,
Queensland Univ., Brisbane (Australia). Dept. of Mechanical Engineering.
D. I. Pullin, and P. N. Joubert.
Journal of Fluid Mechanics, Vol. 141, p 123-138, April, 1984. 13 Fig, 8 Ref.

Descriptors: *Breakwaters, *Converging channel breakwaters, *Energy transmission, Wavebreakers, Waves, Mathematical equations, Transmitted waves, Floating breakwaters, Hydraulic design, Wavelength.

The energy-transmission characteristics of an array open convergent-channel-type wavebreakers to a normally incident wavetrain is studied experimentally and theoretically. A model of the wavebreaker transmission response to a sinusoidal incident wavetrain on a constant-depth ocean is developed as a boundary-value problem within the framework of linearized water-wave theory. This results in an integral equation based on a Green-function solution to the Helmholtz equation, which is solved numerically for each of several wavebreaker geometries over a range of incident wavelengths. Experiments on fixed model wavebreakers performed in an open wave tank are described, and results are compared with the numerical predictions. Theory and experiment indicate that the convergent-channel design is effective in attenuating the transmitted wave at resonant values of the incident wavelength lambda that scale on the channel length L. Forces experienced by each half-wavebreaker are largely transverse; the calculated longitudinal forces for the fixed breakwater are small compared to those on a solid wall except at one resonance near L/lambda = 0.5. Experiments indicate that this last condition does not occur for a floating breakwater, where the corresponding transmission of wave energy is high. (Author's abstract)
W85-00713

REFRACTION-DIFFRACTION MODEL FOR WEAKLY NONLINEAR WATER WAVES,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
P. L.-F. Liu, and T.-K. Tsay.
Journal of Fluid Mechanics, Vol. 141, p 265-274, April, 1984. 4 Fig, 1 Tab, 14 Ref.

Descriptors: *Refraction, *Diffraction, *Mathematical models, *Water waves, Wave convergence, Slopes, Nonlinear theory.

A refraction-diffraction model was developed based on the Stokes-wave theory. Assuming that the bottom slope is smaller than the wave slope, an evolution equation is derived for the wave envelope which is a nonlinear Schrodinger equation with variable coefficients. The model equation is used to investigate the wave convergence over a semicircular sloping topography (which acts as a focusing lens). Numerical results are compared with experimental data from a wave tank. Nonlinear effects, which generate higher-harmonic wave components, are definitely important in the focusing zone. In spite of the data scattering, the agreement between the nonlinear theory and experimental results is reasonably good. The linear theory tends to overpredict the first-harmonic wave amplitude, and is unable to calculate the second-harmonic component, which is significant in this study. (Moore-IVI)
W85-00715

EXCITATION OF LONG NONLINEAR WATER WAVES BY A MOVING PRESSURE DISTRIBUTION,
Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
T. R. Akylas.
Journal of Fluid Mechanics, Vol. 141, p 455-466, April, 1984. 3 Fig, 8 Ref. ONR project NR 062-742.

Descriptors: *Water waves, *Pressure distribution, *Wave propagation, Mathematical equations, Wave amplitude, Solitons, Asymptotic behavior.

A study is made of the wave disturbance generated by a localized steady pressure distribution travelling at a speed close to the long-water-wave phase speed on water of finite depth. The linearized equations of motion are first used to obtain the large-time asymptotic behavior of the disturbance in the far field; the linear response consists of long waves with temporally growing amplitude, so that the linear approximation eventually breaks down owing to finite-amplitude effects. A nonlinear theory is developed which shows that the generated waves are actually of bounded amplitude, and are governed by a forced Korteweg-de Vries equation subject to appropriate asymptotic initial conditions. A numerical study of the forced Korteweg-de Vries equation reveals that a series of solitons are generated in front of the pressure distribution. (Author's abstract)
W85-00716

NEW NUMERICAL MODEL AND TECHNIQUE FOR WATERHAMMER,
National Research Inst. of Agricultural Engineering, Yatabe (Japan). Dept. of Hydrological Engineering.
M. Shimada, and S. Okushima.
Journal of Hydraulic Engineering, Vol. 110, No. 6, p 736-748, June, 1984. 2 Fig, 6 Tab, 8 Ref, 1 Append.

Descriptors: *Waterhammer, *Mathematical models, Pipelines, Mathematical equations, Second-order models, Newton-Raphson method, Steady flow.

How efficiently a second-order model is handled is analyzed for simplified equations governing waterhammer appearance in piping systems. A series solution method and a Newton-Raphson method with new calculation steps are proposed, which are efficient numerical methods, through omitting trivial terms computed within a truncation error. With fewer calculations than required previously, the

proposed methods can give a solution with a required accuracy without any iteration. The second-order model, therefore, offers more accurate and efficient methods than those offered by a first-order model. However, the second-order model causes an error in computing steady flows; ways to remove or reduce this error are shown. The validity of the analyses is examined by numerical computations in which system parameters are varied over a wide range of parameters. (Author's abstract)
W85-00727

NUMERICAL ALTERNATIVES IN TRANSIENT STREAM RESPONSE,
California Univ., Berkeley. Dept. of Civil Engineering.
R. J. Sobey.
Journal of Hydraulic Engineering, Vol. 110, No. 6, p 749-772, June, 1984. 7 Fig, 39 Ref, 1 Append.

Descriptors: *Mathematical models, *Transient stream response, Prediction, Hydraulic engineering, Hydrodynamics, Grid resolution, Mass transport, Moving coordinate system.

A fundamental problem in the numerical prediction of transient stream response is identified as grid resolution. As it is unrealistic to expect predictive performance beyond the Nyquist limit, a successful algorithm must involve a compromise between adequate resolution and acceptable computational effect. Difficulties are rarely encountered in the numerical estimation of the hydrodynamic response, but serious numerical dispersion and solution oscillations frequently corrupt numerical estimates of the mass transport response. The numerical solution difficulties are traced to the discrete approximation to the convective term in an Eulerian framework, regardless of the numerical method adopted. The impact of grid resolution is quantified by Fourier response factor computations and numerical experiments for typical algorithms. Higher order nodal continuity and moving coordinate systems are identified as appropriate solution techniques for the mass transport response, the moving coordinate system approach being shown to be particularly attractive. (Author's abstract)
W85-00728

FIELD MEASUREMENTS ON SIDE ARMS OF LAKE ANNA, VA.,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
E. E. Adams, and S. A. Wells.
Journal of Hydraulic Engineering, Vol. 110, No. 6, p 773-793, June, 1984. 8 Fig, 4 Tab, 15 Ref, 2 Append.

Descriptors: *Side arms, *Lake Anna, *Virginia, *Heat transfer, Cooling ponds, Water circulation, Abutments, Shorelines, Bathymetry, Stratification, Reservoirs, Exchange flow.

Cooling lakes formed by damming a river or stream often include long dendritic backwater areas called side arms. An extensive set of field measurements has been collected on Elk Creek and Millpond Creek side arms which are attached to Lake Anna, a cooling lake which receives waste heat from a nuclear power station. Important features of each side arm are highway bridge abutments, located near the entrance to the main lake. These abutments restrict exchange flow to and from the side arms, thus decreasing thermal performance. The data are consistent with the basic pattern of two layer exchange flow postulated in several mathematical models of side arm circulation. Analysis suggests that circulation is controlled in large part by inertial resistance and head loss caused by the constrictions formed by highway bridge abutments. In addition to the entrance constrictions, flow is further complicated by irregular shorelines and bathymetry within the side arm and by transient forcing, including seasonal stratification, in the main lake outside the side arm. Both side arms appear to achieve about 50% of the heat loss expected for equivalent, unconstricted side arms of uniform rectangular cross section. The impact on cooling efficiency of such constrictions should be considered in future design or modification of cooling impoundments. While the two side arms have similar surface area and entrance cross sections, the greater average depth of Millpond creek appears to be responsible for more efficient circulation of the side arm based on given entrance conditions. (Moore-IVI)
W85-00729

TWO-DIMENSIONAL SURGES AND SHOCKS IN OPEN CHANNELS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
N. D. Katopodes.
Journal of Hydraulic Engineering, Vol. 110, No. 6, p 794-812, June, 1984. 11 Fig, 13 Ref, 1 Append.

Descriptors: *Open channels, *Surges, *Shock waves, *Mathematical equations, Parasitic waves, Dissipation, Discontinuous flow, Galerkin method.

The finite element method based on the classical Galerkin formulation produces very poor results when applied to discontinuous channel flow, although the complex geometry of most practical problems makes the use of finite elements very desirable. A variance of the Galerkin scheme for conservation laws in two-dimensional, nearly horizontal flow, which exhibits a remarkable shock-capturing ability, is presented. The parasitic waves in the vicinity of the discontinuity commonly present in the Galerkin solution are selectively dissipated, and, in fact, the sharpness of the front is improved by the addition of the dissipation mechanism. The method is based on discontinuous weighting functions which introduce upwind effects in the solution while maintaining central difference accuracy. No arbitrary parameters are needed because the disspitation level is selected analytically. No higher order derivatives appear in the governing equations which simplifies the construction and execution of the scheme. Results are presented for several flow situations that give rise to spontaneous formation of surge and shock waves in two space dimensions. The accuracy of computation is verified by comparison with analytical solutions and by continuous monitoring of the conservation properties of the model. (Author's abstract)
W85-00730

SPREADING LAYER OF TWO-DIMENSIONAL BUOYANT JET,
Michigan State Univ., East Lansing. Dept. of Civil and Sanitary Engineering.
R. B. Wallace, and S. J. Wright.
Journal of Hydraulic Engineering, Vol. 110, No. 6, p 813-828, June, 1984. 9 Fig, 2 Tab, 11 Ref. NSF grant NSF-ENG-78-05445.

Descriptors: *Buoyant jets, *Mathematical equations, *Spreading layers, Jets, Density stratification, Mixing, Dilution, Effluents.

Buoyant jets are produced by the discharge of effluent through ports in a diffuser designed to encourage the effluent to mix with ambient fluid. A density stratification in the ambient fluid can cause the effluent to stop rising and spread laterally away from the buoyant jet axis before reaching the water surface. Prediction of this behavior is important because it affects both location and concentration of the pollutant in the region near the diffuser. A two dimensional buoyant jet, discharged vertically into a stratified fluid with no crossflow, is considered. Simple equations are developed with dimensional analysis to predict the location and concentration of effluent as it begins to spread horizontally from the buoyant jet axis; the dimensionless independent variables are determined by a stratification parameter and the jet-source flux of either momentum or buoyancy. Scale model tests verify the form of these equations and provide experimental values of coefficients not provided by the dimensional analysis. The results obtained using the simple equations are easier to use than the integral equations, and they are preferred to results obtained with the integral equations because they inherently include the influence of the complicated mean flow patterns and mixing near the maximum height of rise. (Moore-IVI)
W85-00731

SUBMERGED DISCHARGE RELATIONS OF LOGARITHMIC WEIRS,
Poznan Technical Univ. (Poland) Inst of Environmental Engineering.
H. Majcherek.
Journal of Hydraulic Engineering, Vol. 110, No. 6, p 840-846, June, 1984. 4 Fig, 2 Ref.

Descriptors: *Flow discharge, *Weirs, *Submerged discharge, Design criteria, Logarithmic discharge, Free falling weirs, Mathematical equations.

Previous studies of free falling weirs with a logarithmic discharge characteristic were intended to derive equations that describe the notch shape for specified discharge characteristics. How far the submersion of weirs affects the discharge characteristics of free falling weirs was investigated. The submersion correction factor that characterizes the effect of weir submersion on the change in its characteristic is a monotonically increasing function of the argument h/H and a monotonically decreasing one of the argument a/H. This function makes it possible to replace two equations which have a complicated structure with an approximate equation, thereby simplifying the computation of the discharge values. The coefficient of discharge for the free falling weirs under investigation is a function of nappehead. As a result of analyzing theoretical solutions and experimental measurements, it has been shown that the acceptance of a constant value for this coefficient does not cause essential variations in the predetermined discharge characteristic. The formulas as derived help make it possible to use logarithmic submerged weirs for determining discharge. (Baker-IVI)
W85-00733

8C. Hydraulic Machinery

RENOVATION OF A MAJOR RESERVOIR,
Male (C.T.) Associates, Schenectady, NY.
G. R. Male, and R. J. Lilley, Jr.
Public Works, Vol. 115, No. 6, p 70-73, June, 1984. 4 Fig.

Descriptors: *Reservoirs, *Renovation, *Bevis Hill Reservoir, *New York, Construction, Repairs, Gate valves, Pipes, Check valves, Butterfly valves, Telemetry.

For almost 70 years the Bevis Hill Reservoir in Niskayuna, Schenectady County, New York has stored finished water for the City of Schenectady and surrounding communities without major repair or shutdown. Recently during periods of high flow the water has become discolored. A visual inspection - underwater and surface - revealed the extremely poor operating condition of several gate valves in the division wall and at the inlets and outlets. The initial concept of the renovation was to drain, remove the accumulated sedimentation, and disinfect the reservoir. Valve replacement and piping revisions were included after the inspection revealed that several of the gate valves were inoperative and that the existing outlet piping arrangement made it impossible to maintain the valves without removing the entire reservoir from service. Approximately $330,000 worth of work was then scheduled to be performed while the reservoir was drained. The major improvements made included removal of the wyed inlet line and replacing it by two 24-in inlet mains, each with a new check valve and butterfly valve; installation of new check valves and butterfly valves on the outlets, allowing for proper maintenance and repair; removal of the altitude valve and the use of an existing liquid level telemetering system connected to the water treatment plant to control the level of the reservoir; and the installation of silt stops on the outlets. (Baker-IVI)
W85-00736

RARITAN RIVER BASIN RESERVOIR SYSTEM HYDROELECTRIC FEASIBILITY STUDY: ROUND VALLEY AND SPRUCE RUN RESERVOIRS.
Cumberland County Planning Board, Bridgeton, NJ.

primary bibliographic entry see Field 6C.
5-00826

IGATION PUMPING WITH WIND ERGY ONLY,
icultural Research Service, Bushland, TX. servation and Production Lab.
N. Clark.
icultural Engineering, Vol. 64, No. 12, p 15-18, ember, 1983. 7 Fig.

criptors: *Pumps, *Wind energy, *Irrigation, lraulic machinery, Wind, Irrigation require-ts, Progressive cavity pumps.

ause of the need for an independent, high-me pumping system powered by the wind, a d alone windpowered pumping system has n designed. Irrigation pumping requires large unts of power because crops like corn, rice, on, and wheat transpire 1 L/s per hectare (0.1 's per acre) of water. This is the amount of er that must be available throughout the grow-season. Irrigators prefer to have between 30 50 L/s (7.9 and 13.2 gal/s) available from their ps. Two different but related studies have been ducted relating to stand alone mechanical ping. A detailed evaluation of all pump types performed and each pump was evaluated for ching the operating characteristics of wind tur-s. The other study was a field test of a mechan-system using a progressive-cavity type pump. presently manufactured pump proved superior use with a wind turbine when operating in a d alone model. A progressive cavity pump was alled on a 4-kW (5-hp) wind turbine for field ng of a stand alone pumping system. Results wed that power and rotational speed to the p increased with windspeed and that power ged from 0 to 3.6 kW (4.8) while pump speed nged from 500 to 900 r/min. Since flow was portional to pump speed, the flow varied 5 to L/s (1/3 to 2.9 gal/s) or by a factor of 2. The d powered pumping system stalled in wind-eds below 9 m/s (30 ft/s), thereby making it of e value during much of the irrigation season. ker-IVI)
5-00943

. Rock Mechanics and Geology

FECTS OF AQUEOUS CHEMICAL ENVI-NMENTS ON CRACK PROPAGATION IN ARTZ,
ana Univ. at Bloomington. Dept. of Geology.
. Dunning, D. Petrovski, J. Schuyler, and A. ens.
rnal of Geophysical Research, Vol. 89, No. B6, 15-4123, June, 1984. 4 Fig, 2 Tab, 31 Ref. NSF nt EAR-80-06539.

criptors: *Quartz, *Crack propagation, cks, *Aqueous environments, Rock mechanics, mical properties, Zeta potential, Surface rgy, Branching cracks.

chemical role of water and other aqueous ironments in crack propagation was examined series of crack propagation tests in natural and hetic quartz. The potential roles of surface free rgy reduction and zeta potential (surface elec-tatic potential) in chemical weakening were cifically examined by running the crack propa-on tests in the presence of six surface active eous environments which varied substantially hese parameters with respect to quartz. Calori-ric and electrophoresis tests were also under-en in order to determine the degree of reduction he surface energy of quartz produced by each mical environment and the zeta potential be-en each environment and quartz. It was found there was a moderate correlation between reduction of the crack propagation stress of quartz and the degree by which the surface energy was reduced in the presence of a particular environment. No such correlation was found with respect to zeta potential. It was also observed that some of the chemical environments appeared to produce highly branched cracks in quartz. This branching effect is probably related to the velocity of crack propagation. (Author's abstract)
W85-00723

8F. Concrete

PHYSICO-MECHANICAL CHARACTERISTICS OF HYDRATING TETRACALCIUM ALUMINOFERRITE SYSTEM AT LOW WATER:SOLID RATIOS,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
V. S. Ramachandran, and J. J. Beaudoin.
Journal of Chemical Technology and Biotechnology, Vol. 34A, No. 4, p 154-160, May, 1984. 9 Fig, 9 Ref.

Descriptors: *Portland cements, *Hydration, *Tetracalcium aluminoferrite, *Gypsum, Cements, Ettringite, Sulfoaluminate, Temperature, Porosity.

Tetracalcium aluminoferrite (C4AF) was mixed with 0, 5, 10, 20, and 30% gypsum and was was hydrated at 25 or 80 degrees C, either as discs (formed at pressures of 140 and 690 MPa to obtain an effective water:solid ratio of 0.08 and 0.13, respectively) or in powder form at water:cement ratios of 0.5 and 1.0. Hydration products formed at periods ranging from a few minutes to 7 days were identified and estimated. The formation of hexagonal hydrate, cubic hydrate, ettringite, low sulfoaluminate series and their interconversions was primarily dependent on gypsum content, temperature, and initial water:solid (w/s) ratio. Ettringite need not necessarily be a precursor of the formation of low sulfoaluminate hydrate when hydration is carried out at a very low w/s ratio at 80 degrees C. The mechanism of formation of hydration products has to be taken into consideration to explain differences in strength development at different temperatures and similar porosities. Ettringite in C4AF+CSH2 systems formed at low water:solid ratios need not necessarily be detrimental to strength development. Low sulfoaluminate formed directly or through conversion of ettringite increases porosity and decreases strength. (Moore-IVI)
W85-00696

8G. Materials

TREATING AND MONITORING CORROSION AND SCALE IN DISTRIBUTION SYSTEMS,
Calgon Corp., Pittsburgh, PA.
For primary bibliographic entry see Field 5F.
W85-00551

8I. Fisheries Engineering

SEASONAL DISTRIBUTION AND AGGREGATION BEHAVIOR OF GOLDFISH (CARASSIUS AURATUS L.) IN EASTERN WASHINGTON LAKES: NEW TECHNOLOGY FOR CONTROL OF GOLDFISH POPULATIONS BASED ON THEIR BEHAVIORAL ECOLOGY,
Eastern Washington Univ., Cheney. Dept. of Biology.
A. Scholz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84 195825, Price codes: A03 in paper copy, A01 in microfiche. Water Research Center Completion Report, Washington State Univ., Pullman, September 1983. 23 p, 7 Fig, 1 Tab, 30 Ref.

Descriptors: *Goldfish, Fish behavior, Rotenone, *Electrofishing, Water quality, Eutrophication, Seasonal distribution, *Washington, Lakes, Fish aggregation.

Goldfish (Carrassius auratus L.) are a problem in eastern Washington because they are becoming established in lakes that are managed as rainbow trout fisheries. Goldfish affect trout adversely and also contribute to increasing the rate of eutrophication and reducing the water quality of lakes. In eastern Washington rough fish populations are normally controlled by whole-lake application of rotenone; however, rotenone is not effective in eradicating goldfish. The objective of the present study was to develop new management technology for goldfish control. In observational, mark-recapture, and biotelemetry investigations conducted at Clear and Medical Lakes, Spokane County, Washington goldfish in both lakes form aggregations at particular locations at certain times of the year. In both lakes, behavior patterns are seasonally repetitive and predictable, the locations of the aggregation sites are fixed, and all or most of the goldfish in the lakes are concentrated at these sites. These results have application for managing goldfish because they should be easier to remove at times when they are aggregated at a few sites than when they are dispersed throughout the lakes. In early spring, aggregated goldfish are extremely torpid and highly susceptable to electrofishing. In a goldfish removal project conducted at Medical Lake in the spring of 1983, 17,837 goldfish were removed by electrofishing over a period of 7 days with an average trip of 4.8 h duration and 5.7 crew members. The efficiency of the procedure was quantified by comparing goldfish county and gill net catch per unit effort data between the summers of 1982 and 1983: an estimated 95-99% of the goldfish were removed.
W85-00610

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

ACID PRECIPITATION- AN ANNOTATED BIBLIOGRAPHY.
Geological Survey, Albany, NY. Water Resources Div.
Available from Distr. Br., USGS, 604 S. Pickett St., Alex., VA 22304. U.S. Geological Survey Circular 923, 1984. 282 p, 1 Tab, 8 Ref.

Descriptors: *Bibliographies, *Acid rain, Chemistry of precipitation, Acidic soils, Acid streams, Literature review, Acidic atmospheric deposition.

This collection of 1660 bibliographies references on the causes and environmental effects of acidic atmospheric deposition was compiled from computerized literature searches of earth-science and chemistry data bases. Categories of information are (1) atmospheric chemistry (gases and aerosols), (2) precipitation chemistry, (3) transport and deposition (wet and dry), (4) aquatic environments (biological and hydrological), (5) terrestrial environments, (6) effects on materials and structures, (7) air and precipitation monitoring and data collection, and (8) modeling studies. References date from the late 1800's through December 1981. The bibliography includes short summaries of most documents. Omitted are unpublished manuscripts, publications in press, master's theses and doctoral dissertations, newspaper articles, and book reviews. Coauthors and subject indexes are included. (USGS)
W85-00864

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DOCUMENTS

PB85-910203

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 18, NUMBER 3
MARCH 1985

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AT URBANA-CHAMPAIGN

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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 18, NUMBER 3
MARCH 1985

W85-01118 -- W85-01631

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1985.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

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SUBJECT FIELDS AND GROUPS

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01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

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10 SCIENTIFIC AND TECHNICAL INFORMATION

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SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

VATER CYCLE

'RIBUTION OF BENTHIC INVERTE-TES ALONG A DISTURBED SECTION OF LA TROBE RIVER, VICTORIA: AN LYSIS BASED ON NUMERICAL CLASSI-ATION,
onal Museum of Victoria, Melbourne (Austra-

archant, P. Mitchell, and R. Norris.
ralian Journal of Marine and Freshwater Re-h, Vol. 35, No. 3, p 355-374. 3 Fig, 7 Tab, 27

riptors: *La Trobe River, *Victoria, thos, *Invertebrates, *Species diversity, Simi- indices, Ecological effects, Population densi- hysicochemical properties, Suspended solids, luctivity, Dams, Heated water, Wastewater, ric powerplants, Water pollution effects, Pulp es.

auna of the La Trobe River, Victoria, Austra- vas surveyed on a reach that is impacted by arges of heated cooling water and releases of effluent from power stations, effluent from a ge treatment plant, effluent from a pulp mill, dam and weirs. Additionally, there are dif- lischarges from agricultural land. The benthic tebrates of the banks and main channel at 10 along 100 km of the lower reach were quanti- ly sampled every two months between May and March 1981; 23 chemical variables were ured concurrently. In all, 337 taxa were col- d. Normal and inverse classifications of the l data with two similarity indices (Czekan- i, Canberra Metric) indicated that the upper- two sites (upstream of the industrial areas) a rich fauna were clearly distinct from the depauperate downstream sites. Multiple dis- nant analysis of the previously established site os with 17 of the chemical variables indicated igh values for conductivity distinguished the downstream site groups, which had the poor- una; the effect of this factor on the fauna was ently indirect. The analysis also indicated a decrease in suspended solids at site groups impounded section and an increase in nutri- t a site immediately downstream of the input ated sewage were associated with changes in auna. The release of heated water (< 25 es C) from a power station at one of the sites e impounded section had little effect on the . (Collier-IVI)
01165

General

ERS OF THE EARTH,
ersity Coll., Dublin (Ireland). Dept. of Civil neering.
I. Dooge.
ological Sciences Journal, Vol. 29, No. 2, p 76, June, 1984. 9 Fig, 3 Tab, 68 Ref.

riptors: *Hydrology, *Geophysics, *Hydro- cycle, *Hydrologic models, Paleohydrology, an population, International agreements, ematical models, International commissions, ment areas.

ology and paleohydrology are considered in ontext of the solar system, the water-related s of geophysics, the human environment, and national scientific cooperation. Global water ces and dynamic hydrological models are y described. Many of the modern estimates of l or regional fluxes of precipitation, evapora- and runoff have been presented as closed ces thus ignoring the effects of changes in sea level or in the ice caps which could be large in comparison with the components of vater balance of more immediate concern in logy. On a catchment scale, there is a large y of hydrological models. Hydrological ls can be classified (based on the nature of data appropriate to them) into probabilistic ls, stochastic models, and deterministic ls. Based on knowledge of system structure, nic models may be divided into (a) black-box models which link the input and output of a basin module or of a total basin, (b) regression models linking hydrological variables, (c) conceptual models of hydrological processes, and (d) models based on the application to hydrological processes of the principles of mathematical physics. Also, at each time and space scale, a different type of model is needed. (Collier-IVI)
W85-01135

REGULATION OF THE WHITE NILE,
G.K. Associates, Wirral (England).
G. W. Kite.
Hydrological Sciences Journal, Vol. 29, No. 2, p 191-201, June, 1984. 3 Fig, 2 Tab, 5 Ref.

Descriptors: *White Nile, *Regulated flow, *Nile River, *Lake Victoria, *Lake Kyoga, *Lake Mobuto Sese Seko, *Mathematical models, Owens Falls dam, Kyoga Nile, Riparian land, Model studies, Water resources development.

Since the early twentieth century, plans have been proposed to regulate and control the lakes and rivers of the Nile River basin to increase the reliability and usefulness of river flows. Investigations were made into regulation of the White Nile during Phase III of the WMO/UNDP Hydrometeorological Survey of the catchments of Lakes Victoria, Kyoga and Mobuto Sese Seko. A number of historical regulation plans were evaluated using the mathematical model developed by the project. The objectives of a new regulation plan were assumed to be: to maximize the power output at the Owens Falls dam; to maximize power potential in the Kyoga Nile; to meet the forseeable water resources requirements of the riparian countries of the Upper Nile basin; to provide maximum guaranteed annual yield downstream of Lake Mobutu; to minimize impact on riparian people. A series of new plans was devised, utilizing the best parts of the historic plans and attempting to improve upon their performances, although, due to lack of data, economic and ecological effects were not included. (Collier-IVI)
W85-01137

RAINFALL-RUNOFF-SEDIMENT YIELD RELATION BY STOCHASTIC MODELLING,
Consiglio Nazionale delle Ricerche, Turin (Italy). Ist. di Ricerca per la Protezione Idrogeologica nel Bacino Padano.
For primary bibliographic entry see Field 2J.
W85-01138

COMPARATIVE PERFORMANCE OF TWO RUNOFF MODELS ON GRASSLAND WATERSHEDS,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
C. S. Pathak, F. R. Crow, and R. L. Bengtson.
Transactions of the American Society of Agricultural Engineers, Vol. 27, No. 2, p 397-402 and 406, March-April, 1984. 5 Fig, 6 Tab, 10 Ref.

Descriptors: *Model studies, *Rainfall-runoff relationships, USDAHL model, CREAMS model, Breakpoint rainfall option, Grassland, Watersheds, Simulation, Hydrologic models.

The relative performances of the USDAHL model and the CREAMS hydrology model (Breakpoint rainfall option) were compared on four grassland watersheds ranging in area from 6.3 to 83 ha. The USDAHL model simulated monthly runoff more accurately than the CREAMS model on all watersheds. Watershed size and soil homogeneity were factors in simulation accuracy. Both models simulated monthly runoff more accurately on the two small watersheds (6.3 and 7.8 ha) with relatively homogeneous soils than on the two larger watersheds (37 and 83 ha) with heterogeneous soils. Compared with observed runoff the CREAMS model underestimated monthly runoff during the cool season months and overestimated during the summer months, especially in August. The simulation errors were especially serious on the larger watersheds. (Baker-IVI)
W85-01183

MODIFICATION OF A STEVENS TYPE-F RECORDER FOR SIMULTANEOUS RECORDING OF RAINFALL AND WATER LEVEL,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 7B.
W85-01191

RETURN PERIOD ANALYSIS OF MINIMUM EVENTS USING SLIDING POLYNOMIALS,
Agricultural Research Service, Washington, DC.
For primary bibliographic entry see Field 6A.
W85-01194

SURFACE WATERS, AN EXCLUSIVE FEATURE OF OUR PLANET (LES EAUX DE SURFACE, UNE EXCLUSIVITE DE NOTRE PLANETE),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
D. Vischer.
Journal of Hydraulic Research, Vol. 21, No. 1, p 45-50, 1983. 1 Fig, 2 Tab, 2 Ref. In English and French.

Descriptors: *Surface water, Solar system, Earth, Planets, Water supply, Ice, Water vapor.

The earth's water supply remains constant, being recycled again and again for reuse by man and other creatures on this planet. The world's water resources in gaseous, liquid and solid form amount to some 1,400 million cu km, or .13% of the total volume of the earth. By far the greatest part of the resource, 97.8%, is present in liquid form. Moisture in the soil and groundwater account for only 0.005 and 0.61% of this total respectively. The vast majority is present as surface waters making up streams, rivers, lakes and oceans. So far as is known, the earth is the only planet that contains water in all its three phases and in particular, in liquid form in extensive surface waters. (Baker-IVI)
W85-01230

RAINFALL-RUNOFF MODEL FOR SMALL BASINS (EIN NIEDERSCHLAG/ABFLUSS-MODELL FUR KLEINE EINZUGSGEBIETE),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
P. Zuidema, and E. Kolla.
Wasser, Energie, Luft, Vol. 75, No. 5/6, p 124-125, January, 1983. 4 Fig, 1 Ref.

Descriptors: *Rainfall-runoff relationships, *Model studies, Small watersheds, Storm runoff, Floods, Groundwater.

A storm runoff model was developed for small catchments with substrata of low permeability. The model was applied to three small basins: Rietholzbach in St. Gallen Canton; Grosser Runs in Schwyz Canton; and Rotenbach, in Freiburg Canton. The model can be applied to practical problems such as flooding and groundwater relationships. (Moore-IVI)
W85-01268

HYDROLOGICAL MODEL FOR SMALL AGRICULTURAL CATCHMENT AREAS (MODELISATION DES EVENEMENTS AVERSES-CRUES SUR LES PETITS BASSINS VERSANTS),
Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Genie Rural.
J.-F. Jaton.
Wasser, Energie, Luft, Vol. 75, No. 10, p 245-247, January, 1983. 5 Fig, 4 Ref.

Descriptors: *Hydrologic models, *Agricultural watersheds, Rainfall-runoff relationships, Model studies, Overland flow.

A hydrological model is presented for small agricultural catchment areas. Use of a point-rain as input and a time-dependent coefficient of overland

runoff are proposed. Transformation from rainfall to runoff is accounted for mathematically; the corresponding functions are based on a short series of observation. (Author's abstract)
W85-01269

EFFECT OF SOIL MOISTURE ON THE SHORT-TERM CLIMATE AND HYDROLOGY CHANGE - A NUMERICAL EXPERIMENT,
National Oceanic and Atmospheric Administration, Princeton, NJ. Geophysical Fluid Dynamics Lab.
For primary bibliographic entry see Field 8G.
W85-01335

NONPARAMETRIC TREND TEST FOR SEASONAL DATA WITH SERIAL DEPENDENCE,
Geological Survey, Reston, VA.
R. M. Hirsch, and J. R. Slack.
Water Resources Research, Vol. 20, No. 6, p 727-732, June, 1984. 2 Fig, 2 Tab, 17 Ref.

Descriptors: *Hydrologic data, *Statistical methods, *Trends, Seasonal variation, Nonnormality, Censoring, Serial dependence.

Statistical tests for monotonic trend in seasonal (e.g., monthly) hydrologic time series are commonly confounded by some of the following problems: nonnormal data, missing values, seasonality, censoring (detection limits), and serial dependence. An extension of the Mann-Kendall test for trend (designed for such data) is presented. Because the test is based entirely on ranks, it is robust against nonnormality and censoring. Seasonality and missing values present no theoretical or computational obstacles to its application. Monte Carlo experiments show that, in terms of type I error, it is robust against serial correlation except when the data have strong long-term persistence (e.g., ARMA (1,1) monthly processes with phi $>$ 0.6) or short records (ca 5 years). When there is no serial correlation, it is less powerful than a related simpler test which is not robust against serial correlation. (Author's abstract)
W85-01347

SENSITIVITY ANALYSIS OF A DRAINAGE SIMULATION MODEL,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
R. S. Kanwar, and H. P. Johnson.
Water Resources Bulletin, Vol. 20, No. 3, p 339-342, June, 1984. 3 Fig, 1 Tab, 4 Ref.

Descriptors: *Simulation, *Computer models, *Sensitivity analysis, *Drainage, Hydrologic models, Soil-water-plant relationships, Nitrogen, Soil water.

The integration of various processes representing a hydrologic system with a model structure to account for the time and space variability of the hydrologic components is a major problem in computer simulation modeling. A sensitivity analysis of a computer model, simulating major water and nitrogen processes of a soil-water-plant-climatic system on an annual basis, was conducted to determine how the model reacts to the variations in selected hydrologic and nitrogen parameters. As major output variables, total subsurface drain volume and cumulative nitrate loss with subsurface drain water were selected for the sensitivity analysis. The sensitivity analysis has shown that model predictions are more sensitive to hydrologic processes and parameters than to nitrogen parameters. Initial soil moisture content in the soil profile has the largest effect on the drain flow volume, and nitrate losses with subsurface drainage water. Soil moisture characteristics need to be investigated throughly to provide better simulation values. (Moore-IVI)
W85-01373

CASE FOR CARBON DIOXIDE,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 4C.
W85-01440

AMAZON BASIN: A SYSTEM IN EQUILIBRIUM,
Centro de Energia Nuclear na Agricultura, Piracicaba (Brazil).
E. Salati, and P. B. Vose.
Science, Vol. 225, No. 4658, p 129-138, 13 July, 1984. 2 Fig, 7 Tab, 83 Ref.

Descriptors: *Environmental effects, *Deforestation, *Amazon River Basin, Hydrologic cycle, Andes Mountains, Cycling nutrients, Phosphorus, Nitrogen, Evapotranspiration, Precipitation, Erosion.

Despite very active deforestation of the last decade, the Amazon Basin is still primarily covered with trees and is a system in equilibrium. The main influx of atmospheric water into the basin comes from the Northern Hemisphere trade winds. Rainfall ranges from 1500 to 3000 mm annually, averaging about 2000 mm in the central Amazon. Examination of aerial studies and Landsat imagery has indicated no evidence of major north south movements of water vapor within the basin. Large scale deforestation, if continued at current rates, must inevitably affect the present equilibrium of the water cycle. An increase in peak flow associated with deforestation has been ascribed to the Peruvian upper Amazon. Real loss of water from the Amazon water cycle is likely to be the major factor determining potentially adverse climatic change in this region. The distribution of rainfall is also important. If a relatively small reduction in annual rainfall resulted in an extension of the dry period, this could have serious consequences. Most of the nutrients present, phosphorus and nitrogen, are found in the soil, and the remaining nutrient elements in the standing biomass. Some nutrient recycling occurs with little loss from the intact ecosystem. Continued large scale deforestation is likely to lead to increased erosion and water runoff with initial flooding in the lower Amazon, together with reduced evapotranspiration and ultimately reduced precipitation. Reduced precipitation in the Amazon could increase the tendency toward continentality and adversely affect climate and the present agriculture in south central Brazil. (Baker-IVI)
W85-01499

COUPLING OF GROUNDWATER AND OPEN-CHANNEL FLOW,
Waterloopkundig Lab., Delft (Netherlands).
J. I. Crebas, B. H. Gilding, and J. W. Wesseling.
Journal of Hydrology, Vol. 72, No. 3/4, p 307-330, June, 1984. 6 Fig, 1 Tab, 23 Ref.

Descriptors: *Groundwater movement, *Open-channel flow, *Hydrologic models, *Drainage, Model studies, Precipitation, Computer models, Hydrologic budget, Seepage.

A physically-based hydrologic response model was developed that incorporates drainage and the interaction of groundwater and open-channel flow; the model is called PREDIS for precipitation-discharge. The self contained computer module for groundwater flow which forms one of the couples for the exchange phenomena is based upon a standard two dimensional regional technique for groundwater modelling. The module for open channel flow which forms the other couple is a numerical scheme for solving the one-dimensional Saint-Venant flow equations. Two classes of exchange were distinguished. The first is concerned with the influence of minor conduits which require too much refinement to be modelled on an individual basis, but amalgamated make an important contribution to the water budget of a region on an areal basis. The second class of exchange is direct seepage from or into the larger waterways in which the flow is significant and is modelled as a distinct hydrologic process. A theory for treating the exchange phenomena was developed. The basis is formed by the Hooghoudt-Ernst formula of drainage design and the theory of additional seepage resistances. The main technical hurdle was the coupling of the two fundamentally incompatible numerical schemes for groundwater and open-channel flow in such a way that a conservative water balance is maintained. (Collier-IVI)
W85-01615

2B. Precipitation

MOST SEVERE RAINSTORM OF INDIA - A BRIEF APPRAISAL,
Indian Inst. of Tropical Meteorology, Poona.
O. N. Dhar, A. K. Kulkarni, and B. N. Mandal
Hydrological Sciences Journal, Vol. 29, No. 2, 219-229, June, 1984. 4 Fig, 3 Tab, 17 Ref.

Descriptors: *Rainstorms, *India, *Dharamp *Rainfall intensity, Flooding, Precipitation inte ty, Depth-area-duration analysis, Precipitation r

The rainstorm of 1-5 July 1941 which caused ceptionally heavy rains over the coastal belt north Konkan-south Gujarat has been analyz The center of this rainstorm was at Dharam (Surat district of Gujarat state) which recorded highest one-day rainfall of 987 mm on 2 July 19 The areal rain depths obtained from this rainsto for durations of one to three days over differ sized areas were found to exceed the highest a rain depths obtained in India. A comparison areal rain depths for this rainstorm with sim rain depths obtained from the most severe r storms of the USA and Australia showed th barring one or two small areas, the July 19 rainstorm gave higher rain depths up to an area 65,000 sq km for durations of one to three da The efficiency of this rainstorm was also det mined and found to be the highest among Indian and American rainstorms. Considering th the July 1941 rainstorm may be considered as of the world's most severe rainstorms. (Autho abstract)
W85-01139

RELATIVE EFFECTS OF U.S. POPULATI SHIFTS (1930-80) ON POTENTIAL HEATIN COOLING AND WATER DEMAND,
National Oceanic and Atmospheric Administ tion, Boulder, CO. Environmental Research La
H. F. Diaz, and R. L. Holle.
Journal of Climate and Applied Meteorology, V 23, No. 3, p 445-448, March, 1984. 4 Fig, 1 Tab Ref.

Descriptors: *Water demand, *Human populati *Population dynamics, *Heating demand, *Co ing demand, Regional analysis, Regional develo ment, Water shortage, Precipitation rate, Strea flow.

A shift and growth of population in the contiguo 48 states of the USA from cooler and wet regions to warmer and drier areas have induc changes in potential heating, cooling and wat demand. The greatest proportional increase 'warm' state population compared to 'cold' st population, based on US census data since 193 occurred during the 1970's; preliminary proje tions indicate that the trend will continue or acc erate through the year 2000. Monthly precipitati data for the contiguous USA from 1931 to 19 was obtained from the National Climactic Da Center. In 1980, over 35.5 million more peo were living in areas where the mean annual pr cipitation was $<$ or $=$ 762 mm compared to 194 an increase of 40% in the proportional figure. 6 Million of this increase took place in states who mean annual precipitation is between 254 and 5 mm. More people are also living in areas of high natural precipitation variability (higher coefficie of variation - C.V.) than in the past. In contra the cumulative percent change in the proportion people living in areas of least C.V. shows a stea decline. The increase in population in the ar West has increased the region's sensitivity to pr cipitation, and hence streamflow fluctuations. T expected continuation of these population tren may result in an increased vulnerability to period water shortages that may have important econon ic and social consequences in the future. (Collie IVI)
W85-01153

COMBINED EFFECT OF WIND AND TOPO RAPHY ON RAINFALL DISTRIBUTION,

nion - Israel Inst. of Tech., Haifa. Faculty of
Engineering.
oreh, and E. Mechrez.
nal of Hydrology, Vol. 72, No. 1/2, p 1-23,
l, 1984. 13 Fig, 21 Ref.

riptors: *Rainfall distribution, *Wind, *To-
aphy, Local precipitation, Precipitation, Ter-
analysis, Rainfall intensity.

combined effect of wind and topography on
motion and rainfall distribution is analyzed. It
own that the effect depends on the inclination
e of the raindrops at large heights and on a
nsionless number, P, which describes the ratio
e response distance of falling raindrops to the
h-scale of the topography. Two asymptotic
ions are derived, for small and large values of
d it is proved that the hydrological rainfall
sity per projected unit area over large-scale
graphical configurations is uniform. The rain
on and rainfall distributions over low hills for
mediate values of P are calculated numerical-
he analysis exhibits the features of the effect
ts dependence on the raindrop size, wind field
the scale of the topography. (Author's ab-
t)
-01166

UENTIAL GENERATION OF SHORT
E-INTERVAL RAINFALL DATA,
ourne Univ., Parkville (Australia). Agricul-
Engineering Section.
ikanthan, and T. A. McMahon.
lic Hydrology, Vol. 14, No. 5, p 277-306,
3 Fig, 18 Tab, 10 Ref.

riptors: *Model studies, *Rainfall, *Australia,
zone, Stochastic hydrology, Time series anal-

ly and six-minute interval models were devel-
to stochastically generate sequences of rain-
lepths. The models were applied to data re-
ed at twelve rainfall stations in Australia, in-
ng several from the arid zone. At each station
al replicates of rainfall sequences of length
to the historical record were generated. The
y rainfall model, which consists of a daily
ition probability matrix incorporating an
y time dependent second order Markov chain
hourly transition probabilities, satisfactorily
rated hourly rainfall for all the twelve stations
in the study. The daily, monthly and annual
neters obtained by aggregating the hourly
ll are also satisfactorily reproduced. The
rvation of monthly and annual parameters is
s good as that from a monthly model. This is
ably due to the increased complexity of gener-
rainfalls at small intervals compared with
ration on a monthly basis. Moreover, only
replicates, each of length equal to the histori-
record, were produced. Six minute rainfall
ration is an extension of hourly generation.
six minute model reproduced most of the
acteristics of the six minute rainfall. Because
six minute rainfall depths are adjusted to
y rainfall depths synthesized from the hourly
el, hourly, daily, monthly and annual param-
are also preserved. (Baker-IVI)
-01235

TIAL CORRELATION OF THE SOUTH-
T MONSOON RAINFALL OVER THE
THERN DISTRICTS OF KERALA,
in Univ. (India). Dept. of Marine Sciences.
Ram Mohan, and K. G. Anil Kumar.
tin of the Department of Marine Science Uni-
ty of Cochin, Vol. 12, No. 2, p 139-146, De-
er, 1981. 5 Fig, 1 Ref.

riptors: *Rainfall, *Spatial distribution, *Mon-
s, *Kerala, *India, Distribution, Topography,
l.

spatial correlation was measured using data
cted from 28 stations during the period 1945-
in the study area covering nearly 21,500 sq
f the districts of Trivandrum, Quilon, Alle-
, Kottayam, Idukki, Ernakulam, Trichur and
of Palghat. The spatial distributions of the correlation coefficients for a majority of base stations are irregular and do not fit into any general pattern. However, for a few base stations, high correlation coefficients were noted over large areas of the study region. The observed irregularity of the patterns of spatial distribution and the wide range of correlations may be due to exclusion of topography in the present study. The need for computing correlation coefficients on shorter time scales and for including topographical features and upper wind flow patterns is emphasized. (Baker-IVI)
W85-01464

SOME ASPECTS OF THE RAINFALL OF KERALA AND ADJOINING AREAS I. THE SOUTHWEST MONSOON RAINFALL OF COCHIN,
Cochin Univ. (India). Dept. of Marine Sciences.
C. K. Rajan, P. Valsala, and R. Ananthakrishnan.
Bulletin of the Department of Marine Sciences, University of Cochin, Vol. 12, No. 2, p 65-102, December, 1981. 8 Fig, 6 Tab, 15 Ref.

Descriptors: *Monsoons, *Rainfall, *Cochin, *India, Diurnal variation, Rainfall duration, Rainfall intensity, Mathematical equations.

The diurnal variation of the southwest monsoon rainfall of Cochin (India) was studied based on the analysis of self-recording raingauge charts for 1965-1969. The hourly rainfall of Cochin shows a pronounced diurnal cycle with maximum between 0300 and 0400 hours IST in the early morning and minimum between 1300 and 1400 hours in the afternoon. For the total seasonal rainfall the early morning maximum is 4 times the afternoon minimum. Rain spells of $<$ 5 mm (which account for 32% of the total rainfall) show a ratio of 3:1 between the early morning maximum and the afternoon minimum. The corresponding ratio for spells $>$ or $=$ 5 mm (68% of the total rainfall) is 6:1; for spells $>$ or $=$ 10 mm (37% of the total rainfall) the ratio is 20:1. Rain spells $>$ or $=$ 15 mm were absent at the minimum epoch but occurred during the maximum epoch. The rain durations in the chronological hourly intervals also show diurnal variation similar to the rain amounts, the amplitude of the variation increasing for spells with more rainfall. The total duration of rainfall for the entire southwest monsoon season (June to September) based on five-year average was 189 hours of which 78 hours were contributed by spells $>$ or $=$ 5 mm and 27 hours by spells $>$ or $=$ 10 mm and 15 hours by spells $>$ or $=$ 15 mm. More than two-thirds of the monsoon rainfall of Cochin is recorded in an integrated duration of a little over 3 days. The average hourly rain intensity is 10.2 mm/hr when all rain spells are considered. The intensity increased to 16.7 mm/hr for spells $>$ or $=$ 5 mm; 26.2 mm/hr for spells $>$ or $=$ 10 mm and 28.2 mm/hr for spells $>$ or $=$ 15 mm. An analytical equation with one empirical constant gives a reasonably good representation of the association between percentage cumulative rainfall and rain duration. (Moore-IVI)
W85-01466

ENHANCEMENT OF CONVECTIVE PRECIPITATION BY MESOSCALE VARIATIONS IN VEGETATIVE COVERING IN SEMIARID REGIONS,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 3B.
W85-01541

AREA-TIME INTEGRAL AS AN INDICATOR FOR CONVECTIVE RAIN VOLUMES,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
A. A. Doneaud, S. Ionescu-Niscov, D. L. Priegnitz, and P. L. Smith.
Journal of Climate and Applied Meteorology, Vol. 23, No. 4, p 555-561, April, 1984. 5 Fig, 2 Tab, 17 Ref. North Dakota Weather Modification Board contract WMB-IAS-80-1.

Descriptors: *Rainfall amount, *Area-time integral, *Convective precipitation, *North Dakota, Radar, Reflectivity, Rainfall rate, Estimation.

Digital radar data are used to investigate further a simple technique for estimating rainfall amounts on the basis of area coverage information. The basis of the technique is the existence of a strong correlation between a measure of the rain area coverage and duration called the Area-Time Integral (ATI) and the rain volume. This strong correlation is again demonstrated using echo cluster data from the North Dakota Cloud Modification Project 5 cm radars. Integration on a scan-by-scan basis proved to be superior for determining ATI values to the hour-by-hour integration used previously. A 25 dB(z) reflectivity threshold was found suitable for the ATI calculation. The correlation coefficient on log-log plots of cluster rain volume versus ATI is approximately 0.98, indicating a power-law relationship between the variables. The exponent of that relationship is just a little higher than one, which indicates that the cluster average rainfall rate is almost independent of the storm size and duration. A test of the relationship derived from one set of data (1980) against an independent set (1981) showed it to be consistent. Using the 1980 relationship to estimate the 1981 cluster rain volume for a given ATI, the uncertainty of the rain volume estimates was found to be -31%, +46%. (Author's abstract)
W85-01542

2C. Snow, Ice, and Frost

NATURAL CONVECTION IN AN INCLINED SQUARE CAVITY IN REGIONS OF DENSITY INVERSION OF WATER,
Kitami Inst. of Tech., Hokkaido (Japan).
For primary bibliographic entry see Field 8B.
W85-01519

SIMULATION OF GROWTH AND DECAY OF RIVER ICE COVER,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
H. T. Shen, and L.-A. Chiang.
Journal of Hydraulic Engineering, Vol. 110, No. 7, p 958-971, July, 1984. 7 Fig, 2 Tab, 28 Ref. New York Sea Grant Institute contract 344-S129-G, Great Lakes Environmental Research Laboratory contract NA80RAC0014.

Descriptors: *Ice cover, *Simulation, *Rivers, *St. Lawrence River, Mathematical models, Heat transfer, Ice-water interfaces, Ice-air interfaces, Ice breakup.

A numerical model for simulating thermal-ice conditions in a natural river is developed with emphasis on its application to the growth and decay of the ice cover. The model treats the river as a coupled air-ice-water-bed system taking into consideration the heat exchanges at all interfaces in the system. The heat conduction in the ice cover is represented by a one-dimensional, quasi-steady state approximation. The temperature distribution in the water is formulated by the longitudinal dispersion equation. The model is applied to a 28-mile reach of the St. Lawrence River between Iroquois Dam and the Moses-Saunders Power Dam. Numerical results show good agreement with field data in both the ice thickness and the break-up dates. (Author's abstract)
W85-01559

LIMITATIONS ON SEASONAL SNOWMELT FORECAST ACCURACY,
Washington Univ., Seattle. Dept. of Civil Engineering.
D. P. Lettenmaier.
Journal of Water Resources Planning and Management, Vol. 110, No. 3, p 255-269, July, 1984. 6 Fig, 2 Tab, 18 Ref, 1 Append.

Descriptors: *Snowmelt, *Runoff forecasting, Mountainous watersheds, Simulation, Mathematical models, Forecasting, Snow accumulation, Ablation, Conceptual models.

Forecasting of seasonal snowmelt runoff is an important exception to the otherwise limited accuracy of long-term runoff forecasts. Conceptual

models of the snow accumulation and ablation and precipitation-runoff processes have been advocated as a means of introducing physical understanding of the dominant hydrologic processes into seasonal snowmelt runoff processes. However, the paucity of information and extreme spatial variability of meteorological processes and watershed characteristics in mountainous watersheds often result in large simulation errors. The analysis reported here relates monthly simulation error statistics to maximum achievable seasonal runoff forecast accuracy, presuming perfect knowledge of future (gage) precipitation and temperature, but without updating of model parameters or states. In some cases, this accuracy limit is less than that actually achievable using simpler models. The results suggest a preference for simple models if the coefficient of variation of monthly simulation error cannot be reduced below about 10-15%. (Author's abstract)
W85-01563

2D. Evaporation and Transpiration

SIMULATION OF THE UTILIZATION OF WATER AND OF PLANT PRODUCTION OF A SAHELIAN PHYTOCENOSE IN SENEGAL (SIMULATION DE L'UTILISATION DE L'EAU ET DE LA PRODUCTION VEGETALE D'UNE PHYTOCENOSE SAHELIENNE DU SENEGAL),
Centre National de la Recherche Scientifique, Montpellier (France). Centre d'Etudes Phytosociologiques et Ecologiques Louis-Emberger.
For primary bibliographic entry see Field 2I.
W85-01179

STOCHASTIC SIMULATION OF EVAPORATION DATA FOR AUSTRALIA,
Melbourne Univ., Parkville (Australia). Agricultural Engineering Section.
R. Srikanthan, and T. A. McMahon.
Nordic Hydrology, Vol. 14, No. 4, p 207-228, 1983. 2 Fig, 10 Tab, 16 Ref.

Descriptors: *Stochastic process, *Evaporation, *Model studies, *Australia, Rainfall, Simulation, Computer models.

One major use of evaporation data in conjunction with rainfall data is in computer simulation modelling of rainfall/runoff processes. Stochastic models are developed to simulate annual, monthly and daily evaporation data for Australia. For annual and monthly synthesis, the evaporation values are generated independently and dependently of rainfall. Generation of daily evaporation is based on the knowledge of occurrence of daily rainfall. Data from nine Australian stations are used to illustrate applications of the models. Evaporation data only can be generated using a first order Markov model and a two-tier model. With an adequate length of historical data, the method of fragments can be used to generate monthly evaporation. If evaporation data are required along with rainfall, both should be generated simultaneously so that the observed cross correlations are preserved. For annual data, a multisite type model is satisfactory. For monthly data where an adequate length of evaporation data is available, a model is provided which may be used to generate monthly evaporation and rainfall simultaneously. A second model is also presented which can be used to generate monthly evaporation from previously generated monthly rainfall. Finally, a first order Markov model dependent on the type of day was found to perform satisfactorily in generating daily evaporation data. (Baker-IVI)
W85-01236

MONTHLY EVAPORATION FOR MILFORD LAKE IN KANSAS,
Illinois State Water Survey Div., Champaign.
H. V. Knapp, Y.-S. Yu, and E. C. Pogge.
Journal of Irrigation and Drainage Engineering, Vol. 110, No. 2, p 138-148, June, 1984. 7 Fig, 3 Tab, 11 Ref. OWRT project B-053-KAN.

Descriptors: *Milford Lake, *Kansas, *Lake evaporation, Pan evaporation, Water supply, Reservoirs, Evaporation, Seasonal variation, Mathematical models, Time series, Water temperature.

Municipal water supplies in east Kansas rely heavily on the storage of existing reservoirs. In planning the operation of a multipurpose pool for water supply, accurate estimates of weekly or monthly evaporation are imperative. The mean annual lake evaporation estimated from measured pan evaporation is generally accepted in practice, but the time series for weekly or monthly lake evaporation cannot be obtained accurately from pan evaporation because of uncertainties in the variability of the pan coefficients. A weekly evaporation time series generated by the mass transfer method for Milford Lake displays a predominant annual cycle with low evaporation in spring and winter and high evaporation in summer and fall. On the average, total evaporation for the four months from June through September exceeds 50% of the mean annual evaporation. A mathematical model for the time series is developed. The model consists of a mean weekly component represented by a Fourier approximation and a stationary random residue represented by an autoregressive model. From the synthetic evaporation series, the frequency distribution is obtained. Sensitivity analysis shows that the estimated evaporation is most sensitive to changes in water temperature. (Moore-IVI)
W85-01507

MAPPING AVERAGE DAILY PAN EVAPORATION,
Agricultural Research Service, Tucson, AZ. Southwest Watershed Research Center.
D. A. Woolhiser, and D. E. Wallace.
Journal of Irrigation and Drainage Engineering, Vol. 110, No. 2, p 246-250, June, 1984. 4 Fig, 4 Ref.

Descriptors: *Pan evaporation, *Fourier series, Maps, Evaporation, Estimating.

Estimates of average daily pan evaporation are frequently useful as an index of potential evapotranspiration in simplified water balance studies. Daily Class A pan evaporation data are available for many stations in the United States and are summarized as monthly averages. Fourier series can be fitted to average monthly pan evaporation data and the Fourier coefficients mapped to provide a regional description. Maps of the mean, amplitude, and phase angle of the first harmonic of Fourier series which describe mean daily Class A pan evaporation are presented for the United States east of the Rocky Mountains. The parameter maps provide a rather quick and easy method of estimating average daily pan evaporation, and can be used to provide ready input to simple water balance models. (Moore-IVI)
W85-01516

EXPERIMENTAL STUDY OF POTENTIAL EVAPOTRANSPIRATION (PET) IN CENTRAL AFRICA,
Institut National de la Recherche Agronomique, Paris (France). Station de Bioclimatologie.
C. Riou.
Journal of Hydrology, Vol. 72, No. 3/4, p 275-288, June, 1984. 8 Fig, 3 Tab, 1 Ref.

Descriptors: *Congo, *Central African Republic, *Chad, *Evapotranspiration potential, *Evaporation pans, *Lysimeters, Moisture meters, Climates, Climatic zones, Sahelian zones, Semiarid climates, Deserts, Equatorial zones, Evaporimeters, Net radiation.

Potential evapotranspiration (PET) and evaporation pan data were collected in central Africa (Chad, Central African Republic and Congo) over a ten year period in desertic, sahelian, tropical rainy and equatorial areas. A grass-covered lysimeter was placed at the center of the evapotranspirometer grass cover. The annual totals of potential evapotranspiration of short grass appears to range from approximately 1000 mm/yr for the equatorial zone to approximately 2400 mm/yr for the desertic zone. A sharp drop in PET occurs during the rainy season (monsoon). The ratio between annual PET and open-water evaporation, calculated by Penman's method is around 0.80 in the dry zone and approximately 0.75 in the rainy zones. A comparison between net radiation and PET shows that in the dry zone evaporation energy is much higher than net radiation; it represents only 3/4 of the radiation in the rainy zone. (Collier-IVI)
W85-01613

2E. Streamflow and Runoff

SYSTEM MODEL OF STREAM-CHANNEL SHAPE AND SIZE,
Indiana Univ. at Bloomington. School of Public and Environmental Affairs.
T. K. Miller.
Geological Survey of America Bulletin, Vol. 95, No. 2, p 237-241, February, 1984. 2 Fig, 5 Tab, 7 Ref, 1 Append.

Descriptors: *Model studies, *Channel morphology, *Cross-sections, Streamflow, Impact assessment, Sediment discharge, Mathematical models.

Models of stream-channel development typically focus on the effects of discharge and sediment. Missing from the traditional models is an explicit representation of the mechanism through which channel cross-section elements interact and adjust. A multiple-equations model was developed which includes the effects of mutual adjustment of channel characteristics, as well as of discharge and sediment. It incorporates both channel shape and size as endogenous variables. Discharge has primarily direct effects on the channel, whereas sediment appears to have primarily indirect effects. Given that the adjustment mechanism is represented as a set of indirect effects, the channel adjustment process is dependent principally on sediment rather than on discharge. There is a significant indirect effect of discharge on channel depth that operates through the mutual-adjustment mechanism for width and depth. The model may be used for impact assessment, such as for estimating the impact on channel depth of activity in a watershed that would increase stream discharge. It could also be used for estimating explicitly the impact on channel width of activity that would deepen the channel. (Collier-IVI)
W85-01132

BED-MATERIAL ENTRAINMENT AND HYDRAULIC GEOMETRY OF GRAVEL-BED RIVERS IN COLORADO,
Geological Survey, Denver, CO.
E. D. Andrews.
Geological Survey of America Bulletin, Vol. 95, No. 3, p 371-378, March, 1984. 3 Fig, 1 Tab, 19 Ref.

Descriptors: *Colorado, *Bed load, *Entrainment, *Hydraulic geometry, *Gravel bed, *Bankfull stage, *River beds, Cross sections, Flow discharge, Shear stress, Mathematical models, Channel morphology.

Mobility of bed material and bankfull hydraulic geometry were studied in 24 gravel-bed rivers in the Rocky Mountain region of Colorado. In each river reach, several cross sections and longitudinal profiles of the riverbed, water surface, and bankfull elevation were surveyed. The median diameter of the bed-material surface ranged from 23 mm to 120 mm. Bankfull discharges ranged from 0.70 cu m/sec to 255 cu m/sec. Computed values of the dimensionless shear stress (tau*) showed that the threshold of particle motion was exceeded at flows slightly less than bankfull. The average value of tau* at bankfull was 0.046. The averaged computed value of tau* for the 100-yr flood discharges was only 0.068. Transport of bed-material particles is a relatively frequent occurrence. Large bed-material transport rates, however, are extremely rare. Empirical evidence obtained at these and other streams indicates that a stable, self-formed gravel-bed channel cannot be maintained at a dimensionless shear stress greater than about 0.080. The 24 river reaches were divided into 2 groups, depending upon bank stability as indicated by bank vegetation. Separately determined bankfull hydraulic-geometry equations for each group were

ıd to have the same exponents, but slightly erent coefficients. An analysis of variance de- ined that 67% of the observations were within or - 15-20% of the predicted values for most raulic variables. (Collier-IVI)
5-01133

ULATION OF THE URBANIZATION ECT IN FLOW,
dacao Centro Tecnologico de Minas Gerais zil).
. Motta, Jr., and C. E. M. Tucci.
rological Sciences Journal, Vol. 29, No. 2, p 147, June, 1984. 9 Fig, 5 Tab, 11 Ref.

criptors: *Urban watersheds, *Urbanization, del studies, *Simulation, *Diluvio Creek, rto Alegre, *Brazil, Urban planning, Urban nage, Urban hydrology, Flood hydrographs, rception loss, Soil storage loss, Basin routing, nnel routing, Mathematical models, Rainfall- ff relationships.

nsequence of urban development in a basin is increase of peak discharge and surface flow ch may cause flooding. Main channel design to take into account future city development. nathematical conceptual rainfall-runoff model developed in order to simulate the urban Dilu- Creek basin at Porto Alegre (Brazil). The el has four algorithms: interception losses, soil ge loss, basin routing, and channel routing. nnel flow is routed by the model through a matic wave formulation with the lateral flow ulated by the earlier IPH II version of the el. Based on the Urban Development Master , some of the model parameters were modified evaluated, and a preliminary assessment of the t of urbanization on flow hydrographs was e. (Collier-IVI)
-01134

ULATION OF THE WHITE NILE,
. Associates, Wirral (England).
primary bibliographic entry see Field 2A.
-01137

AMETER IDENTIFICATION OF TIME- YING NOISY DIFFERENCE EQUATIONS REAL-TIME URBAN RUNOFF FORE- TING,
Iaster Univ., Hamilton (Ontario). Dept. of Engineering and Engineering Mechanics.
. Patry, and M. A. Marino.
nal of Hydrology, Vol. 72, No. 1/2, p 25-55, l, 1984. 14 Fig, 10 Tab, 43 Ref. CSRS project D*-LAW-4254-H.

riptors: *Urban Runoff, *Runoff forcasting, del studies, Runoff, Montreal Island, Quebec, fall, Sewer systems, Catchment areas.

ar difference equation models, which consti- a particular subset of input-output models, an interesting alternative to the more com- conceptual runoff models. For real-time urban ff forcasting, such models can be very appro- e, because in addition to being parametrically monious, they are computationally more effi- than the usual mechanistic models. More- , their use in recursive-adaptive mode can lead od agreement between forecast and observed s, particularly for short forecast lead times. sfer function model parameters were identi- under noisy input (rainfall) and output (flow) urement conditions. Equation-error and ut-error types of recursive parameter identifi- n algorithms were compared for accuracy and ergence rate. The analysis is extended to the ification of time-varying parameters by in- ng into the identification process, sets of rain- unoff events generated by distinct impulse nse functions observed on the Curotte-Papin- catchment on the north shore of the Island of treal, Canada. Although no specific parameter ification method could be identified as being matically better than the others, output-error rithms have generally been observed to con- e more rapidly than the equation-error algo- rithm, particularly in the first stage of the identification process. (Collier-IVI)
W85-01167

SENSITIVITY AND APPLICATION OF DIFFERENCE EQUATION MODELS TO REAL-TIME URBAN RUNOFF FORECASTING,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
G. G. Patry, and M. A. Marino.
Journal of Hydrology, Vol. 72, No. 1/2, p 57-66, April, 1984. 5 Tab, 7 Ref. CSRS project CAA-D*-LAW-4254-H.

Descriptors: *Differential equations, *Urban runoff, *Runoff forcasting, *Montreal, *Quebec, Rainfall, Sewer systems, Catchment areas, Error analysis.

Linear difference equation models for real-time urban runoff forcasting were applied to rainfall-runoff data collected on a 860 ha combined sewer catchment located in Montreal, Canada. Parameter identification of linear difference equation models for real-time urban runoff forcasting was reported previously (Patry, G. G. and Marino, M. A., 1984. J. Hydrology, Vol. 72, No. 1/2, p 25-55.). The problems of parameter identification and forecast error analysis under the specification of erroneous model structures based on synthetically generated rainfall-runoff sequences were examined. Sensitivity analysis was conducted by using a variety of recursive parameter identification algorithms, including equation-error and output-error algorithms. Overestimation of the structural model polynomial order parameters na and/or nb (where na is the autoregressive level and nb is the exogenous input level) is not as serious as underestimation of those parameters when measured in terms of the Root Mean Square Error (RMSE) in the simulated flows. The forecast models are applied to a combined sewer catchment for lead times ranging from 5 to 60 min. The Extended Estimation Method (EEM) algorithm was found to provide slightly better forecasts than either the Recursive Extended Least-Squares (RELS) or Recursive Ordinary Least-Squares (ROLS) algorithms for lead times of up to 30 min. (Collier-IVI)
W85-01168

RUNOFF RESPONSE TO BASIN PARAMETERS IN SOUTHWESTERN NIGERIA,
Ife Univ. (Nigeria). Dept. of Geography.
O. O. Ogunkoya, J. O. Adejuwon, and L. K. Jeje.
Journal of Hydrology, Vol. 72, No. 1/2, p 67-84, April, 1984. 2 Fig, 6 Tab, 18 Ref.

Descriptors: *Nigeria, *Rainfall-runoff relationships, *Runoff rates, *Catchment basins, *Runoff response, Runoff coefficient, Saprolite, Soil water, Rainfall rate.

Runoff studies produce useful information on the water-yield capabilities of drainage basins with different physiographic and land-use attributes. They are of value in determining the proportion of rainfall that reaches the rivers as runoff, and in identifying those basin parameters that influence runoff response. Runoff studies are especially valuable where little information exists about the hydrology of drainage basins as in the case of southwestern Nigeria. The monthly, seasonal and annual runoff and runoff coefficients of fifteen third-order basins in a part of southwestern Nigeria were determined. Measured rainfall values generally exceeded 1400 mm except in four basins located in the north of the study area, which recieved between 927 and 965 mm. Rainfall was higher in the higher hilly part than in the rest of the study area. The runoff values appear to be generally low and vary widely among the basins. They also vary strongly over the hydrological year, reflecting the water-yielding capacity of the basin saprolite, rocks and soil-moisture status. This last appears to be very important at the peak of the rainy season. The annual runoff coefficients range from 1 to 40% of annual rainfall. There may be a correspondence between the temporal distribution of runoff from any basin and the pattern of rainfall distribution, but the runoff parameters considered are strongly influenced by the nature of the saprolite and rocks underlying the basins. (Collier-IVI)
W85-01169

EVALUATION OF THE EFFICIENCY OF STREAMFLOW DATA COLLECTION STRATEGIES FOR ALLUVIAL RIVERS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
P. K. Kitanidis, O. G. Lara, and R. W. Lane.
Journal of Hydrology, Vol. 72, No. 1/2, p 85-103, April, 1984. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Missouri River, *Alluvial rivers, *Data acquisition, *Stream discharge, Stage-discharge relations, Sampling, Costs.

In alluvial streams, stage-discharge relationships change continually and, sometimes, quite markedly; such changes may be caused by major floods, seasonal variations, or long-term secular trends associated with changes in the river channel. Consequently, reliable estimates of discharge using rating curves are not possible unless frequent direct measurements of discharge are made. Such measurements involve appreciable costs, and it is important to evaluate their contribution in increasing the accuracy of estimation of quantities of interest such as mean daily, monthly or annual flow. A methodology for the evaluation of the efficiency of data-collection strategies for alluvial rivers was developed and applied to 10 stations on the Missouri River, throughout the length of a navigation channel between river miles 98 (Herman, Missouri) and 732 (Sioux City, Iowa). A flexible and expedient model describing the variability of discharges and shifts in the stage-discharge relationship was developed. The calibrated and validated model was then employed in simulations to evaluate the effect of sampling strategies (such as frequency and accuracy of discharge measurements) on the accuracy of estimated mean daily, monthly and annual flow. Curves relating the cost of sampling to the achieved accuracy can be generated, and the optimization of sampling strategies given accuracy or budget objectives or constraints can be achieved. (Collier-IVI)
W85-01170

INVESTIGATION OF OUTLIERS IN ANNUAL MAXIMUM FLOW SERIES,
Birmingham Univ. (England). Dept. of Civil Engineering.
N. T. Kottegoda.
Journal of Hydrology, Vol. 72, No. 1/2, p 105-137, April, 1984. 5 Fig, 9 Tab, 45 Ref.

Descriptors: *Outliers, *Maximum flow, *Annual distribution, Statistical analysis, Shapiro-Wilk test, Flood forecasting, Flood frequency.

Outlier detection procedures are reviewed under different hypotheses and assumptions on distribution. Tests of discordancy for detecting outliers are based on goodness of fit, kurtosis, skewness and optimal statistics from the ratios of variances and Studentized deviates. A particular form of multiple outlier detection is adopted. In the statistical testing, the null hypothesis is that the sample comes from a normal population, after necessary transformation; the alternative hypothesis can be one of three general types, with the population having a different type of distribution or a mixture of distributions or one in which there is slippage in the parameters. Inferences are conditional on the number of outliers and the alternate hypothesis. Application is made to 51 series of annual maximum flows from North America. Sixteen series are closely normal in distribution after deleting discordant values. Transformations are made to normality from assumed log-normal, and approximately from assumed gamma and log-gamma distributions. The Shapiro-Wilk goodness of fit test for normality is applicable under any alternate hypothesis. Ratios of variances and Studentized deviates give results of greater consistency than the other tests of discordancy when the distribution of outliers is unspecified or there is slippage in the parameters. Thick-tailed distributions can partly account for outliers. Another approach, which is

exploratory, is to transform from an extreme value to an exponential type prior to detection; the exponential is the null distribution in this case. Methods of accommodating outliers in models for flood estimation are discussed. These will be examined further in a following publication. (Author's abstract)
W85-01171

MODELLING THE RUNS' PROPERTIES OF ANNUAL FLOWS,
Technical Univ. of Istanbul (Turkey). Dept. of Civil Engineering.
M. Bayazit, and B. Oguz.
Journal of Hydrology, Vol. 72, No. 1/2, p 139-148, April, 1984. 5 Fig, 8 Ref.

Descriptors: *Run-lengths, *Run-sums, *Model studies, *Annual flows, *Annual floods, Deficit, Reservoir design, Statistical analysis, Regression analysis.

The required capacity of an ideal reservoir that is allowed to spill is a parameter of the flow series called the 'deficit.' The deficit for any flow series can be expressed in terms only of the run's properties (run-lengths and run-sums) of the annual flows at a truncation level equal to the desired yield. A model was developed that preserves the statistical properties of run-lengths and run-sums of a stationary flow series at a given truncation level. The model first generates the positive and negative run-lengths, and then the corresponding run-sums by a regression equation. It is applied to independent and first-order autoregressive processes. It is shown that the deficit of the process can be expressed in terms only of the runs' properties. Thus the model reproduces the statistical properties of the deficit for a certain yield by choosing the truncation level accordingly. The simulation results show that the model works more satisfactorily for independent processes, although the simulation results for the dependent processes are also reasonable. (Collier-IVI)
W85-01172

TURBULENT BOUNDARY-LAYER FLOW OVER PERMEABLE AND NON-PERMEABLE ROUGH SURFACES (COUCHE LIMITE TURBULENTE SUR DES SURFACES RUGUEUSES PERMEABLES ET NON PERMEABLES),
Ecole Polytechnique Federale de Lausanne (Switzerland). Lab. d'Hydraulique.
H. J. Zippe, and W. H. Graf.
Journal of Hydraulic Research, Vol. 21, No. 1, p 51-65, 1983. 8 Fig, 3 Tab, 13 Ref.

Descriptors: *Boundary layers, *Turbulent flow, *Permeability, *Roughness height, Reynolds number, Resistance, Shear velocity, Flow characteristics, Model studies.

Experimental research on flow over permeable surfaces is reported, in which flow over a permeable, rough surface is compared with flow over non-permeable, rough and smooth surfaces. The experiments were conducted in a wind tunnel using two permeable surfaces of relative thicknesses D/de = 2,73 and 9,67. Velocity profiles and their turbulent fluctuation were measured with a constant-temperature hotfilm-anemometer. The universal velocity-defect law was applied to obtain the shear velocity, u sub*; and the law of the wall was used to obtain the reference level and the roughness height, y'; the impulse equation was used to check these results. The local resistance coefficient, c'f, versus the Reynolds number, Re, given may be considered as the resulting display of data. It is concluded that the boundary resistance of the tested permeable surface is higher than that of the non-permeable boundaries having identical roughness. (Author's abstract)
W85-01231

UTILIZATION OF SATELLITE SNOW-COVER OBSERVATIONS FOR SEASONAL STREAMFLOW ESTIMATES IN THE WESTERN HIMALAYAS,
Howard Univ., Washington, DC.
For primary bibliographic entry see Field 7B.
W85-01233

WATERSHED BOUNDED NETWORK MODEL (WBNM) FOR RUNOFF PREDICTION OF LARGE BASINS,
Centre for Water Resources, Madras (India).
K. Venugopal, T. V. Gopalakrishnan, and R. Sakthivadivel.
Nordic Hydrology, Vol. 14, No. 4, p 229-238, 1983. 8 Fig, 2 Tab, 10 Ref.

Descriptors: *Watersheds, *Model studies, *Runoff forcasting, *Catchment areas, *Duck River, *North Carolina, Flood hydrographs, Hyetographs, Rainfall, Flood peak.

Applicability of a nonlinear version of the watershed bounded network model (WBNM) for large basins - namely Shellbyville (1,246 sq km), Columbia (3,129 sq km), Centreville (5,304 sq km) and Hurricane Mills (6,536 sq km) - of the Duck River basin (North Carolina) to predict flood hydrograph based on rainfall excess hyetograph was investigated using eight storm events. A WBNM was used that takes into account geomorphological and hydrological characteristics of the basin for conversion of rainfall excess to runoff and advocates division of the catchment into a number of sub-areas along the watershed lines, each representing a storage element, namely an ordered basin or an inter-basin area. Model parameter c was found to vary from basin to basin and in a given basin it varies with rainfall excess volume. For each model structure, the number of elements (sub-areas) were progressively reduced forming a combined sub-area of larger size. The time to peak (TPS), correlation coefficients (R), and the lag time (LAG) response measures determined from the predicted surface runoff hydrographs get stabilized beyond a minimum number of divisions. For the four catchments studied the minimum number of sub-areas required ranges from 10 to 20, with larger values required for bigger catchments. (Collier-IVI)
W85-01237

NOTE ON BOUNDARY EFFECTS ON STREAM MEANDERING,
Kanazawa Inst. of Tech. (Japan). Dept. of Civil Engineering.
T. Nakagawa, and M. Hotsuta.
Sedimentology, Vol. 31, No. 1, p 119-122, February, 1984. 5 Fig, 3 Ref.

Descriptors: *Streamflow, *Meanders, *Boundary conditions, Shear stress, Erosion, Streams.

Evidence is presented supporting the necessary but insufficient condition for the formulation of stream meandering proposed by Nakagawa (1983, Sedimentology, Vol. 30, p 117-127). Provided the conditions are met, the main thread of the stream meanders in the non-erodible channel. The maximum amplitude, the angle between the channel central axis and oblique crest line of the surface wave, and the mean wavelength of the main thread decrease as the non-dimensional parameter increases. In erodible channels the amplitude of the main thread of the stream increased with time, and eventually impinged at points along the bank. As a result the bed and banks were eroded along the sinuous locus of the main thread. The meander length was almost constant in erodible canals as the channel developed from straight to meandering. Each of the bend apices migrated downstream with time. Therefore the meander wavelength manifested in natural alluvial rivers might also depend on the non-dimensional parameter, decreasing as this parameter increases. (Baker-IVI)
W85-01275

LABORATORY STUDIES OF THE EFFECTS OF THE CAPILLARY FRINGE ON STREAMFLOW GENERATION,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
A. S. Abdul, and R. W. Gillham.
Water Resources Research, Vol. 20, No. 6, p 691-698, June, 1984. 10 Fig, 18 Ref.

Descriptors: *Capillary fringe, *Streamflow generation, Surface-groundwater relations, Runoff, Precipitation, Soil saturation, Water table, Hydraulic gradient, Seepage, Permeability coefficient, Slopes, Rainfall intensity.

This paper describes laboratory experiments that were conducted to investigate the groundwater-surface water interactions during the process of streamflow generation. In particular, the experiments were designed to examine the role of the capillary fringe in the runoff processes and its influence on the groundwater response to precipitation. The experimental results clearly show that if the zone of tension saturation extends to, or near, ground surface, the application of a small amount of water can cause an immediate rise in the water table, and the magnitude of the rise is much greater than would be expected on the basis of normal specific yield values for sandy materials. Because of the sloping surface of the laboratory model the rising water table caused the rapid generation of hydraulic gradients directed towards the toe of the slope (the stream) resulting in the immediate generation of groundwater discharge to the stream. Two experiments using chloride as a tracer and having rainfall rates of 4.3 and 1.9 cm/h showed that the discharge of preevent water to the stream preceded event water and that at early times, preevent water was the predominant component of streamflow. In addition, the results of the two tracer experiments show that the significance of preevent water increases with decreasing rainfall rate and that for the 1.9 cm/h rainfall rate preevent water was the main component of the stream hydrograph. The proportions of preevent and event water in the streamflow after steady conditions were reached were determined largely by the extent of the seepage face. This in turn would be determined by the hydraulic conductivity of the medium, the surface slope, and the rainfall intensity. (Author's abstract)
W85-01342

SIMULATION OF RUNOFF FROM SNOW-COVERED HILLSLOPES,
Old Dominion Univ., Norfolk, VA. Dept. of Civil Engineering.
A. O. Akan.
Water Resources Research, Vol. 20, No. 6, p 707-713, June, 1984. 5 Fig, 1 Tab, 16 Ref.

Descriptors: *Snowmelt, *Mathematical models, *Runoff, *Simulation, Slopes, Thaw, Freezing, Heat conduction, Flow, Vapor diffusion, Diurnal variations.

Accurate evaluation of the quantity and timing of daily springtime runoff from snow-covered hillslopes is needed for many purposes, such as flood forecasting, water supply forecasting, and the design and operation of regulatory hydraulic structures. A physics-based mathematical model of springtime runoff from snow-covered hillslopes is presented, which accounts for liquid water flow, heat conduction, and vapor diffusion simultaneously within a snow cover. Runoff from the unsaturated zone is coupled with a saturated basal flow. The physics-based approach is verified by testing the model with two sets of observed data. After reaching a state of ripeness, a snowpack will experience daytime thaw and nighttime freezing during the spring. In order to illustrate the mechanism of diurnal variations in a wet snowpack, the mathematical model was applied to a hypothetical snow-covered plot. Based on the hypothetical case, springtime diurnal changes are not restricted to a thin layer near the snow surface, but they may influence the entire depth of a wet snowpack. (Moore-IVI)
W85-01344

HYDROLOGIC IMPACTS OF A LARGE-SCALE MOUNTAIN PINE BEETLE (DENDROCTONUS PONDEROSAE HOPKINS) EPIDEMIC,
Montana Univ., Missoula. School of Forestry.
For primary bibliographic entry see Field 4C.
W85-01375

PROBABLE MAXIMUM FLOOD ESTIMATION - EASTERN UNITED STATES,
Hydrologic Engineering Center, Davis, CA.
P. B. Ely, and J. C. Peters.

· Resources Bulletin, Vol. 20, No. 3, p 391-
une, 1984. 3 Fig, 4 Tab, 7 Ref.

iptors: *Probable Maximum Flood, *Storms,
ipitation, Spatial distribution, Temporal dis-
ion, Computers, Rainfall-runoff relationships,
ble Maximum Storms.

82, the National Weather Service (NWS)
hed criteria for developing the spatial and
ral precipitation distribution characteristics
bable Maximum Storms. The criteria, which
tended for use in the United States east of the
meridian, involve four variables: (1) location
storm center, (2) storm-area size, (3) storm
ation, and (4) temporal arrangement of pre-
ion amounts. A computer program has been
oped which applies the NWS criteria to
ce hyetographs of spatially-averaged precipi-
for a basin, or for each subbasin if the basin
divided. The basis and operational character-
of the program are described, and an applica-
illustrated in which the program is used in
nction with a precipitation-runoff simulation
am (HEC-1) to compute a Probable Maxi-
Flood. (Author's abstract)
01377

TING OF DAM BREAK FLOODS,
r-Columbus Ingenieurunternehmung A.G.,
(Switzerland).
Petrascheck, and P. A. Sydler.
ational Water Power and Dam Construction,
6, No. 7, p 29-32, July, 1984. 3 Fig, 3 Tab, 9

iptors: *Dam failure, *Flood routing, *Pre-
n, *Mathematical models, Model studies,
s, Water management, Erosion, Dams, Flood

thematical model is presented which is used
dy the process of flood flows resulting from a
reach. The initial outflow is governed by the
ving major factors: dam height, reservoir
ne and reservoir geometry; downstream river
geometry; hydrological conditions at the
nt of failure; and size and form of the breach
me required for its formation. The time for
h formation is not an important parameter
considering peak flow and wave height;
ver, it has a significant influence on wave
gation. It is unrealistic to assume, for em-
nent dams, that only a narrow breach will
as lateral erosion will widen the breach.
ning that 70% of the main dam will be
d out is certainly a conservative assumption.
height and the related storage volume are the
decisive parameters. Peak outflows are influ-
by height by a power factor of 1.5 or more.
routing a dam breach flood along some river
hes, the results are similar far from the breach
parameters are varied. This is understandable
after some distance from the dam, a given
ne is distributed over a certain area according
draulic principles which do not allow for too
variation. (Baker-IVI)
01550

MATING URBAN TIME OF CONCEN-
TION,
land Univ., College Park. Dept. of Civil En-
ring.
McCuen, S. L. Wong, and W. J. Rawls.
al of Hydraulic Engineering, Vol. 110, No. 7,
-904, July, 1984. 2 Fig, 6 Tab, 23 Ref, 1
nd.

riptors: *Concentration time, *Flood flow,
an watersheds, Mathematical equations,
l peak, Flood hydrographs, Rainfall intensity.

ologic flood-flow design methods generally
re one time parameter, such as the time of
ntration, as input, and the accuracy of the
ated peak discharge or flood hydrograph is
ive to the accuracy of the estimated time
neter. Numerous equations for estimating the
of concentration have been proposed. Eleven
ions for estimating t sub c are compared using
collected from 48 urban watersheds located in most regions of the country. All the watersheds had areas less than 4,000 acres; the average impervious was 29.1%, and the mean time of concentration was 1.49 hr. Using accuracy and bias as the criteria for comparison, the eleven equations show wide variation in accuracy and bias. Two equations are calibrated with the data; the rainfall intensity is found to be the most important input parameter. The mean time of concentration computed by the velocity method for the 48 watersheds agrees very closely with the mean time computed from rainfall and hydrograph data. However, for individual watersheds the differences are relatively large. (Author's abstract)
W85-01557

SHEAR-INDUCED SECONDARY CURRENTS IN CHANNEL FLOWS,
Ministry of Works and Development, Palmerston North (New Zealand).
A. J. Odgaard.
Journal of Hydraulic Engineering, Vol. 110, No. 7, p 996-1004, July, 1984. 5 Fig, 14 Ref.

Descriptors: *Fluid mechanics, *Model studies, *Channel flow, *Shear, Secondary currents, Flow, Channels, Mathematical equations, Velocity, Open channels, Shear stress.

A simple analytical relationship is presented between the strength of the secondary flow and the transverse variation of shear velocity. The effect of the secondary flow on the streamwise velocity profile is evaluated. The analysis related to flow in a rectangular or trapezoidal channel in which the transverse variation is symmetrical about the channel centerline, which is usually the case in straight open-channel flows. After simplifying assumptions were made, the analysis provided a quite accurate description of the flow and stress behavior in an open channel flow in which the bed shear stress varied symmetrically in the transverse direction. The assumptions made put an upper limit on the degree of nonuniformity of the bed shear stress. However, the flow and stress profiles developed compared favorably with earlier experimental findings in which the bed shear stress varied by a factor of more than 2.5 across the width of the channel. While it does not explain physically the mechanism generating the secondary flow cells, merely the relationship between secondary motion and roughness variation, the approach is believed to provide a useful framework for analytical and experimental studies of secondary currents in open-channel flows. (Baker-IVI)
W85-01562

ICE-RELATED FLOOD DAMAGE ESTIMATION,
Army Engineer District, St. Louis, MO.
C. E. Yoe.
Journal of Water Resources Planning and Management, Vol. 110, No. 2, p 141-152, April, 1984. 2 Fig, 3 Tab, 19 Ref.

Descriptors: *Ice jams, *Flood damage, *Economic prediction, *Flood protection, Damage, Economic evaluation, Frazile ice, Flood frequency, Flood forcasting.

Ice jams are a major cause of flooding. Channel blockage by frazile ice or fragmented solid ice can cause water levels that far exceed even the highest fluvial flood levels. Since the economic feasibility of a flood protection measure is generally based on damages prevented, reliable estimates of expected annual damages are necessary for efficient allocation of scarce resources by decision makers. Estimation of expected annual damages (the expression of flood damage in terms of the value of a uniform annual series having a present worth equivalent to that of the nonuniform rate at which flood damages accrue) under ice conditions is a complex problem because up to three different sets of hydraulic conditions must be accounted for. These hydraulic conditions are referred to as fluvial conditions, single layer ice sheet conditions, and ice jam conditions. Three separate estimates of expected annual damages in areas subject to flooding may be obtained for each hydraulic condition by assigning probabilistic weights at various points in the computation of these damages. Estimates of these weights, which are very sensitive to simplifying assumptions must be made in the analysis. Where it is necessary to use damage-frequency curves which already reflect the probabilistic weights, the weights should be applied to elevation-frequency relationships (Collier-IVI)
W85-01573

FLOOD-PLAIN DELINEATION IN ICE JAM PRONE REGIONS,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
R. M. Vogel, and J. R. Stedinger.
Journal of Water Resources Planning and Management, Vol. 110, No. 2, p 206-219, April, 1984. 6 Fig, 1 Tab, 33 Ref, 2 Append. NSF grant CME-8010889.

Descriptors: *Missisquoi River, *Flood plains, *Ice jams, *Flood forecasting, Risks, Maximum probable floods, Maximum flows, River forecasting.

In northern regions of the U.S., where ice plays a significant role in the hydraulics of rivers, the distribution of flood events is comprized of at least two populations: annual maxima from ice jams and from storm (non-ice) events. A methodology was developed for incorporating the risk of ice jams into flood-plain delineations in northern regions of the U.S. The distribution of flood elevations was derived from the marginal probability distributions for ice cover and storm induced flood elevations. Discharge measurements from a U.S.G.S gage on the Missisquoi River over a 45 year period were used for simulation of the water surface profiles. The distributions of ice jam induced flood elevations were found to be more important than those for storm events in determining the risk of flooding all locations along a 15.5 mile reach of the river except in the vicinity of three dams. Incorporation of the derived marginal distribution of annual maximum flood elevations results in substantial increases in the inundation levels which generally implies a significant increase in the lateral extent of flood-plain boundaries. These results document the need to consider the probability of ice jam flood events in the computation of annual maximum flood elevation distributions and flood risk in ice jam prone regions. (Collier-IVI)
W85-01578

CLIMATE AND EPHEMERAL-STREAM PROCESSES: TWENTIETH-CENTURY GEOMORPHOLOGY AND ALLUVIAL STRATIGRAPHY OF THE LITTLE COLORADO RIVER, ARIZONA,
Geological Survey, Flagstaff, AZ.
R. Hereford.
Geological Society of America Bulletin, Vol. 95, No. 6, p 654-668, June, 1984. 15 Fig, 3 Tab, 76 Ref.

Descriptors: *Little Colorado River, *Arizona, *Geomorphology, *Alluvial channels, *Climates, *Stratigraphy, Channel morphology, Flood plains, Ephemeral streams, Precipitation.

During the first 40 years of the twentieth century, erosion was the dominant geomorphic process affecting the morphology of the Little Colorado River channel. The discharge regimen was one of frequent large floods and high annual discharge that created a wide sandy channel free of vegetation. In the 1940s and early 1950s, average annual precipitation declined, reducing annual discharge to about 57% of that of the preceding period as well as reducing the frequency of large floods. The channel adjusted to the new hydrologic regimen by reducing its width. Parts of the channel were frequently dry, and riparian vegetation, primarily nonnative salt cedar, became established on the higher channel surfaces. Precipitation and discharge thereafter increased and aggradation by overbank deposition was the primary geomorphic process, as indicated by accretion of 2 to 5 m of flood-plain alluvium between 1952 and 1978. Events of 1980, however, suggest that the flood plain has ceased to accrete, although climate has not fluctuated. The flood plain has probably reached a critical height above the channel,

beyond which further accretion is unlikely under the existing discharge regimen. The recent history of the Little Colorado broadly suggests that flood-plain development was initiated by climatically induced hydrologic fluctuations. Flood-plain deposits in the stratigraphic column of such ephemeral streams may record repeated adjustments to altered hydrologic conditions. (Author's abstract)
W85-01606

STORAGE-YIELD RELATIONSHIPS FOR RESERVOIRS BY TWO DIFFERENT PROCEDURES,
Cukurova Univ., Adana (Turkey). Dept. of Civil Engineering.
T. Haktanir.
Journal of Hydrology, Vol. 72, No. 3/4, p 245-259, June, 1984. 5 Fig, 1 Tab, 17 Ref.

Descriptors: *Hudson River Basin, *Delaware River Basin, *Susquehanna River Basin, *Ohio River Basin, *Reservoir yield, *Reservoir storage, Water demand, Statistical analysis, Model studies, Storage capacity, Storage-yield relationships.

Storage-yield relationships for seasonally-varying annually-constant urban water demand at 50 gaging stations of randomly chosen streams in the northeastern U.S.A. were computed by two different procedures which would give probability-attributed results. The locations chosen were in the Hudson, Delaware, Susquehanna, and Ohio River basins, and were free of upstream hydraulic regulation. First, a conventional operation-study type of analysis was performed on ten non-overlapping 50-yr. data segments of 500-yr. long synthetic data generated from 37 yr. of historical data at each site. Next, a practical storage-yield formula for constant demand was derived utilizing statistical principles, which was applied with the 37-yr. long historical data at each station. The results of both procedures with 97.5% probability were compared and reasonable agreements were observed. (Author's abstract)
W85-01611

2F. Groundwater

SOIL MOISTURE TRANSPORT THROUGH THE UNSATURATED ZONE: TRITIUM TAGGING STUDIES IN SABARMATI BASIN, WESTERN INDIA,
Physical Research Lab., Ahmedabad (India).
S. K. Gupta, and P. Sharma.
Hydrological Sciences Journal, Vol. 29, No. 2, p 177-189, June, 1984. 5 Fig, 3 Tab, 12 Ref. Government of Gujarat grant GWR/1975/287/I(i).

Descriptors: *Sabarmati Basin, *India, *Aeration zone, *Soil water, *Tritium, *Groundwater recharge, Precipitation, Hydrogeology, Recharge basins, Drainage area.

A study was conducted for groundwater recharge estimation in the Sabarmati basin, western India, by means of the tritium tagging method. Areal average recharge for the basin was determined from the point recharge estimates obtained at various field stations. A considerable variability in recharge estimates was observed at nearby locations having apparently similar conditions of soil and climate. In spite of the observed spatial variability in recharge estimates, data from the tritium tagging experiment in combination with conventional hydrogeological information (i.e., grain size, water level of the unconfined aquifers and other geological information) enabled the division of the alluvial parts of the basin into three recharge zones. On an average basis, about 14% of the precipitation input was estimated to be recharged annually in the alluvial parts of the Sabarmati basin. (Author's abstract)
W85-01136

GROUNDWATER RESIDENCE TIMES AND RECHARGE RATES USING A DISCRETE-STATE COMPARTMENT MODEL AND 14C DATA,
Georgia State Univ., Atlanta. Dept. of Geology.
M. E. Campana, and E. S. Simpson.
Journal of Hydrology, Vol. 72, No. 1/2, p 171-185, April, 1984. 3 Fig, 4 Tab, 16 Ref.

Descriptors: *Groundwater residence times, *Groundwater recharge, *Model studies, *Carbon radioisotopes, *Discrete-state compartment models, *Tuscon, *Arizona, Flow models, Piston flow, Groundwater recharge, Vertical flow, Paleohydrology.

In the absence of pure piston-flow, the C-14 decay ages of groundwater can be related to groundwater residence times only in the context of a flow or mixing model. Discrete-state compartment models offer a means of constructing flow models that can simulate flow regimes ranging from pure piston-flow to perfect mixing and can thus be used to relate C-14 decay ages to residence times. A three-dimensional steady-state flow model of a portion of the Tucson Basin aquifer, south-central Arizona, U.S.A., was constructed using the theory of discrete-state compartment models and calibrated with the spatial distribution of adjusted C-14 decay ages. The model provides estimates of groundwater residence times (about 100-15,000 yr.), vertical flow in the aquifer and long-term average annual recharge (0.048 cu km). Although the amount of time spanned by the model is long and presents problems with respect to the constancy of hydrologic processes, it may suggest a novel use for such models: that of delineating the paleohydrology of a particular region. (Author's abstract)
W85-01174

RECHARGE INTO A SHINGLE BEACH,
Southern Water Authority, Worthing (England).
T. Keating.
Journal of Hydrology, Vol. 72, No. 1/2, p 187-194, April, 1984. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Recharge, *Dungeness Beach, *United Kingdom, *Beaches, Pebbles, Shingles, Penman evaporation model, Evaporation, Soil water, Rainfall, Lysimeters, Groundwater flow.

Traditionally, groundwater recharge in the U.K. has been calculated by the Penman method on a monthly basis, using values of potential evaporation derived from averaged meteorological data and monthly totals of rainfall. The problems with this approach are that possible summer recharge events are often missed because of the soil-moisture deficits which prevail. The monthly totals considerably underestimate recharge calculated over shorter time periods; 1-day, or at worst, 10-day intervals should be used. Field experiments to measure recharge into a shingle beach at Dungeness (on the south coast of the U.K.) were made with a lysimeter over a 6-yr. period (1977 to 1982). The beach is composed of poorly sorted flint pebbles and is between 3 and 15 m thick. The lysimeter consists of a circular tank approximately 1.07 m in diameter and 1.5 m deep sunk into the shingle and back filled with shingle. Recharge was collected from a drain at the base of the lysimeter. Recharge into the shingle occurred whenever significant precipitation occured, even during the summer months. Over the six year period, the measured recharge ammounted to 76% of the rainfall. The Penman model is unrealistic for estimating recharge into such a beach; an alternative model for calculating recharge yielded good estimates of the long-term recharge. The alternative model may be considered as a limiting form of the Penman model, representing a soil with a zero root constant and no storage capacity. The model has been used to compute daily recharge over a 20-yr period for use in calibrating a finite-element model of groundwater flow in the beach. (Collier-IVI)
W85-01175

HYDROGEOLOGY OF WADI AL-YAMMANIYAH, SAUDI ARABIA,
La Moreaux (P.E.) and Associates, Inc., Tuscaloosa, AL.
B. A. Memon, A. Kazi, and A. S. Bazuhair.
Ground Water, Vol. 22, No. 4, p 406-411, July-August, 1984. 6 Fig, 3 Tab, 15 Ref.

Descriptors: *Wadi Al-Yammaniyah, *Saudi Arabia, *Hydrogeology, Groundwater potential, Water resource development, Permeability coefficient, Storativity, Pumping tests, Groundwater recharge, Geohydrology.

Wadi Al-Yammaniyah constitutes one of the important sources of supply of groundwater to the Holy City of Makkah, in Saudi Arabia. The wadi has a drainage area of about 620 sq km. Quaternary alluvium, ranging in thickness from a few to 100 meters underlain by Precambrian rocks of metamorphic and igneous origin, constitutes an important source of groundwater in Wadi Al-Yammaniyah. The hydraulic properties, quality of water, and estimated change in storage in waterbearing rocks in the area were assessed. The results of eight pumping tests carried out in hand-dug, large-diameter wells, indicate that the hydraulic conductivity of the alluvial aquifer ranges from 0.000056 to 0.00185 cm/sec and its storativity varies from 0.0823 to 0.117. The aquifer is replenished by sporadic but intensive rainfall of short duration. The present withdrawal is only about 10% of the annual recharge which is estimated at 52,000,000 cu m. The wadi groundwater resource, when properly exploited, could be used for further development of the area as well as to meet the increasing demand for water for the Holy City of Makkah. (Moore-IVI)
W85-01527

GROUND-WATER CHEMISTRY OF DIBDIBA FORMATION, NORTH KUWAIT,
Kuwait Univ., Safat. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W85-01528

BEDROCK DEPTH ESTIMATES FROM GROUND MAGNETOMETER PROFILES,
New Hampshire Univ., Durham. Dept. of Earth Sciences.
F. S. Birch.
Ground Water, Vol. 22, No. 4, p 427-432, July-August, 1984. 7 Fig, 20 Ref.

Descriptors: *Bedrock, *Magnetometers, Magnetic studies, Geological formations, Geophysics.

Bedrock depths can be calculated readily from ground magnetic profiles using either Werner deconvolution or Fourier spectral analysis. For crystalline basement rocks of New England and eastern Canada, a vertical dike is a useful magnetic source model. Formulae for these methods are presented along with some practical guidelines for implementing them. Six field examples from metamorphic and igneous areas in New Hampshire show that bedrock depths from spectral analysis agree well with estimates from seismic refraction, from wells and from outcrops. The Werner estimates are much more variable but commonly bracket the others. At several of these sites, measurements by other geophysical methods would be practical, more expensive, or restricted to certain times of the year. (Author's abstract)
W85-01530

IDEALIZED GROUND-WATER FLOW AND CHEMICAL TRANSPORT MODEL (S-PATHS),
Battelle-Northwest, Richland, WA. Geosciences Research and Engineering Dept.
For primary bibliographic entry see Field 5B.
W85-01532

FIELD AND LABORATORY ANALYSES OF WATER FROM THE COLUMBIA AQUIFER IN EASTERN MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 5A.
W85-01533

RELATIONSHIP OF GRAIN-SIZE DISTRIBUTION AND HYDRAULIC CONDUCTIVITY - AN ALTERNATE APPROACH,
Summers (W.K.) and Associates, Inc., Socorro, NM.
W. K. Summers, and P. A. Weber.

nd Water, Vol. 22, No. 4, p 474-475, July-ıst, 1984. 2 Fig, 1 Ref.

riptors: *Permeability coefficient, *Particle Sand, Silt, Clay, Gravel, Trilinear diagrams.

pproach is suggested to relationship between -size frequency distribution and hydraulic uctivity, based on the premise that for a given -size frequency distribution (ogive), some ıe combination of factors generates a maxi- hydraulic conductivity such that any change y factor diminishes the hydraulic conductivi- ın attempt is made to express the relation of ıaximum hydraulic conductivity to grain size ntours on a trilinear diagram (percent silt and percent sand, and percent gravel). (Moore-

-01534

)UND-WATER/SUBSIDENCE MODEL: A NAGEMENT TOOL,
Associates, Stafford, TX.
. Pollard, and K. H. Johnson.
ıal of Water Resources Planning and Manage-, Vol. 110, No. 3, p 323-332, July, 1984. 6 Fig, ef.

riptors: *Groundwater movement, *Model es, *Subsidence, *Management planning, cot Aquifer, *Evangeline Aquifer, *Texas, ntiometric level, Harris County, Galveston ıty, Aquifer management.

ıite difference computer modeling system has developed to predict future subsidence as a tion of ground-water pumpage in Harris and eston Counties, Texas. Two previously devel- models, one for ground water, the other for dence, were specifically calibrated for the and linked through the common parameter of ntiometric surface elevation. The two pumped fers, Chicot and Evangeline, are modeled g a modified Trescott, three-dimensional flow el, while subsidence is calculated at 21 specific ectors within the Harris-Galveston Coastal idence District using a modification of Helm's dimensional Terzaghi-consolidation model. models have been calibrated against historical The predictions run to date indicate changing ds in the location of future subsidence-prone s. The modeling system will allow the District ıake rapid, reproducible, documented predic- s of land subsidence resulting from anticipated re pumpage of ground water. (Author's ab- ct)
-01568

NSTRAINTS TO MANAGING INTERSTATE UIFER,
ıp, Dresser and McKee, Inc., Boston, MA.
C. Noonan, M. S. Rosenberg, and D. W. Wood.
ıal of Water Resources Planning and Manage- t, Vol. 110, No. 2, p 191-205, April, 1984. 7 11 Ref.

criptors: *Delaware River Basin, *Aquifer agement, *Model studies, *Interstate commis- s, New Jersey, Coastal aquifers, Groundwater agement, Water supply development, Ground- er pollution, Institutional constraints, Legal as- ts, Political constraints.

undwater studies of the the Coastal Plain Aq- r System of the Delaware River Basin were cuted to supplement the Level B Study for the nprehensive Plan of the Delaware River Basin mmission (DRBC). Total extractions from the stal Plain Aquifer System, including areas out- DRBC jurisdiction, equal 558 mgd. Large es of depression due to overpumping are caus- deteriorating groundwater quality throughout Potamic-Raritan-Magothy aquifer group which he most heavily used of the three groups of ifers in the System. The greatest threats to the gterm quality of Coastal Plain groundwater are thetic organic contamination and salinity intru- . Legal action has been taken to protect the ifer including DRBC policy which defines ximum withdrawal restrictions, and the Pine- ds Commission (New Jersey) Draft Manage-ment Plan and NJ legislation (both as yet unimplemented) which prohibit the export of Pinelands water from the Pinelands area. Two major institutional problems exist in the study area: the proliferation of small, isolated water purveyors and the lack of a regional data management system. Six alternative groundwater management strategies were evaluated using a Finite Element Model. A ground-water management plan was developed which includes provisions for locating future ground-water withdrawals away from stressed areas; developing a surface water supply as part of a conjunctive use scheme; and developing new well fields in the phreatic portions of unstressed areas. The plan also contains a set of policy recommendations aimed at addressing legal and institutional problems. (Collier-IVI)
W85-01577

STEADY TWO-DIMENSIONAL GROUNDWATER SEEPAGE: NUMERICAL ANALYSIS IN THE PHI-, PSI-PLANE,
Agricultural Univ., Wageningen (Netherlands). Dept. of Land and Water Use.
P. E. V. Van Walsum, and R. W. R. Koopmans.
Journal of Hydrology, Vol. 72, No. 3/4, p 331-354, June, 1984. 13 Fig, 3 Tab, 16 Ref.

Descriptors: *Groundwater movement, *Seepage, *Numerical analysis, *Mathematical studies, Dams, Dunes, Aquifers, Saline-freshwater interfaces, Boundary conditions.

Numerical analysis of steady-state two-dimensional seepage usually proceeds by solving either of the two conjugate functions phi(x,y) and psi(x,y), where phi is a potential function and psi, a stream function. A problem that is adequately defined can be solved by considering the inverse functions y(phi, psi) and x(phi, psi) in the phi-, psi-plane instead of phi(x,y) and psi(x,y) in the xy-plane. The former has the advantage that boundaries are transformed to a more simple geometry. The theory was applied to seepage through a dam and flow in a symmetric dune aquifer involving a phreatic surface with accretion and a fresh water-salt water interface. The method requires a complete solution of y(phi, psi) each time by a numerical technique. In the case of dam seepage the correct value of the discharge was found with a simple iteration procedure using the specified dimensions of the dam to compute the adjustment factor. Computations were carried out with many nodes (1300-2000) in the finite-difference grid and also with rather few nodes (50-100), with very little difference in the results. The solution for the second problem involves an adjustment factor for the scale of the phi-axis in order to eliminate the x error at the culmination point. This means that y(phi, psi) is solved each time within a subiteration cycle. The potential difference between phreatic surface and interface was adjusted while the shape of the phreatic surface was found by checking the boundary condition for x. (Collier-IVI)
W85-01616

STEADY GROUNDWATER FLOW IN LEAKY MULTIPLE-AQUIFER SYSTEMS,
Vrije Univ., Amsterdam (Netherlands). Inst. of Earth Sciences.
C. J. Hemker.
Journal of Hydrology, Vol. 72, No. 3/4, p 355-374, June, 1984. 7 Fig, 3 Tab, 18 Ref.

Descriptors: *Groundwater movement, *Leaky aquifers, *Aquifer systems, *Netherlands, *Confining beds, Confined aquifers, Mathematical analysis Leaky boundaries, Boundary conditions, Hydraulic properties.

Many aquifers in nature gain or lose water through adjacent confining beds of realtively low permeability. When such aquifers are part of a multiple aquifer system, withdrawal or recharge in one particular aquifer will influence the head distribution in the entire system. The hydraulic properties of stratified formations usually vary from layer to layer. Within the area of influence of a pumped well, drain, or section of a river, the subsoil can often be schematized into a limited number of aquifers each separated by less pervious layers. A general method was developed for the analytical solution of steady flow problems in leaky multiple-aquifer systems comprising any number of aquifers. This method has been used to investigate potential distributions in multilayered aquifers of infinite extent, being pumped or recharged at a constant rate using completely penetrating wells and drains in one or more of the aquifers. The same approach is applicable to groundwater flow problems with more complicated boundary conditions, such as the influence of a wide river partially penetrating the leaky top-layer. The well flow solution was applied to evaluate hydraulic properties of several aquifers and aquitards from pumping-tests done in 1979 and 1980 in a six-layer leaky aquifer system located between 30 and 50 km east of Rotterdam, The Netherlands. (Collier-IVI)
W85-01617

DETERMINATION OF FORMATION PERMEABILITY OF DOUBLE-PACKER TESTS,
Technion - Israel Inst. of Tech., Haifa.
C. Braester, and R. Thunvik.
Journal of Hydrology, Vol. 72, No. 3/4, p 375-389, June, 1984. 7 Fig, 5 Tab, 7 Ref.

Descriptors: *Permeability, *Permeameters, *Double-packer tests, Model studies, Mathematical analysis, Anisotropy, Boreholes.

The double-packer test is a classical field method for in situ determination of formation permeability. The formulae used in this calculation are based on the assumption that the formation is continuous, homogeneous and isotropic, and that the borehole is cased (impervious) except for the region of injection between the packers. These ideal conditions are rarely realized in practice, and the present paper deals with the error which thus in the calculated permeability is included, for an inhomogeneous, anisotropic or discontinuous formation, as well as for an uncased (pervious) borehole. The investigation takes the form of a numerical simulation of double-packer tests in hypothetical formations of a priori known permeability, with the rate of flow and the water overpressure at quasi steady state measured as in a real packer test. This information is subsequently used as input for calculating the permeability in the idealized model, and the calculated permeabilities are compared with the actual ones. It has been shown that for homogeneous and isotropic formations, Dagan's, Hvorslev's and Moye's formulae yield similar results, cased and uncased boreholes show practically the same permeability value, and a low permeability around the borehole accounts for a significant distortion of the representative value for the formation as a whole. For an anisotropic formation with horizontal vertical principal axes of anisotropy, the calculated results more or less coincide with the horizontal value. (Author's abstract)
W85-01618

2G. Water In Soils

DETERMINING SOIL MOISTURE FROM GEOSYNCHRONOUS SATELLITE INFRARED DATA: A FEASIBILITY STUDY,
National Aeronautics and Space Administration, Greenbelt, MD. Lab. for Atmospheric Sciences.
P. J. Wetzel, D. Atlas, and R. H. Woodward.
Journal of Climate and Applied Meteorology, Vol. 23, No. 3, p 375-391, March, 1984. 8 Fig, 2 Tab, 61 Ref, 1 Append.

Descriptors: *Remote sensing, *Soil water, *Infrared imagery, *Geosynchronus satellites, Satellite technology, Model studies, Solar radiation, Drought, Mathematical models.

The thermal infrared observation of soil moisture requires only a modest sensing system. It is possible to use sensors on existing satellites at geosynchronus altitudes to continuously monitor soil moisture with the same horizontal resolution planned for a possible future 21 cm microwave antenna. To determine which physical parameters observable from GOES are most sensitive to soil moisture and which are less prone to interference by seasonal changes, atmospheric effects, vegetation cover,

etc., a detailed one-dimensional boundary layer-surface-soil model was employed. Sensitivity tests showed that the mid-morning differential of surface temperature with respect to absorbed solar radiation is optimally sensitive to soil moisture. A case study comparing model results with GOES infrared data confirmed the sensitivity of this parameter to soil moisture and also established the applicability of the model to predicting area-averaged surface temperature changes. A series of model runs were used to develop a simulated surface temperature dataset from which a soil moisture algorithm was developed. This algorithm uses only GOES observations to separate the soil moisture signal from the interfering effects on the surface temperature. Soil moisture can be most accurately estimated by this method in dry or marginal agricultural areas where drought is a frequent threat. (Collier-IVI)
W85-01152

HIGH RESOLUTION SCANNER DATA FOR THE DETECTION OF SOIL MOISTURE VARIATION,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Physics and Engineering Lab.
S. M. Timmins, and P. D. Fitzgerald.
New Zealand Journal of Agricultural Research, Vol. 27, No. 1, p 125-131, January, 1984. 3 Fig, 3 Tab, 10 Ref, 1 Append.

Descriptors: *New Zealand, *Canterbury, *Remote sensing, *Soil water, Multispectral analysis, Agriculture, Infrared imagery, Aerial photography.

Three meter resolution, 11-channel multispectral scanner data were obtained for Winchmore Irrigation Research Station, Canterbury, New Zealand from an airborne LRM scanner flown at a height of 1.4 km. At the time of the scanner flight, soil moisture levels were measured using the gravimetric technique. The scanner data were analyzed to determine if a relationship existed between them and agricultural information, especially soil moisture levels. Spectral data do correlate well with superficial soil moisture, but not at depths relevant to agriculture. Multispectral data can be used to detect gross soil moisture variation. A general trend of increasing soil moisture deficit emerged; however, the spectral ranges overlapped too much to be used to map the soil moisture moisture deficit. The thermal infrared band was particularly effective for detecting dry pasture. (Collier-IVI)
W85-01177

DRAINAGE-TILLAGE INTERACTION ON CLERMONT SOIL,
Agricultural Research Service, Columbus, OH.
N. R. Fausey.
Transactions of the ASAE, Vol. 27, No. 2, p 403-406, March-April, 1984. 5 Fig, 4 Tab, 4 Ref.

Descriptors: *Ohio, *Clermont soil, *Drainage, *Tillage, Plowing, Subsurface drainage, Corn, Crop production, Crop yield, Raised beds, Surface drainage, Soil water.

Spring chisel plowing, no-tillage, and no-tillage on permanent beds are the tillage systems which were compared on Clermont silt loam soil in southwest Ohio. Subsurface drainage was by means of shallow, small diameter draintubes, and the influence of the subsurface drainage was evaluated by measuring the stand and yield of corn at various distances from the drain lines. The tillage treatments significantly affected both population and yield. The plant population was not affected by distance from the subsurface drains, while the yield was significantly related to the distance. The subsurface drainage and the tillage effects were independent. The additional surface drainage resulting from the raised beds had a highly significant effect on the performance of the no-tillage system and could form the basis for the successful use of no-tillage practices on this type of soil. (Author's abstract)
W85-01184

QUANTITY AND QUALITY VARIATIONS IN SUBSURFACE DRAINAGE,
Nevada Univ., Reno. Div. of Plant, Soil and Water Science.
J. C. Guitjens, P.-S. Tsui, and D. F. Thran.
Transactions of the ASAE, Vol. 27, No. 2, p 425-428, March-April, 1984. 9 Fig, 3 Tab, 7 Ref.

Descriptors: *Subsurface drainage, *Water quality, *Water supply, Wheat, Alfalfa, Irrigation, Dissolved solids, Flood irrigation, Sprinkler irrigation, Sodium, Chlorides, Turbidty, Suspended solids, Nitrogen.

Fifteen parallel drains, spaced at 37 m and servicing an overlying area of 180,000 sq m, were monitored for quality and quantity evaluation of subsurface drainage. Of interest were spatial and temporal variations in drainage and whether such variations were induced by changes in water management. Spring wheat was grown in 1979, winter wheat in 1980, and alfalfa in 1981. Irrigation methods included flooding and sprinkling. In the first two years TDS vs. EC, TDS vs. Na, and TDS vs. Cl were statistically significant in simple regression tests. Mean annual values of all drains combined showed significant differences between 1979 and 1980 in the case of concentrations of CO3, turbidity, TSS, and Kjedlahl-N. Only TSS and Kjeldahl-N were significantly different for loading rates. Spatial variations were very pronounced; each parameter produced a different spatial pattern for annual mean values. Data from 1981 were used to demonstrate temporal variability. Management effects could not be separated from natural effects of the soil. (Author's abstract)
W85-01188

MODELLING WATER FLOW THROUGH UNDISTURBED SOIL CORES USING A TRANSFER FUNCTION MODEL DERIVED FROM 3HOH AND CL TRANSPORT,
Oxford Univ. (England). Dept. of Agricultural Science.
R. E. White, G. W. Thomas, and M. S. Smith.
Journal of Soil Science, Vol. 35, No. 2, p 159-168, June, 1984. 3 Fig, 4 Tab, 23 Ref.

Descriptors: *Soil water, *Mathematical models, *Solute transport, *Transfer functions, Tracers, Breakthrough, Interstitial water, Chlorides, Tritiated water, Velocity, Flow.

Large undisturbed soil cores (20 cm diam. x 25-30 cm long) were irrigated at rates of 0.5-4 cm/h with 0.005 M CaCl2 solution labelled with 3HOH. The cores were used at varying initial water contents and flow in all cases was unsaturated. Breakthrough curves for Cl and 3HOH were markedly asymmetric and unlike those reported for columns of packed aggregates. The data could be satisfactorily described using a density distribution function of the logarithm of cumulative drainage D. The mean and standard deviation of ln D were estimated by a curve-fitting procedure from Cl and 3HOH effluent concentrations in each core. The mean pore water velocity and fraction of the soil water that participated in solute transport (the mobile volume) were also calculated. The apparent velocity of Cl movement was always greater than that of 3HOH which suggested that the mobile volume involved in convective and diffusive transport of Cl was less than that for 3HOH. Cl and 3HOH may have diffused at different rates out of flowing water films in a relatively few large conducting channels into essentially immobile water within the surrounding soil matrix. The difference in mobile volume for Cl and 3HOH was used to calculate the perimeter of voids in any horizontal cross-section of the soil through which water flowed, assuming a planar interface between the mobile and immobile water. (Author's abstract)
W85-01326

SOIL WATER REGIMES OF SOILS DEVELOPED ON KEUPER MARL,
Nottingham Univ. (England). School of Agriculture.
M. McGowan.
Journal of Soil Science, Vol. 35, No. 2, p 317-321, June, 1984. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Soil water, *Soil saturation, *Keuper Marl, Clay, Shale, Soil drainage, Wetting, Soil pores, Unsaturated soils.

Winter rain throughout England and Wales is usually more than sufficient to satisfy any soil water deficit developed during the summer and gives rise to a drainage excess. Soil wetness (drainage) classes are recognized based upon depth and duration of waterlogging of profiles, inferred from water levels in inspection holes, and gley and mottling features. Where free water is observed in inspection holes it is generally assumed that all soil below the depth of free water surface will be saturated except for a few percent by volume of trapped air. The deeper horizons of soils developed on Keuper Marl (Worcester Series) often remain unsaturated during the winter, with corresponding high tensions, even when the surface layers are waterlogged. Re-wetting of the deeper layers is restricted because of the inherent low volume of coarse pores in the Bt horizon and because the small volume of desiccation cracks formed during the summer soon disappear on re-swelling. The Keuper Marl may be exceptional among clay/shale sediments only in that the depth to dry unsaturated layers may occur within 1 m of the ground surface. The soil drainage (wetness) classes recognized in England and Wales may need to be modified. (Moore-IVI)
W85-01327

STATISTICAL EXPLORATION OF THE RELATIONSHIPS OF SOIL MOISTURE CHARACTERISTICS TO THE PHYSICAL PROPERTIES OF SOILS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
B. J. Cosby, G. M. Hornberger, R. B. Clapp, and T. R. Ginn.
Water Resources Research, Vol. 20, No. 6, p 682-690, June, 1984. 8 Fig, 7 Tab, 20 Ref.

Descriptors: *Soil physical properties, *Soil water, *Statistical analysis, Particle size, Soil hydraulics, Soil texture, Analysis of variance, multiple linear regression.

Stochastic modeling of soil water fluxes in the absence of measured hydraulic parameters requires a knowledge of the expected distribution of the hydraulic parameters in different soil types. Predictive relationships describing the hydraulic parameter distributions must be developed based on the common descriptors of the physical properties of soils (e.g., texture, structure, particle size distribution). Covariation among the hydraulic parameters within these relationships must be identified. Data for 1448 soil samples were examined in an evaluation of the usefulness of qualitative descriptors as predictors of soil hydraulic behavior. Analysis of variance and multiple linear regression techniques were used to derive quantitative expressions for the moments of the hydraulic parameters as functions of the particle size distributions (percent sand, silt, and clay content) of soils. Discriminant analysis suggests that the covariation of the hydraulic parameters can be used to construct a classification scheme based on the hydraulic behavior of soils that is analogous to the textural classification scheme based on the sand, silt, and clay content of soils. (Author's abstract)
W85-01341

KINEMATIC MODELS FOR SOIL MOISTURE AND SOLUTE TRANSPORT,
Texas Univ. at Austin. Dept. of Civil Engineering.
R. J. Charbeneau.
Water Resources Research, Vol. 20, No. 6, p 699-706, June, 1984. 4 Fig, 18 Ref.

Descriptors: *Groundwater recharge, *Soil water, *Solute transport, *Kinematic models, Wetting, Unsaturated flow, Kinematic wave theory, Field capacity.

The kinematic theory of soil moisture and solute transport in the vertical direction for unsaturated groundwater recharge is considered. The general theory of kinematic models is reviewed and ap-

d for an isolated wetting event wherein the soil
ts at and eventually drains to field capacity.
alytical expressions are developed for the water
tent and moisture flux as a function of depth
time. The approach is extended for an arbi-
y sequence of surface flux or water content
ndary conditions. The transport of a solute
h a general nonlinear sorption isotherm is also
sidered. It is shown that for the general iso-
m the vertical displacement of a solute iso-
re during an arbitrary wetting sequence de-
ds only on the total depth of water infiltrated
not on how the infiltration rate varies with
e. (Author's abstract)
5-01343

ANSPORT OF CATIONIC SOLUTES IN RBING POROUS MEDIA,
isterie van Volksgezondheid en Milieuhygiene,
dschendam (Netherlands).
. H. van Eijkeren, and J. P. G. Loch.
er Resources Research, Vol. 20, No. 6, p 714-
June, 1984. 2 Fig, 13 Ref.

criptors: *Solute transport, *Cations, *Mathe-
ical models, *Porous media, Simulation, Soil
er, Adsorption, Mathematical equations.

odel simulating transport of a cationic solute
ugh soil under steady state water flux condi-
s is described, and model simulations are re-
ed. Chemical interaction of each cation with
solid soil matrix was assumed to occur by
angeable adsorption and was described by a
eral formulation of the Gapon equation. Physi-
nteraction with the soil system was described
ateral diffusion between a mobile and an immo-
liquid phase. A mathematical model was de-
d from the physicochemical model. The result-
system of two algebraically coupled partial
rential equations was solved numerically by
ying a Crank-Nicolson time discrete Galerkin
roximation. This approximation resulted in a
em of nonlinear equations that was solved by
rton-Raphson iterations. Model simulations in-
ted that particular and combined effects of the
icochemical processes involved. Model com-
tions were compared with the results of a
ratory experiment employing a cation ex-
nger column. Considering the uncertainty of
e of the parameter estimations, the model simu-
ns and experimental results compared reason-
well. (Author's abstract)
-01345

STERESIS AFFECTED WATER MOVE-NT IN SCALE HETEROGENEOUS PRO-ES,
South Wales Univ., Kensington (Australia).
t. of Civil Engineering.
. Curtis, and K. K. Watson.
er Resources Research, Vol. 20, No. 6, p 719-
June, 1984. 10 Fig, 24 Ref, 2 Append.

criptors: *Hysteresis, *Scale heterogeneity,
water, Mathematical models, Infiltration,
us media, Redistribution.

ethod is presented for applying the concept of
heterogeneity to infiltration and redistribu-
problems in heterogeneous porous materials.
re water movement is not monotonically con-
ed to either wetting or draining boundary
es, full soil water characteristics are needed to
yze the flow process numerically. Profile het-
eneity results in these characteristics becoming
ally dependent, with each position in the pro-
requiring its own set of soil water characteris-
Numerical techniques used to overcome the
ting problems of data storage and manipula-
are outlined. These techniques include a
le interpolative soil water hysteresis model
a method of utilizing the dimensionless scaling
r to compute the required soil water charac-
ics at any depth from a datum material. Re-
for unimpeded infiltration and redistribution
or infiltration into a bounded profile are com-
d with those for equivalent homogeneous pro-
to demonstrate the utility of the method.
hor's abstract)
-01346

EVALUATION OF THE HYDROLOGIC SOIL GROUPS AS USED IN THE SCS RUNOFF METHOD ON RANGELANDS,
New Mexico State Univ., Las Cruces. Dept. of Animal and Range Sciences.
M. K. Wood, and W. H. Blackburn.
Water Resources Bulletin, Vol. 20, No. 3, p 379-389, June, 1984. 3 Fig, 4 Tab, 24 Ref.

Descriptors: *Surface runoff, *Soil types, *Rangeland, Vegetation, Infiltration, Cropland, Estimation, Hydrologic aspects.

The U.S. Soil Conservation Service has developed a method for estimating runoff for small watersheds when stream flow data are not available. The technique is based on a simplified infiltration model of runoff using various kinds of soil, land use, and empirical approximation. The model uses a runoff curve number or hydrologic soil-cover complex number. The equation overestimated observed runoff 67% of the time while estimating correctly 11% of the time and underestimating 22% of the values. This method explained 63% of the total plot-to-plot variation when all sites were pooled. Further testing revealed many problems with the hydrologic groups that are used to determine a curve number or hydrologic soil-cover complex number for the model. The equation actually worked better when the rangelands' vegetative condition become poorer and approached the bare conditions under which the technique was developed on croplands. When the vegetative condition became good or excellent by approaching the ecological climax, modification of the hydrologic soil groups was necessary. (Author's abstract)
W85-01384

2-D INFILTRATION EQUATIONS FOR FURROW IRRIGATION,
Hawaii Univ. at Manoa, Honolulu. Dept. of Civil Engineering.
Y.-S. Fok, and S. H. Chiang.
Journal of Irrigation and Drainage Engineering, Vol. 110, No. 2, p 208-217, June, 1984. 8 Fig, 4 Tab, 11 Ref, 1 Append.

Descriptors: *Infiltration, *Furrow irrigation, Mathematical equations, Permeability coefficient, Soil saturation, Head loss.

The two-dimensional infiltration phenomenon for an irrigation furrow can be expressed by the explicit, power algebraic equations derived from the one- and two-dimensional infiltration equations and the composite analog of the furrow's geometric cross section. Since the geometric cross section of a furrow can have different forms, a simple rectangular cross section is used for illustration. Two laboratory experiments on dry and wet soils showed that the measured cumulative infiltrations were quite similar to the computed ones, despite the simplifying assumptions using constants for porosity, net incremental degree of saturation, hydraulic conductivity, and total head loss. The laboratory data are generally in good agreement with the computed value from the developed two-dimensional infiltration equations and the composite analog of the furrow's geometric cross section. (Moore-IVI)
W85-01512

IRRIGATION IN HUMID AREAS: NET BENEFITS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
R. S. Huebner, D. F. Kibler, and W. R. DeTar.
Journal of Water Resources Planning and Management, Vol. 110, No. 2, p 180-189, April, 1984. 6 Fig, 3 Tab, 7 Ref, 2 Append.

Descriptors: *Irrigation, *Pennsylvania, *Benefits, *Humid areas, Cost-benefit analysis, Crop yield, Irrigation practices, Economic evaluation, Rainfall.

The use of irrigation in humid regions has been minimal; the argument against it is that the return on investment is negligible. A general frequency-based procedure for evaluating alternative policies that maximize irrigation net benefits was developed. The method accounts for the random nature of rainfall events and their obvious impact on crop yields and irrigation costs. A deterministic hydro-economic model was applied to long-term daily climatic data for Pennsylvania in order to evaluate alternative irrigation policies and the economic feasibility of irrigation in humid regions. The benefits of agricultural production are quantified by the cash value of the crops produced during a growing season. A 4 yr average of Pennsylvania crop value adjusted for inflation was used. Cost functions based upon the design of irrigation systems for a variety of crops at 23 sites across the state were used to determine irrigation costs. The functions for each type of system examined provided an estimate of the total annual costs by summing the annual capital cost of applying irrigation water to the field, a fixed cost; bringing water to the edge of the field, another fixed cost; and the annual operating cost, a variable cost depending upon the number of irrigations required per season and thus the amount of water used each year. The method developed is specifically suited for analysis of expected annual net benefits at a single site whose characteristics represent some regional average. (Collier-IVI)
W85-01576

NATURE OF THE TILE-DRAIN OUTFALL HYDROGRAPH IN HEAVY CLAY SOILS,
Birkbeck Coll., London (England). Dept. of Geography.
I. Reid, and R. J. Parkinson.
Journal of Hydrology, Vol. 72, No. 3/4, p 289-305, June, 1984. 6 Fig, 2 Tab, 28 Ref.

Descriptors: *Enfield Chase, *England, *Outfall, *Tile drains, *Clays, *Hydrographs, Soil types, Clay soils, Subsurface drainage, Subsurface Drains, Drainage, Topography, Seepage, Flooding.

The outfall hydrographs of agricultural underdrainage installations in a heavy clay soil on Enfield Chase, England, were examined over four drainage seasons. Seasonal differences in drainage response to rainfall are attributed to antecedent soil conditions and these are controlled in part by the influence of topography upon downslope seepage. Bowl-shaped landforms are kept moister by convergent interflow streamlines and drainage follows the onset of rainfall most quickly in winter. Well-drained convex slopes, on the other hand, are subject to greater summer desiccation and deep cracks convey autumn rainwater directly into the subsoil so that drainage response here is quicker at this time of year. Peak drainflow occurs at approximately 3.6 hr after the rainfall centroid in winter for both topographical situations but median values of peak discharge can be up to four times those of the non-winter drainage period during which adsorption of rainfall by the soil leads to a reduction in drainage outfall. The largest risk of flooding in river basins where underdrainage is widespread comes from complex storms. Secondary peaks in the drainage hydrograph not only arrive earlier by an average of 1.38 hr but are also shown to reach discharges more than three times those associated with simple storms having equivalent rainfalls. (Author's abstract)
W85-01614

RAPID NUMERICAL METHOD FOR HORIZONTAL FLUID FLOW IN UNSATURATED SOILS,
Warren Spring Lab., Stevenage (England).
For primary bibliographic entry see Field 2H.
W85-01619

2H. Lakes

TEMPERATURE DEPENDENCE OF MN(II) OXIDATION IN LAKEWATERS: A TEST OF BIOLOGICAL INVOLVEMENT,
Freshwater Biological Association, Ambleside (England).
E. Tipping.
Geochimica et Cosmochimica Acta, Vol. 48, No. 6, p 1353-1356, June, 1984. 2 Fig, 2 Tab, 24 Ref.

Descriptors: *Manganese, *England, *Esthwaite Water, *Rostherne Mere, *Biological oxidation, Oxidation, Temperature effects, Dissolved oxygen.

The oxidation rates of Mn(II) in water samples from two English lakes, Esthwaite Water and Rostherne Mere, display clear temperature optima, varying from 15 degrees C to 30 degrees C, in the pH range 7-8. This is strong evidence of biological mediation of the oxidation. Filtration of lakewater samples through filters of pore size 0.1 micro M strongly inhibits their ability to support the oxidation of Mn(II) at 25 degrees C. The maximum observed rate in Esthwaite Water samples tends to increase with temperature and to decrease with the concentration of O2. In Rostherne Mere samples, the rate is also dependent on the concentration of O2, but the maximum observed rate decreases with temperature. The variations in optimum temperature from as low as approximately 15 degrees C to as high as approximately 30 degrees C suggests that not only the concentration but also the type of Mn-oxidizing organisms is variable. (Collier-IVI)
W85-01130

HYDRODYNAMICAL MODEL FOR CALCULATING THE VERTICAL TEMPERATURE PROFILE IN LAKES DURING COOLING,
Sveriges Meteorologiska och Hydrologiska Inst., Norrkoeping.
J. Sahlberg.
Nordic Hydrology, Vol. 14, No. 4, p 239-254, 1983. 11 Fig, 1 Tab, 14 Ref.

Descriptors: *Lake Vasman, *Sweden, *Temperature gradient, *Lakes, *Cooling, *Hydrodynamics, Enthalpy, Heat flow, Model studies, Mixing.

The most important processes that control the heat contents and their distribution in a lake during cooling are the net heat flux through the water surface and the rate of mixing in the lake. A one-dimensional hydrodynamical model was developed for stimulating the vertical temperature profile in a lake during cooling conditions. The vertical mixing rate is calculated by solving the equations for turbulent kinetic energy and dissipation of energy. The heat exchange between the water and atmosphere consists of the radiation fluxes, sensible heat flux, and latent heat flux. Temperature measurements from Lake Vasman (central Sweden) during November-December, 1981, were used in the verification study. The agreement between calculated and measured temperature profiles is very good. Even the weak stratification that occurs at the end of the cooling period in Lake Vasman is simulated by the one-dimensional model. This indicates that both the mixing processes and the net heat flux are well described in the model. (Collier-IVI)
W85-01238

SIDE-SCAN TARGETS IN LAKE SUPERIOR - EVIDENCE FOR BEDFORMS AND SEDIMENT TRANSPORT,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 2J.
W85-01277

PARAMETER CONSTRAINTS IN A STREAM ECOSYSTEM MODEL: INCORPORATION OF A PRIORI INFORMATION IN MONTE CARLO ERROR ANALYSIS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
R. V. O'Neill, R. H. Gardner, and J. H. Carney.
Ecological Modelling, Vol. 16, No. 1, p 51-65, July, 1982. 3 Fig, 5 Tab, 21 Ref.

Descriptors: *Monte Carlo method, *Error analysis, *Model studies, *Ecosystems, *Streams, Parametric hydrology, Cycling nutrients, Nutrients, Prediction.

Monte Carlo methods are ideally suited to the investigation of parameter uncertainty. A serious drawback has been that it includes all possible behavior of the model within the range of parameters used. A model of mass and nutrient dynamics in a stream was employed to evaluate the usefulness of a priori information to increase the accuracy and efficiency of Monte Carlo error analysis. Findings indicate that great improvements can be made in estimating means and variances of predictions by placing realistic limits on model behavior. A logical sequence for incorporating a priori information into Monte Carlo simulations is indicated. A prioritized list of procedures based on effectiveness in constraining the system, ease of implementation, and effect on the simultaneous efficiency includes parameter truncation, mass-balance constraints, and state-variable constraints. In many cases the investigator will not have measured correlations between parameters, but there may still be considerable a priori information. For example, an independent study may have regressed one parameter against another. This second parameter could then be calculated from the regression equation, and then varied about this estimate based on the error associated with the regression. (Baker-IVI)
W85-01302

COMPARISON OF A SIMPLE AND A COMPLEX SEDIMENT PHOSPHORUS MODEL,
S. E. Jorgensen, L. Kamp-Nielsen, and H. F. Mejer.
Ecological Modelling, Vol. 16, No. 2/3/4, p 99-124, August, 1982. 13 Fig, 1 Tab, 22 Ref.

Descriptors: *Lake sediments, *Model studies, *Phosphorus, Lake Esrom, Oxygen, Mathematical equations, Decomposition, Diffusion, Adsorption, Sedimentation, Resuspension.

A model describing phosphorus and oxygen conditions in lake sediments is presented as a set of partial differential equations. The mechanisms included are anaerobic and aerobic decomposition, diffusion, adsorption, chemosorption, sedimentation and resuspension. The decomposition process takes into account that effective age profiles are influenced by oxygen and temperature conditions. The driving variables and comparisons with measurements are based on experimental data from Lake Esrom. A comparison is made between these results and those obtained using a simpler model. The more complex model does not fit the observed values any better than does the simpler except in the case where an additional process is incorporated, grazing at the sediment surface. The complex model has been used to relate the empirical parameters in the simpler model to generally applied concepts such as diffusion coefficients, the thickness of the transition layer, the sediment compaction and the annual net sedimentation. (Baker-IVI)
W85-01303

DESCRIPTION OF THE MULTI-ANNUAL EUTROPHICATION PROCESS OF SHALLOW LAKES BY A DISCRETE TIME WATERSHED DEVELOPMENT MODEL,
Magyar Tudomanyos Akademia, Budapest. Szamitastechnikai es Automatizalasi Kutato Intezete.
For primary bibliographic entry see Field 5C.
W85-01305

EFFECTS OF WHITE AMUR (CTENOPHARYNGODON IDELLA) ON A FLORIDA LAKE: A MODEL,
Florida Univ., Gainesville. School of Forest Resources and Conservation.
For primary bibliographic entry see Field 5G.
W85-01306

MODEL OF THE VERTICAL MIXING IN LAKE ERIE IN SUMMER,
Australian National Univ., Canberra. Research School of Earth Sciences.
G. N. Ivey, and J. C. Patterson.
Limnology and Oceanography, Vol. 29, No. 3, p 533-563, May, 1984. 5 Fig, 1 Tab, 26 Ref.

Descriptors: *Lakes, *Vertical flow, *Mixing, *Lake Erie, Destratification, Stratification, Thermal stratification, Model studies, Basins, Coriolis force, Simulation.

A vertical one-dimensional model is proposed to describe the vertical mixing in the central portion of the central basin of Lake Erie in summer. The model explicitly describes the various mechanisms which operate in the well mixed upper and bottom layers. The model predictions are in good agreement with the observed thermal structure over the entire water column during a month long simulation period. A simulation is described for the month from mid-July to mid-August for 197[illegible]. During this period the lake was strongly stratified while at the same time there were storms which drove strong mixing events in the upper mixed layer. This timespan encompassed the largest increases in the bottom mixed layer thickness observed over the summer period. The one-dimensional model was able to describe the vertical mixing in the entire water column in the central portion of this large stratified lake in which Coriolis forces are important and the water column is characterized by both an upper mixed layer and a bottom mixed layer. (Baker-IVI)
W85-01328

ISOTOPIC ANALYSES (18O, 13C, 14C) OF TWO MEROMICTIC LAKES IN THE CANADIAN ARCTIC ARCHIPELAGO,
Quebec Univ., Montreal. Dept. Sciences de la Terre.
P. Page, M. Ouellet, C. Hillaire-Marcel, and M. Dickman.
Limnology and Oceanography, Vol. 29, No. 3, p 564-573, May, 1984. 7 Fig, 1 Tab, 17 Ref.

Descriptors: *Isotope studies, *Lake Garrow, *Lake Sophia, *Northwest Territory, Meromictic lakes, Arctic lakes, Oxygen isotopes, Carbon radioisotopes, Stratification, Chemocline, Salinity, Permafrost.

Meromictic Lakes Garrow and Sophia in the Canadian Arctic Archipelago were sampled to establish the origin and age of their waters by isotopic studies. The delta sub SMOW O-18 values reflect the permanent stratification of the waters in both lakes. The mixolimnia contain waters with an isotopic signal between -13.16 and -21.98 0/00, coherent with the values for precipitation in these high latitudes. The short residence time of the water in this layer makes it possible to record episodic variations of the freshwater inputs to the lakes. In the chemoclines, the delta O-18 values increase to 10 0/00 concomitantly with a rise in chloride content to 42 g/liter. This corresponds to a conservative mixing of surficial and deep waters. In the monimolimnia, hypersaline waters (up to 2.5 times the salinity of seawater) show negative delta O-18 values (ca. -8 0/00). These waters result from brine production during permafrost growth in the watershed, according to Rayleigh process. The brine drained toward the deepest part of each lake, after postglacial uplift, and became isolated. C-14 dating of total inorganic carbon in the Lake Garrow monimolimnion gave an age of 2,580 +/ 260 years B.P. In Lake Sophia, the deep waters exhibit recent C-14 activity (121.4% modern carbon) that suggests recent infiltration of seawater into the lake basin. (Author's abstract)
W85-01329

RADIUM IN THE DEAD SEA: A POSSIBLE TRACER FOR THE DURATION OF MEROMIXIS,
Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotope Research.
M. Stiller, and Y. C. Chung.
Limnology and Oceanography, Vol. 29, No. 3, p 574-586, May, 1984. 3 Fig, 7 Tab, 18 Ref.

Descriptors: *Saline lakes, *Dead Sea, *Radium radioisotopes, *Meromixis, Radioactive tracer, Overturn, Mineral springs, Seepage, Monimolimnion.

Three profiles of Ra-226 in the meromictic Dead Sea measured during 1963-1978 indicate that the radium activities in the upper water mass were higher than in the lower water mass. All three profiles indicate a similar radium inventory. The Jordan inflow is not the primary source of radium to the Dead Sea. Mineral springs and submerged seepages are probably more important contrib

ors. The age of the meromictic structure is estiated by a model which requires that the radium ventory of the lake be at a steady state, that ometime in the past the radium profile of the lake ad been uniform (when either the lake was monoictic or an overturn had ended an earlier meroictic phase) and that the contemporaneous proles of radium have been built up by inflows of adium solely into the upper water mass, while the onimolimnion is relict, isolated, and loses radium nly by radioactive decay. Supporting evidence is resented suggesting that the above conditions ay be fulfilled. Thus, it is possible to estimate that he Dead Sea was meromictic for about 300 years efore the turnover in 1979. From tentative balnces of the Dead Sea dissolved salts it is shown hat a previous overturn might have occurred at a ower lake level than in 1979. (Author's abstract)
V85-01330

CARBONATE EQUILIBRIA AND THE DISTRIBUTION OF INORGANIC CARBON IN SAGINAW BAY,
pstate Freshwater Inst., Syracuse, NY.
W. Effler.
ournal of Great Lakes Research, Vol. 10, No. 1, p -14, 1984. 5 Fig, 1 Tab, 28 Ref.

Descriptors: *Carbon, *Carbonates, *Saginaw Bay, Lake Huron, Calcite, Carbon dioxide, Spatial distribution, Temporal distribution, Seasonal variaion, Water temperature, Photosynthesis, Hydroen ion concentration, Equilibrium.

The spatial and temporal distribution of selected norganic carbon equilibrium species is presented or eleven locations, representing the near surface vaters of Saginaw Bay in Lake Huron during 974. Carbon dioxide and calcite equilibrium conitions are determined through solution of temperture and ionic strength adjusted equilibria and valuated with respect to suitability as indicators f physical conditions and biological activity in the vaters of Saginaw Bay. The participation of inorganic carbon species in several chemical and biohemical reactions leads to the utility of these pecies in reflecting documented spatial and temoral trends in phytoplankton biomass, temperaure, ionic strength, and ionic composition. Subtantial seasonal variations in carbon dioxide and alcite equilibrium conditions were observed at everal locations throughout the bay. The magniude of variation was greatest in the more productive areas of the bay, where extensive calcite supersaturation and carbon dioxide undersaturation ccurred. Maximum calcite saturation and minimum carbon dioxide saturation were calculated for he warm, productive summer months. Transformations in chemical equilibria were mediated by oth physical and biochemical factors, as reflected y seasonal changes in temperature and pH. The ignficance of photosynthetic activity was most ronounced in the inner bay and in shore zones, while temperature became of greater relative imortance where bay waters mixed with the open vaters of Lake Huron. Strong correlations beween time averaged data for chlorophyll a and arbon dioxide (R = 0.97) and chlorophyll a and alcite saturation (R = 0.95) indicate the importance of photosynthetic activity in establishing the distribution of equilibrium conditions of inorganic arbon species. (Author's abstract)
W85-01356

ECOLOGICAL SIGNIFICANCE OF UPWELLING EVENTS IN LAKE ONTARIO,
Windsor Univ. (Ontario). Great Lakes Inst.
G. D. Haffner, M. L. Yallop, P. D. N. Hebert, and M. Griffiths.
Journal of Great Lakes Research, Vol. 10, No. 1, p 28-37, 1984. 9 Fig, 1 Tab, 24 Ref.

Descriptors: *Upwelling, *Lake Ontario, *Plankton, *Nutrients, Diatoms, Zooplankton, Ecological distribution, Hypolimnion, Epilimnion.

As Lake Ontario is subjected to prevailing westerly winds, upwelling events are common phenomena along the northwest nearshore zone. Upwelling events were studied to determine their significance as mechanisms to provide nutrients from the hypolimnion to the epilimnion and their impact on resident plankton communities of the nearshore zone. Such events did not result in sufficient mixing to recharge nutrient stocks of these areas. Upwellings were temporal displacements of nearshore water masses which returned at the end of each event. Plankton communities of the nearshore area were displaced with the water mass and therefore received little or no benefit from the upwelled nutrient rich hypolimnetic waters. Diatom species such as Asterionella formosa and Fragilaria crotonensis were able to grow in the upwelled hypolimnetic water, and upwellings might be a mechanism to inoculate these species into the epilimnion of deep lakes prior to the autumn overturn. Zooplankton populations of two nearshore stations were modified considerably by the late summer upwelling event. Surveys of zooplankton abundance showed that taxa whose densities peaked with the warm water of late summer showed major density declines during periods of upwelling. The magnitude of these declines was largest at inshore stations, and least evident offshore. (Moore-IVI)
W85-01357

RELATIONS BETWEEN COLOR AND SOME LIMNOLOGICAL CHARACTERISTICS OF FLORIDA LAKES,
Florida Univ., Gainesville. School of Forest Resources and Conservation.
D. E. Canfield, Jr., S. B. Linda, and L. M. Hodgson.
Water Resources Bulletin, Vol. 20, No. 3, p 323-329, June, 1984. 2 Fig, 2 Tab, 33 Ref.

Descriptors: *Color, *Limnology, *Florida, Geology, Transparency, Iron, Hydrogen ion concentration, Alkalinity, Chlorophyll a, Physiography.

Data obtained from a limnological survey of 165 Florida lakes were analyzed to determine regional differences of lake color (Pt-Co units) and relations between color and various physical, chemical, and biological parameters. Average color measurements for the different lakes ranged from 0 to 416 Pt-Co units with individual measurements being as high as 600 Pt-Co units. With the exception of extreme south Florida, lake color concentrations were found to increase from north to south and from inland highlands to lowlands. Central Florida had the greatest heterogeneity in lake color because of an extremely diverse geology and physiography. Color was inversely related to Secchi disc transparency and positively related to total iron concentrations. Color was not strongly related to pH, total alkalinity nutrients, chlorophyll a, and many other limnological parameters. Although lakes having color concentrations greater than 20 Pt-Co units can often be visually identified as colored lakes, the limnological processes in these are not necessarily different from those of lakes having clear water. (Author's abstract)
W85-01372

SOURCES OF VARIABILITY IN PHOSPHORUS AND CHLOROPHYLL AND THEIR EFFECTS ON USE OF LAKE SURVEY DATA,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
M. F. Knowlton, M. V. Hoyer, and J. R. Jones.
Water Resources Bulletin, Vol. 20, No. 3, p 397-407, June, 1984. 6 Fig, 6 Tab, 39 Ref.

Descriptors: *Phosphorus, *Chlorophyll a, *Lakes, *Reservoirs, *Variability, Limnology, Statistical studies, Water quality, Mathematical studies.

Summer lake survey measurements of total phosphorus (TP) and chlorophyll a (CHLa) from 188 reservoirs and natural lakes in the midwest were analyzed to determine the magnitude of major sources of variability. Median variance among replicate samples collected at the same location and time was about 7-8% of the mean for both TP and CHLa. Median observed temporal variability within summers was 27% of the mean TP and 45% of the mean for CHLa. Median values of year-to-year variance in average TP and CHLa were 22% and 31% of the mean, respectively. A range of approximately two orders of magnitude was observed among individual estimates of variance in each of these categories. The magnitude of observed temporal variability was affected only slightly by variance among replicate samples on individual days and was weakly correlated with the length of time during which samples were collected from individual lakes. Observed temporal variation was similar between reservoirs and natural lakes when variances were calculated with log-transformed data. The magnitude of temporal and year-to-year variance can severely limit the power of statistical comparisons of TP and CHLa means, but has less effect on establishing relative rankings of lake means. Sources and relative magnitude of variability are important in the use of TP and CHLa data in regression models and in the planning of lake surveys and subsequent data analysis. (Author's abstract)
W85-01383

DISSOLVED OXYGEN DYNAMICS OF A STREAM: MODEL DISCRIMINATION AND ESTIMATION OF PARAMETER VARIABILITY USING AN EXTENDED KALMAN FILTER,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
B. J. Cosby.
Water Science and Technology, Vol. 16, No. 5-7, p 561-569, 1984. 10 Fig, 5 Tab, 13 Ref.

Descriptors: *Extended Kalman filter, *Dissolved oxygen, *Model testing, Mathematical models, Macrophytes, Photosynthesis, Light intensity.

A model identification procedure is presented based on an extended Kalman filter (EKF) applied to the oxygen mass balance equation of a stream. The procedure is used with data from a small Danish stream to discriminate among eight mathematical models of the photosynthesis-light (P-I) response of macrophytes in the stream. Each model was tested for adequacy using objective criteria based on the expected behavior of the innovations sequence (the time series of differences between predicted and observed oxygen concentrations) derived from the EKF. Temporal variation of the model parameters was also examined using the EKF. The maximal photosynthetic rate (Pm) varied slowly over the year but was essentially stationary within any three to six day period. The low light efficiency of photosynthesis (Eo) varied from day to day within any short period, but three to six day means of Eo were essentially stationary over the year. The ratio (Ik = Pm/Eo) was highly correlated with both short and long term variations in daily mean light intensity. (Author's abstract)
W85-01428

PREDICTIVE OR EXPLANATORY MODELS FOR AQUATIC ECOSYSTEMS,
Ecole Nationale Superieure d'Ingenieurs Electriciens de Grenoble, Saint-Martin d'Heres (France). Lab. d'Automatique.
S. Gentil.
Water Science and Technology, Vol. 16, No. 5-7, p 571-578, 1984. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Aiguebelette, *France, *Model testing, *Ecosystems, Phytoplankton, Zooplankton, Eutrophic lakes, Model studies, Color, Prediction, Identifiability, Computer models, Linear models, Algae.

Aiguebelette, a small eutrophic lake in the French Alps, had received the wastewater for some 15,000 to 20,000 inhabitants for more than 50 years. The color of the water plays an important part in tourist activities in the region. The evolution of the trophic state of the lake must be predicted; a model can be useful in understanding this evolution. A mechanistic non-linear model was developed; this model had to be simplified in view of its identifiability study, and parameters estimates were obtained by non-linear optimization techniques. The identifiability test of the non-linear structure is a good way to select the parameters to be identified, with the remaining parameters set to literature values or obtained from laboratory measurements. The Computer-Aided-Design package known as

I.S.E.R. was used to develop linear models describing the phytoplankton or zooplankton data. The linear model obtained in the case of Aiguebelette aquatic ecosystem is interesting to use for short-term forecasting. The model also allows a quick data analysis and data coherence is easily verified by investigating the linear relationships. In this example, the use of only one meteorological input proves that neither temperature nor solar radiation is a limiting factor for algal growth: phosphates and grazing are the explicative factors of phytoplankton behavior. (Moore-IVI)
W85-01429

METHODS OF ASSESSING THE TROPHIC STATE OF LAKES AND RESERVOIRS,
Salford Univ. (England). Dept. of Mathematics.
B. Henderson-Sellers.
Water Science and Technology, Vol. 16, No. 5-7, p 653-662, 1984. 3 Fig, 37 Ref.

Descriptors: *Trophic level, *Lakes, *Reservoirs, Eutrophication, Phosphorus, Model studies, Reviews, Turbidity, Chlorophyll a, Bioindicators, Dissolved oxygen, Water quality.

A review is undertaken of various methods of assessment of trophic state in lakes and reservoirs. Input-output models, multi-layer models and trophic state indices are evaluated. Future development of multi-layer models and the use of biological indicators as contributors to compound trophic state indices is advocated. Chlorophyll-a, phosphorus, hypolimnetic oxygen and turbidity are important to the various models presented. One difficulty arises in the amalgamation of these different quality characteristics consistent with the classification that would otherwise be afforded to the lake. The importance of incorporating more biological indicators of water quality in trophic state indices would appear to have been underestimated. (Baker-IVI)
W85-01437

DECOMPOSITION AND SEDIMENTATION PROCESSES IN OLIGOTROPHIC, SUBARCTIC LAKE THINGVALLA, ICELAND,
Odense Univ. (Denmark).
E. Lastein.
OIKOS, Vol. 40, No. 1, p 103-112, January, 1983. 8 Fig, 5 Tab, 27 Ref.

Descriptors: *Lake Thingvalla, *Iceland, *Decomposition, *Sedimentation, Oligtrophic lakes, Phytoplankton, Nutrients, Seasonal variation, Nitrogen, Mixing, Mineralization.

In Lake Thingvalla, Iceland at 64 degrees 15' N and 21 degrees 7' W gross phytoplankton production averaged 90 g C/sq m/yr. Chemical variables, chlorophyll a, seston concentration and sediment composition point out Lake Thingvalla as a medium oligotrophic lake, allochthonous inputs being negligible. In the early cycle two periods might be distinguished. The spring, where a limited pool of nutrients (calculated to 7 g N/sq m/yr) was converted into organic matter, of which 2-3% sedimented per d, diminishing the nutrient pool and generating nitrogen depleted growth. From late August 1979 the nutrient pool was successively reestablished by faster mixing of the lake. This created new growth conditions, and the beginning of a period where pelagic mineralization rather than sedimentation predominated. Net sedimentation amounted to 0.5 mm/yr or 0.5 g N/sq m/yr. (Author's abstract)
W85-01453

A/C (ARAPHIDINEAE/CENTRALES) RATIO IN HIGH AND LOW ALKALINITY LAKES IN EASTERN MINNESOTA,
Southern Illinois Univ. at Edwardsville.
R. B. Brugam, and C. Patterson.
Freshwater Biology, Vol. 13, p 47-55, 1983. 5 Fig, 1 Tab, 25 Ref. OWRT grant Minn-128, NSF grant EAR 76-01412.

Descriptors: *Diatoms, *Alkalinity, *Lakes, *Minnesota, Eutrophic lakes, Calcium carbonate, Paleolimnology, Lake sediments, Eutrophication.

Diatoms from surface sediment samples from lakes on both sides of a glacial drift border in eastern Minnesota show that Araphidinate diatom genera like Fragilaria, Asterionella and Synedra are more common in lakes in drift with lower CaCO3 whereas Stephanodiscus and Melosira species are more abundant in those with high CaCO3. In a lake sediment core from low carbonate drift Fragilaria crotonensis and Asterionella formosa increased when pioneer farmers arrived. These results confirm speculation that high A/C ratios are associated with low-alkalinity eutrophic lakes. (Author's abstract)
W85-01461

DIEL ASPECTS OF THE THERMAL STRUCTURE AND ENERGY BUDGET OF A SMALL ENGLISH LAKE,
Freshwater Biological Association, Windermere (England).
E. Frempong.
Freshwater Biology, Vol. 13, p 89-102, 1983. 6 Fig, 1 Tab, 32 Ref.

Descriptors: *Thermal stratification, *Energy budget, *Esthwaite Water, *England, Diel variation, Solar radiation, Heat transfer, Mixing, Water circulation, Wind.

The diel response of the thermal structure of Esthwaite Water to prevailing meteorological conditions was analyzed for seven selected days, covering different phases of stratification. Meteorological measurements were combined with published empirical relations to compute 24-h thermal energy budgets for 2 days. Amplitudes of diel changes were controlled by the seasonal phase of stratification and the magnitude of incident solar radiation. Heat storage usually followed a sinusoidal curve with a minimum during the night and early morning and a maximum during the late afternoon. Wind-induced turbulent mixing, and vertical circulation induced by nocturnal cooling of the surface water through evaporative and conductive processes, also modified depth-time trends in thermal structure. The budget accounted for almost all the thermal energy exchanges of the lake. Possible sources of a slight imbalance are considered. Although there was a positive daily surplus of net radiation, it may not always imply heat gain by the lake as it may be counter-balanced by heat losses through fluxes of latent and sensible heat. Net back-radiation was a major component of daily heat loss. The combined latent and sensible heat fluxes also accounted for a high proportion of heat loss to the atmosphere. Net flow of sensible heat to the lake was small but not always inappreciable. Net daily heat storage represented 26% (9 May) and 13% (17 June) of solar radiation input. Advected energy due to lake inflow and outflow was negligible. Qualitative comparisons are made with long-term (seasonal and annual) energy budgets and heat fluxes. (Author's abstract)
W85-01462

VERTICAL PROFILES OF PRIMARY PRODUCTIVITY, BIOMASS AND PHYSICOCHEMICAL PROPERTIES IN MEROMICTIC BIG SODA LAKE, NEVADA,
California Univ., Davis. Div. of Environmental Studies.
J. C. Priscu, R. P. Axler, R. G. Carlton, J. E. Reuter, and P. A. Arneson.
Hydrobiologia, Vol. 96, No. 2, p 113-120, October, 1982. 7 Fig, 3 Tab, 34 Ref. NSF grant DEB80-19918.

Descriptors: *Big Soda Lake, *Nevada, *Primary productivity, *Biomass, *Physicochemical properties, Meromictic lakes, Bacteria, Chlorophyll, Phytoplankton, Eutrophication, Iron, Sulfur bacteria, Thermal stratification, Salinity, Alkaline lakes.

The temperature profile in Big Soda Lake was strongly dichothermic as a result of thermal stratification within the mixolimnion and extremely high salt content of the monimolimnion. Alkalinity was extremely high at all depths (about 40 meq in the monolimnion and 244 meq in the monimolimnion) and pH was relatively constant at about 9.5. The vertical profile of primary productivity in the lake was bimodal mith maxima at 3 and 20 the areal production rate was 235 mgC/s The purple sulfur bacteria Thiocapsa sp. sponsible for 25% of the total primary prod Bacteriochlorophyll (BChl) distributio DCMU sensitivity experiments confirmed t terial activity. Bacillariophycean and chl cean species comprise the majority of the phytoplankton assemblage in Big Soda Lak concentrations of photosynthetically inacti toplankton were detected in anaerobic-low water and were attributed to an early seaso bloom that had settled into a zone of m viscosity. Nutrient enrichment bioassay ments indicated that iron was the most im nutrient controlling early season algal grow extreme gradients resulting from meromi place, in a sense, many of the physical, c and biological processes normally found sediment-water interface up into the water c Any changes in the meromictic status of t can be expected to have extreme effects biological properties. (Moore-IVI)
W85-01468

UNUSUAL DIEL PHS IN WATER AS R ED TO AQUATIC VEGETATION,
Arizona Cooperative Fishery Research Tucson.
B. G. Halstead, and J. C. Tash.
Hydrobiologia, Vol. 92, No. 3, p 217-224, O 1982. 3 Fig, 1 Tab, 81 Ref.

Descriptors: *Aquatic plants, *Hydrogen io centration, *Diel variation, *Arizona, Alga trophic lakes, Vegetation, Myriophyllum.

High diel pHs ($X > 9.0$) showing little fluctuation were observed in three manma mictic, eutrophic lakes in Arizona; this phe non lasted several months in one impoundme least 20% of the surface of each lake was c with a mixture of aquatic vascular plants a phytic plants. Long-lasting high pHs showin diel fluctuations were experimentally produ water in small glass aquaria containing only phyllum spicatum or a mixture of Oedog sp./Rhizoclonium sp. High pHs were expe tally produced using as little as 0.2 g/l of e filamentous algae or M. spicata. The abil these plants to cause high diel pHs in wate have evolved in response to competition wit toplankton for carbon. Diel pHs that are c ously high can have significant effects on aquatic biota which require pHs < 8.5 an tolerate higher levels for periods of time no than a few hours to a few days. (Moor W85-01472

EFFECT ON WATER CHEMISTRY AND TOPLANKTON OF ARTIFICIAL INFLO THE RIVER RADOVNA INTO LAKE (YUGOSLAVIA),
Ljubljana Univ. (Yugoslavia). Biological Inst
For primary bibliographic entry see Fiel W85-01473

INVESTIGATION INTO SOME PHYS AND BIOTIC EFFECTS OF FLOODIN RESERVOIR MUD PREVIOUSLY SUBJE TO A PERIOD OF AERIAL EXPOSURE,
Hong Kong Univ. Dept. of Zoology.
D. Dudgeon.
Hydrobiologia, Vol. 97, No. 1, p 27-35, Nove 1982. 7 Tab, 23 Ref.

Descriptors: *Flooding, *Reservoirs, *Mud, lusks, *Plover Cove Reservoir, *Hong Kon ganic matter, Aggregation, Particle size, strates, Organic carbon.

A series of laboratory experiments were c out in order to investigate the effects of se physical and biotic processes on the substrat a recently flooded gently sloping marginal zo Plover Cove Reservoir, Hong Kong. The ph effects of disturbance of the sediments pro the redistribution of organic matter, as sho differences in the percentage of organic mat

the supernatant and residue resulting when reservoir mud was stirred. It is suggested that such a process would promote the transfer of allochthonous organic carbon from the marginal zone (the area of input of such material) to the rest of the water body. Substrate characteristics were also influenced by the activities of two species of benthic gastropod, Sinotaia quadrata and Melanoides tuberculata. These animals increased the rate of production of particles from soaked blocks of parent mud when compared with experimental treatments in the absence of snails. Additionally both species enhanced the production of aggregates from fine sediments with a particle size of less than 125 um. The magnitudes of both processes were statistically significant. Laboratory observations showed that M. tuberculata had a significantly faster rate of aggregate and fine particulate production than S. quadrata and it is possible that the former species may have the capacity to modify the substrate characteristics of the newly flooded marginal zone of Plover Cove. (Author's abstract)
W85-01477

ANALYSIS, BY BIOASSAY, OF THE FACTORS WHICH LIMIT ALGAL GROWTH IN THE P. K. LE ROUX IMPOUNDMENT, ORANGE RIVER, SOUTH AFRICA,
Rhodes Univ., Grahamstown (South Africa). Dept. of Zoology and Entomology.
W. T. Selkirk.
Hydrobiologia, Vol. 97, No. 2, p 151-156, November, 1982. 6 Fig, 2 Tab, 20 Ref.

Descriptors: *Algal growth, *Turbidity, *Impoundments, *Light penetration, *Orange River, *South Africa, Phytoplankton, Chlorophyll a, Nutrients, Phosphorus, Nitrogen.

P. K. le Roux Dam is a turbid, monomictic impoundment on the Orange River, which reached maximum capacity in April 1978. Factors which limit algal growth in a turbid man-made impoundment were investigated using natural phytoplankton populations. Light was the primary limiting factor with nutrients possibly limiting growth in the event of an increase in water transparency. In all algal bioassays where light flux was sufficient, there was an increase in algal growth, as assessed by changes in chlorophyll a concentrations, above levels normally found in the reservoir. Increases in chlorophyll a concentrations were associated with two orders of magnitude increase in numbers of Bacillariophyceae and Cyanophyceae. These results differ from another study which used Selenastrum capricornutum bioassays of water from other areas of the Orange River. The value of natural phytoplankton bioassay techniques is supported by the results. (Baker-IVI)
W85-01478

DECOMPOSITION OF CYNODON DACTYLON (L.) PERS. IN THE SEASONALLY FLOODED AREAS OF THE PONGOLO RIVER FLOODPLAIN: PATTERN AND SIGNIFICANCE OF DRY MATTER AND NUTRIENT LOSS,
Natal Univ., Pietermaritzburg (South Africa).
H. D. Furness, and C. M. Breen.
Hydrobiologia, Vol. 97, No. 2, p 119-126, November, 1982. 2 Fig, 4 Tab, 41 Ref.

Descriptors: *Decomposition, *Cynodon, *Pongolo River, *South Africa, *Flooding, Floodplains, Nutrients, Productivity, Dam effects.

Cynodon dactylon meadows occupying seasonally inundated areas of the Pongolo river floodplain, South Africa, decompose during periods of submergence. The loss of dry matter and nutrients from both fresh and dried material enclosed in litter bags was studied. The pattern of loss of dry matter was diphasic. Loss was more rapid from dried than from fresh material, half the mass being lost in 18 and 28 days respectively. Nutrient loss followed an exponential pattern. Nitrogen, phosphorus and magnesium were lost most rapidly from dried than from fresh material while rates of loss of sodium, potassium and calcium were similar. The significance of Cynodon decomposition in the functioning of the floodplain is assessed from estimates of the above- and below-ground standing crop around one small lake before and after submergence. It is concluded that decomposition of plants growing in seasonally inundated areas of the floodplain may contribute significantly to the productivity of the system, but that the extent of the contribution can be greatly influenced by the flooding regime. The completion of the Pongolapoort dam upstream of the floodplain will alter the natural flooding pattern, effecting a reduction in floodplain productivity, unless a program for flood release can be initiated. (Author's abstract)
W85-01479

OVERTURN IN A HYPERTROPHIC, WARM, MONOMICTIC IMPOUNDMENT (HARTBEESPOORT DAM, SOUTH AFRICA),
National Inst. for Water Research, Pretoria (South Africa).
R. D. Robarts, P. J. Ashton, J. A. Thornton, H. J. Taussig, and L. M. Sephton.
Hydrobiologia, Vol. 97, No. 3, p 209-224, December, 1982. 9 Fig, 2 Tab, 40 Ref.

Descriptors: *Hartbeespoort Dam, *South Africa, *Overturn, Reservoirs, Dissolved oxygen, Nitrification, Chlorophyll, Phytoplankton, Zooplankton, Primary productivity, Bacteria.

Hartbeespoort Dam has a surface area of 20 sq km, and a mean depth of 90.6 m. With decreased air temperatures and increased wind stress, Hartbeespoort Dam turned over in April 1981. A major characteristic of the overturn was the severe oxygen depletion in the surface waters (12.6 mg/l falling to 0.4 mg/l). Recovery of surface oxygen concentrations to supersaturation took approximately three months. Changes in the nitrogen balance after overturn indicated that extremely high rates of nitrification occurred. Little change in phosphorus concentration was observed. Surface chlorophyll concentrations decreased from 235 to approximately 2 mg/ sq m. This was due to the phytoplankton population being washed out of the impoundment. Primary productivity was reduced to rates equivalent to oligotrophic African water. Reduced rates of primary production were maintained for several months after overturn, mainly owing to the low ratio of Zeu/Zm (0.17). No significant changes occurred in the total bacterial population other than a redistribution within the water column. The biomass of zooplankton decreased to 0.406 g/sq m (dry mass) at overturn and rapidly increased thereafter. Vertical distribution changed during this period, with the zooplankton population maxima shifting from the epilimnion to the lower 10 m of the water column. No fish kills were observed although fish populations were oxygen-stressed. (Moore-IVI)
W85-01481

EFFECTS OF THE OLIGOCHAETE BRANCHIURA SOWERBYI BEDDARD (TUBIFICIDAE) ON THE BIOLOGICAL AND CHEMICAL CHARACTERISTICS OF OVERLYING WATER AND SOIL IN A SUBMERGED RICEFIELD SOIL SYSTEM,
Tohoku Univ., Sendai (Japan). Biological Inst.
E. Kikuchi, and Y. Kurihara.
Hydrobiologia, Vol. 97, No. 3, p 203-208, December, 1982. 8 Fig, 8 Ref.

Descriptors: *Oligochaetes, *Ricefields, *Submerged soils, Diffusion, Soil bacteria, Algae, Duckweed, Cladocera, Ostracods, Sulfur bacteria, Organic matter.

Submerged ricefield soils, outdoors, and with and without the tubificid Branchiura sowerbyi Beddard, were used to study the effects of tubificids on some biotic and abiotic variables. Measurements of chemical and biological features showed that the tubificids accelerated the diffusion of dissolved substances, increased the release of soil bacteria and enhanced the production of algae and a duckweed (Lemna paucicostata) in the overlying water. In the presence of tubificids, increased numbers of Cladocera (Moina sp., Simocephalus sp.) and ostracods in the overlying water, and higher number of sulfate-reducing bacteria in the soil were observed. The tubificids enhanced the microbial activity in the upper soil layer, which in turn produced large amounts of organic matter. (Author's abstract)
W85-01482

ROLE OF INTERNAL PHOSPHORUS LOADING IN TWO SHALLOW, PRODUCTIVE LAKES IN ALBERTA, CANADA,
Alberta Univ., Edmonton. Dept. of Zoology.
E. T. Riley, and E. E. Prepas.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 6, p 845-855, June, 1984. 7 Fig, 3 Tab, 31 Ref.

Descriptors: *Phosphorus, *Nakamun Lake, *Halfmoon Lake, *Alberta, Stratification, Sediments, Water exchange, Mixing, Anoxic conditions.

The contribution of internal loading from the sediments to the total phosphorus (TP) budget and to the TP in the surface water was investigated from May to November in Nakamun and Halfmoon lakes, Alberta. During the summer, Nakamun Lake was intermittently stratified and Halfmoon Lake was weakly, thermally stratified. During the stratified periods, water overlying the sediments was anoxic, TP levels increased in the deep water, and sediments were the main source of TP, contributing 1468 and 147 kg of TP to Nakamun and Halfmoon lakes, respectively. During these same periods, internal loading to Nakamun and Halfmoon lakes (12.7 and 15.6 mg/sq m/d, respectively) were slightly higher than the rates predicted from laboratory experiments on sediment cores (9.7 and 7.2 mg/sq m/d, respectively). Quantitative estimates of vertical water exchange in Nakamun Lake and in-lake TP budgets for both lakes indicated that phosphorus released from the sediments was transported to the surface water during mixing. After eight of the nine mixing events that immediately followed stratified periods, TP increased 3-43% and 31-52% in the surface water of Nakamun and Halfmoon lakes, respectively. (Author's abstract)
W85-01488

INTERACTION BETWEEN DISCHARGE AND POPULATIONS OF PARR (SALMO SALAR) OF THE MATAMEC RIVER, QUEBEC (INTERACTION ENTRE LE DEBIT ET LES POPULATIONS DE TACONS (SALMO SALAR) DE LA RIVIERE MATAMEC, QUEBEC),
Laval Univ., Quebec. Dept. of Civil Engineering.
M. Frenette, M. Caron, P. Julien, and R. J. Gibson.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 6, p 954-963, June, 1984. 7 Fig, 3 Tab, 14 Ref.

Descriptors: *Matamec River, *Quebec, *Salmon, *Fish population, *Flow discharge, Model studies, Seasonal variation, Prediction.

Given the hypothesis that in a river, the population of young salmon (Salmo salar), called parr after the first year, is directly related to the discharge-variable physical characteristics of the habitats, a multiple linear regression analysis was carried out between the parr population estimates in the Matamec River (north shore of the Gulf of St. Lawrence) and the minimum, average, and maximum discharges for monthly and season periods. The most significative variables were obtained for the minimum discharge before flooding (around April), the average August discharge of the year before last (2 yr before), and the average July discharge of the previous year. These discharges corresponded to critical biological periods for the young salmon present in the river and were used to develop a prediction model that was loaded with data covering the period 1971-77. The predictions obtained were 95% significant when the three independent parameters were used jointly and reached more than 66% when only one parameter was taken into account. Overall, it is shown that the discharge is an important limiting factor directly influencing salmon survival in streams. (Author's abstract)
W85-01492

IN SITU MEASURES OF DISSOLVED ORGANIC CARBON FLUX IN A RURAL STREAM,
Moravian Coll., Bethlehem, PA. Dept. of Biology.
F. T. Kuserk, L. A. Kaplan, and T. L. Bott.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 6, p 964-973, June, 1984. 4 Fig, 3 Tab, 25 Ref. NSF grant DEB 79-21963.

Descriptors: *Organic carbon, *Dissolved solids, *Streams, Algal growth, Manure, Solar radiation, Microcosms, Diel variation.

Dissolved organic carbon (DOC) dynamics were measured in a second-order stream located in a pasture in southeastern Pennsylvania. In situ measurements made at six stations in early summer showed a diel pattern of net DOC release from the streambed communities with predawn minima and afternoon maxima. When an 18-m section of the stream was covered with black plastic for 1 mo to exclude algal growth and measures were repeated in late summer, a net removal of DOC occurred in the covered section, while in an adjacent uncovered section DOC was released. When a bovine manure extract was introduced into the covered section, the DOC removal rate increased by more than an order of magnitude. Jewel-weed (Impatiens capensis L.) extract also elicited an elevated rate of DOC removal. When these extracts were added individually to microcosms, removal rates in the dark were 57 and 65% of the in situ uptake estimates for the manure extract and leachate, respectively. Abiotic controls showed that nearly all of the DOC removal was biotic uptake. DOC flux measurements in a third-order section of White Clay Creek, located on an adjacent watershed, also revealed a net DOC release from the uncovered streambed. Introduction of a bovine manure extract elicited a DOC removal rate an order of magnitude less than in the pasture stream. A companion microcosm experiment yielded an uptake rate that was 178% of the in situ estimate. (Author's abstract)
W85-01493

PHYSICO-CHEMICAL, BACTERIOLOGICAL AND BIOLOGICAL STUDY OF THE SEYMAZ (ETUDE PHYSICO-CHIMIQUE, BACTERIOLOGIQUE ET BIOLOGIQUE DE LA SEYMAZ),
Hydroart S.p.A., Milan (Italy).
For primary bibliographic entry see Field 5C.
W85-01555

INTERRELATIONSHIP BETWEEN LULE CITY LAKES,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
L. Bengtsson.
Journal of Hydraulic Engineering, Vol. 110, No. 7, p 975-981, July, 1984. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Lakes, *Lule City, *Sweden, Simulation, History, Water level, Model studies, Uplift.

The conditions of the Lulea City lakes are discussed from a historical point of view. Then a model for determining water stages of the different lakes is proposed. The model is applied for steady state and transient present conditions and for determining the long term effects of the landlift on future lake levels. It is suggested that the channels between the lakes be dredged and that a shallow dam be built to the sea, the Bay of Bothnia, in order to keep up the low lake levels during dry periods and periods of low water levels in the sea. The consequences of this dam on the lake levels are discussed using results from simulations by the proposed model. These simulations show that the low water levels would be increased by 0.4 m. The high water levels will be significantly increased only in the northern lakes. Due to landlift the sills between the Lule City lakes become shallower, and gradually the lakes are cut off from the sea. Computations show that the present lake system will be divided into two systems: a northern system which will constitute an inner part of the Lule Archipelago, and a southern system which will develop into three small lakes independent of the sea level, and a lower lake having water levels closely related to the sea level. (Baker-IVI)
W85-01560

PRODUCTION AND CONSUMPTION OF CARBON MONOXIDE IN A EUTROPHIC LAKE,
Max-Planck-Inst. fuer Chemie, Mainz (Germany, F.R.).
R. Conrad, M. Aragno, and W. Seiler.
Limnology and Oceanography, Vol. 28, No. 1, p 42-49, January, 1983. 4 Fig, 38 Ref.

Descriptors: *Carbon monoxide, *Eutrophic lakes, *Vertical distribution, *Lake morphology, Aerobic conditions, Anaerobic conditions, Epilimnion, Metalimnion, Hypolimnion, Oscillotoria.

CO concentrations were measured in the water of a eutrophic lake by a technique which allowed the detection of $>$ or $=$ 0.5 nl CO/liter of water. In spring, when the lake was aerobic to the bottom, CO distribution was relatively homogeneous with concentrations of 40-130 nl/liter. In summer, CO concentrations ranged between 20 and 615 nl/liter in the aerobic epilimnion and metalimnion but reached values of $>$ 8,000 nl/liter in the anaerobic hypolimnion. CO increased during the morning and decreased during the afternoon in the upper water layers as well as in the dark hypolimnion. Incubation of lake water samples from different depths under daylight conditions resulted in a strong CO production. The light-dependent CO production was stimulated by the high numbers of Oscillatoria rubescens in the metalimnion, but also by material from the lake sediment. Incubation of lake water samples in darkness resulted in CO consumption under both aerobic and anaerobic conditions. (Author's abstract)
W85-01585

SOURCES OF ALKALINITY IN LAKE MIKLAVATN, NORTH ICELAND,
Goeteborg Univ. (Sweden). Dept. of Analytical and Marine Chemistry.
S. Einarsson, and U. Stefansson.
Limnology and Oceanography, Vol. 28, No. 1, p 50-57, January, 1983. 5 Fig, 3 Tab, 31 Ref.

Descriptors: *Lake Miklavatn, *Iceland, *Alkalinity, *Saline water, Anaerobic conditions, Alkalinity, Sulfates, Sulfides, Ammonia, Trace metals, Carbonates, Lakes.

Lake Miklavatn, north Iceland, is highly stratified with an 8-9 m layer of freshwater overlying saline and anoxic deeper water. Sulfide and ammonia concentrations are high in the stagnant and saline layer, and titration alkalinity exceeds conservative alkalinity in the deepest part of the lake by a factor of 3-4. Reduction of sulfate was estimated by direct measurement of the sulfate concentration. With one exception the decrease in sulfate was found to exceed the measured sulfide concentration. This is explained by partial oxidation of sulfide due to mixing with oxygenated water from the upper layer. The excess alkalinity is 92-93% accounted for by sulfate reduction and formation of ammonia, whereas excess metal carbonates do not seem to be a source. (Author's abstract)
W85-01586

COPRECIPITATION OF PHOSPHATE WITH CALCITE IN A NATURALLY EUTROPHIC LAKE,
National Water Research Inst., Burlington (Ontario). Aquatic Ecology Div.
T. P. Murphy, K. J. Hall, and I. Yesaki.
Limnology and Oceanography, Vol. 28, No. 1, p 58-69, January, 1983. 5 Fig, 6 Tab, 32 Ref.

Descriptors: *Black Lake, *British Columbia, *Phosphate, *Calcite, *Chemical precipitation, *Eutrophic lakes, Aphanizomenon, Hydrogen ion concentration, Calcium, Alkalinity, Biomass, Algae, Primary productivity.

Phosphorus-rich deposits of Eocene volcanic rock have caused some lakes in the interior of British Columbia to become eutrophic without direct human influence. In Black Lake the soluble reactive phosphorus (SRP) usually exceeds 250 micro g P/liter. When calcite precipitation occurred during blooms of Aphanizomenon, SRP was completely removed from the photic zone. In blooms with no calcite formation, SRP changed little. These o vations were replicated by splitting the lake v curtain. Calcite precipitation was also obs several times in four large enclosures (limn rals). The subsequent disappearance of phos was correlated with an increase in pH and a r tion of Ca and alkalinity and not necessarily primary production or algal biomass. (Au abstract)
W85-01587

PHOTOREDUCTION OF IRON IN THE LIMNION OF ACIDIC LAKES,
Department of Public Works, Eupen (Belg Water Treatment Plant of the Vesdre.
R. H. Collienne.
Limnology and Oceanography, Vol. 28, No 83-100, January, 1983. 12 Fig, 7 Tab, 38

Descriptors: *Lake Vesdre, *Lake Gileppe, gium, *Photoreduction, *Iron, *Epilimnion, lakes, Chemical properties, Hardness, Oxid reduction potential, Sediment-water inte Light intensity, Wavelengths, Organic m Humic acids, Coagulation, Flocculation, treatment.

Two acid soft-water lakes in the east of Bel Lakes Vesdre and Gileppe, contain appre amounts of soluble ferrous iron in the epilim zone which change diurnally and annually. versible photoreduction process of ferric ir occuring in the epilimnion of these lakes. A co erable drop in redox potential in the same confirms the existence of an active reducti ferric iron, with a concomitant solubilizati particulate iron and of deposited iron sup from the sediments in contact with epilim water when the latter is well oxygenated. highly unlikely that reduction is the result of bolic activity of microorganisms. The photoc cal nature of the reduction process is evident the direct relation between light exposure, intensity, light wavelength, and increase in with a drop of redox potential and Fe(III) co tration. The reduction process is promoted by mal pH conditions and by the presence of or matter (humic acids). For the treatment o pounded waters, the irreversible oxidation ganic matter, with Fe perhaps acting as a cat is very favorable for the coagulation-floccul process, because organic matter (humic substa generally inhibits coagulation. (Collier-IVI)
W85-01588

SEASONAL VARIATIONS IN THE CON TRATIONS OF HUMIC SUBSTANCES SOFT-WATER LAKE,
Freshwater Biological Association, Winder (England).
E. Tipping, and C. Woof.
Limnology and Oceanography, Vol. 28, No. 168-172, January, 1983. 2 Fig, 20 Ref.

Descriptors: *Humic acids, *Seasonal vari *Esthwaite Water, *England, Hypolimnion, mal stratification, Stratification, Lakes, Epilim Anoxia.

Concentrations of humic substances were ured in Esthwaite Water, a soft-water lake in bria, England with annual thermal stratific and deep water anoxia. Between June 198 December 1981 the concentrations of humic stances in the epilimnion ranged from abo mg/l in summer to about 33 mg/l in au During winter months when the lake was mixed the humic concentrations at 5 and were, as expected, equal. As the season of th stratification and accompanying deep water a proceeded, however, the concentrations be different; the 5 m values fell to about 1.5 mg remained at this level throughout summer, the 14 m values increased to reach a maxim more than 3 mg/l. The high humic concentr were confined to the bottom few meters. (E IVI)
W85-01590

PYROLYSIS MASS SPECTROMETRY OF SOME SCIRPUS SPECIES AND THEIR DECOMPOSITION PRODUCTS,
Stichting voor Fundamenteel Onderzoek der Materie, Amsterdam (Netherlands). Inst. voor Atoom en Molecuulfysica.
J. J. Boon, R. G. Wetzel, and G. L. Godshalk.
Limnology and Oceanography, Vol. 27, No. 5, p 839-848, September, 1982. 4 Fig, 2 Tab, 32 Ref.

Descriptors: *Decomposition, *Bulrushes, *Detritus, Mass spectrometry, Decomposing organic matter, Organic matter, Aerobic conditions, Anaerobic conditions, Lakes, Eutrophication, Aquatic plants.

Pyrolysis mass spectra were obtained for living tissue of four species of Scirpus and for changes in tissue undergoing decomposition under aerobic and anaerobic conditions so that the composition of the plants and of their products during decomposition could be related to other phenomena observed during degradation. The mass pyrograms of the four species indicated a large degree of similarity except for the mass peaks at m/z 72, 74, 114, and 120. The pyrogram of cellulose shows considerable resemblance to those of the Scripus species. Characteristic peaks for lignin and hemicellulose were present in all four spectra. Large amounts of paracoumaric esters and lignin derivatives were found in all species. Mass peak m/z 120 differed markedly in relative abundance in these plants and was identified by pyrolysis gas chromatography MS as parahydoxystyrene, a pyrolysis product of paracoumaric esters. Decomposition was carried out in the laboratory under aerobic and anaerobic conditions at 10 and 125 degrees C for 180 days. The mass spectra of the senescent S. acutus differed only slightly from the decomposition stages after 180 days at 25 degrees C, but the mass spectra of decomposed senescent submersed foliage of S. subterminalis showed a reduction in pyrolysis products of neutral polysaccharides and an increase in products from proteins and bacterial amino sugar polymers especially after anaerobic decomposition. Findings suggest that paracoumaric esters can influence the slow decay of emergent plants in the littoral zone of lakes. (Baker-IVI)
W85-01591

ACID PRECIPITATION: ITS ROLE IN THE ALKALIZATION OF A LAKE IN MICHIGAN,
Michigan Univ., Ann Arbor. Div. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W85-01592

PHYSICAL, CHEMICAL, AND BIOLOGICAL CHARACTERISTICS OF A STRATIFIED, SALINE, SULFIDE LAKE IN PALAU,
California Univ., Los Angeles. Dept. of Biology.
W. M. Hamner, R. W. Gilmer, and P. P. Hamner.
Limnology and Oceanography, Vol. 27, No. 5, p 896-909, September, 1982. 11 Fig, 23 Ref. NSF grants OCE 77-27578 and OCE 80-08309.

Descriptors: *Physical properties, *Chemical properties, *Stratification, *Saline lakes, *Palau, *Jellyfish Lake, Sulfides, Primary productivity, Seasonal variations, Stability, Hypolimnion, Bacteria, Zooplankton.

Jellyfish Lake is located in the northeastern arm of Palau, Western Caroline Islands. The lake measures 5 ha, is 30 m deep, is a meromictic saline lake, stratified, with anoxic hypolimnion, damped, delayed tides, and no heat accumulation. The top 15 m are oxygenated, nutrient poor but turbid with high primary productivity and large planktonic population of only five metazoans. At the chemocline a floating bacterial plate dominated by photosynthetic purple bacteria degrades and solubilizes almost all particulate material and absorbs all sunlight. Below the plate the anoxic, clear water contains extremely high levels of ammonium ions, hydrogen sulfide, and phosphates. Sediments are mainly undisturbed fish fecal pellets full of copepod exoskeletons. The lake is stable, aseasonal, and shows no obvious cycles of the populations. An unusual horizontal and vertical swimming behavior of Mastigias appears related to light and to the nutrient requirements of its symbiotic zooxanthellae. Other zooplankton show normal vertical diurnal migration patterns. Facultative schooling by Pranesus reflects the absence of predators in the lake. Changes in the lakes of Palau are subtle fluctuations which can be perceived only by extensive sampling. (Baker-IVI)
W85-01593

DYNAMICS OF IRON AND MANGANESE IN A SEASONALLY ANOXIC LAKE; DIRECT MEASUREMENT OF FLUXES USING SEDIMENT TRAPS,
Freshwater Biological Association, Ambleside (England).
W. Davison, C. Woof, and E. Rigg.
Limnology and Oceanography, Vol. 27, No. 6, p 987-1003, November, 1982. 7 Fig, 2 Tab, 48 Ref.

Descriptors: *Lake sediments, *Iron, *Manganese, *Esthwaite Water, *England, Fluctuations, Temperature, Oxygen, Hypolimnion, Seasonal variation, Anoxic lakes.

Twenty sediment traps were deployed for a year in five arrays at three locations in a seasonal anoxic basin in Esthwaite Water, England. Accumulated iron and manganese were measured fortnightly, as were vertical profiles of temperature, oxygen, total iron and manganese, polarographically determined Fe(II) and Mn(II), and light attenuance. The hypolimnion of the lake is horizontally uniform with respect to the concentration of iron and manganese. Sediment traps integrate fluxes and show that during the early stages of stratification iron and manganese may well interact with sediment in a localized cycling of these elements. The trapped quantities of iron and manganese vary seasonally. While horizontal variations are generally small, the variations with depth are significant. Fluxes are highly dependent on the physical and chemical features of a particular lake and will offer considerable variations for different lakes. The differences in the trapped quantities at different vertical positions in the lake provide direct evidence for substantial dissolution of manganese particles and some dissolution of iron particles in the lower anoxic waters of the lake. Transport of iron between sediment and water through a separate cycle of dissolution and precipitation of ferrous sulfide is small compared with other iron fluxes. Resuspension of hypolimnetic iron by wind mixing does not appear to be an important mechanism. Resuspension from the epilimnion still occurs, however, and this probably accounts for the high iron loading to the lake and the sediments during autumn. Iron to manganese ratios in the sediment traps are substantially smaller than those in the sediment and the annual amount of manganese trapped is in excess of the annual increment to the sediment. Since it is probable that most of the manganese coming into the lake is transported to the sediment, almost all the manganese which eventually flows out will have undergone a redox cycle in the lake. A small, relatively inactive fraction of the manganese that reaches the sediment becomes permanently incorporated. (Baker-IVI)
W85-01597

MICROBIALLY MEDIATED MANGANESE OXIDATION IN A FRESHWATER LAKE,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
S. D. Chapnick, W. S. Moore, and K. H. Nealson.
Limnology and Oceanography, Vol. 27, No. 6, p 1004-1014, November, 1982. 7 Fig, 1 Tab, 28 Ref.

Descriptors: *Bacteria, *Manganese, *Oxidation, *Oneida Lake, *New York, Chemical reactions, Manganese oxide, Seasonal variation, Eutrophic lakes.

Oneida Lake is a large, shallow, eutrophic lake in central New York. Due to almost continuous wind mixing when ice-free, the lake is nonstratified and aerobic to the bottom with only rare exceptions. Ferromanganese deposits are concentrated in the well oxygenated areas of the lake. Studies of bottom water samples indicate that bacteria mediate manganese oxidation in these aerobic waters. In lake water samples maintained in the lab, decreases in soluble Mn(2+) and the formation of oxidized manganese occurred only in summer samples which supported metabolically active Mn-oxidizing bacteria. Highly enriched lake water inhibited Mn oxidation. Binding and oxidation of Mn was inhibited in filtered samples when particles > 0.4 micro m were removed, and inhibition persisted when the particles were first ethanol treated and then reintroduced into filtered lake water. Within the range of 0-20 microM Mn(2+) binding varied with the initial Mn(2+) concentrations in August water samples. (Baker-IVI)
W85-01598

ENTRAINMENT BY BOTTOM CURRENT IN LAKE ERIE,
National Water Research Inst., Burlington (Ontario). Basin Investigation and Modelling Section.
G. N. Ivey, and F. M Boyce.
Limnology and Oceanography, Vol. 27, No. 6, p 1029-1038, November, 1982. 9 Fig, 1 Tab, 8 Ref.

Descriptors: *Bottom currents, *Lake Erie, *Entrainment, Basins, Dissolved oxygen, Heat budget, Turbulence, Thermocline, Water circulation, Hypolimnion.

Data collected during an intensive field program in 1979 concerning the central basin of Lake Erie contain an example of an event during which both the thickness and temperature of the hypolimnion increased due to an erosion of the thermocline from below. This thickening of the hypolimnion requires two conditions. First, the thermocline region, or metalimnion, must be thick enough so that the effects of the energetic surface mixing processes are confined to the upper portion of the thermocline. Secondly, the currents in the thin hypolimnion must be strong enough to entrain overlying metalimnion water down into the hypolimnion. An analysis of the current meter data suggests the source of turbulent energy driving the mixing is shearing stresses at the bottom. During the entrainment event, the contribution to bottom dissolved oxygen supply is about 10% of the daily demand. (Baker-IVI)
W85-01600

FREE SURFACE OSCILLATIONS OF LAKE ONTARIO,
National Water Research Inst., Burlington (Ontario).
P. F. Hamblin.
Limnology and Oceanography, Vol. 27, No. 6, p 1039-1049, November, 1982. 8 Fig, 2 Tab, 12 Ref.

Descriptors: *Seiches, *Lake Ontario, Great Lakes, Storm surges, Limnology, Oscillatory waves, Finite element method, Mathematical studies.

Standard 1 hr readings of water level are shown to be unsuitable for determining the periods of seiches of Lake Ontario due to contamination by high frequency noise (aliasing). During an extensive study of the physical limnology of Lake Ontario, readings of water level at 17 tidal gauges and at 5 min intervals were used to form smoothed 30 min estimates of water level. Spectral analyses of these data reveal that numerically calculated periods by the finite element method were within several percent of observed periods and that computed distributions of amplitude and phase of the four lowest gravitational modes generally agreed with field data. The study indicates the need for finer resolution of both numerical models and field measurements in the investigation of modes of oscillation higher than the fourth in Lake Ontario. Offshore measurements of water level would be particularly useful for the study of higher modes. Two-dimensional methods are still warranted if there is interest in higher modes, because these modes tend to exhibit a significant transverse component of motion which would not be accounted for by purely one-dimensional methods. (Baker-IVI)
W85-01601

DIEL FLUCTUATIONS OF DOC GENERATED BY ALGAE IN A PIEDMONT STREAM,

Academy of Natural Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
L. A. Kaplan, and T. L. Bott.
Limnology and Oceanography, Vol. 27, No. 6, p 1091-1100, November, 1982. 4 Fig, 3 Tab, 36 Ref.

Descriptors: *Algal growth, *Dissolved solids, *Organic carbon, *Diel variations, *White Clay Creek, *Pennsylvania, Eutrophication, Primary productivity.

Diel fluctuations in dissolved organic carbon (DOC) were measured in White Clay Creek, a piedmont stream in southeastern Pennsylvania. DOC concentrations were measured on 16 days from late March to early June and on 2 days in early November of 1978 and 1979. Rapid increases were seen from predawn minima to late afternoon maxima and gradual decreases after sunset. During a single day concentrations could increase by as much as 40%. These measurements were made during periods of constant discharge and were not related to volume of flow nor changes in groundwater DOC concentrations. While the importance of algal extracellular release to the temporal fluctuations of DOC in aquatic environments is unknown, benthic algae excrete most of the dissolved organic matter and bacterial uptake may modify its concentration and composition. Net extracellular release can account for up to 20% of the total DOC exported from the basin during the photoperiod on days when the diel pulse is strongest, indicating that concentrations of DOC were controlled by the autotrophs. At those times, the algal community may make an important contribution to the metabolism and composition of aquatic communities both adjacent and downstream. This phenomenon should be found in small to midorder streams during periods of high autochthonous primary productivity and may be particularly striking in desert streams with organic energy budgets dominated by autochthonous inputs. (Baker-IVI)
W85-01602

NITROGEN AND PHOSPHORUS DEPENDENCE OF ALGAL BIOMASS IN LAKES: AN EMPIRICAL AND THEORETICAL ANALYSIS,
Minnesota Univ., Minneapolis. Limnological Research Center.
V. H. Smith.
Limnology and Oceanography, Vol. 27, No. 6, p 1101-1112, November, 1982. 6 Fig, 5 Tab, 58 Ref. NSF grant DEB77-15069.

Descriptors: *Lakes, *Nitrogen, *Phosphorus, *Biomass, *Algae, Eutrophication, Algal growth, Chlorophyll, Prediction, Phytoplankton.

An analysis of mean growing season concentrations of chlorophyll, total phosphorus and total nitrogen in 228 north latitude lakes confirms previous observations that chlorophyll yield is dependent both on the phosphorus concentration and on the total nitrogen:total phosphorus ratio. Of two modified chlorophyll models which depend explicitly on both N and P developed and tested, one, a multiple regression model, appears to greatly reduce the error of chlorophyll prediction in lakes. A theoretical framework is presented which provides an explanation for the observed effects of N:P ratios. The effects of N:P ratios on algal biomass appear to be the result of differences in the nutrient physiology of different algal species. Data have confirmed that the amount of chlorophyll produced by a given concentration of total P is sensitive to variations in the N:P ratio. Further data suggest that a similar effect will be found for total cell volume. Thus, variations in the TN:TP ratio seem to be responsible for a substantial portion of the scatter observed in previous phosphorus chlorophyll regressions and probably also in phosphorus-cell volume regressions. The effects of the TN:TP ratio on algal biomass appear to be driven by species shifts in the phytoplankton. (Baker-IVI)
W85-01603

DISSOLVED OXYGEN CONCENTRATIONS IN LAKE ERIE (U.S.A.-CANADA); 1. STUDY OF SPATIAL AND TEMPORAL VARIABILITY USING CLUSTER AND REGRESSION ANALYSIS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
J. E. Anderson, A. H. El-Shaarawi, S. R. Esterby, and T. E. Unny.
Journal of Hydrology, Vol. 72, No. 3/4, p 209-229, June, 1984. 7 Fig, 6 Tab, 13 Ref.

Descriptors: *Lake Erie, *Dissolved oxygen, *Cluster analysis, *Regression analysis, *Spatial variaton, *Temporal variation, Water temperature, Hypolimnion, Mathematical studies, Oxygen depletion.

A non-hierarchical nearest-centroid clustering method was used to separate data pairs consisting of the dissolved oxygen (DO) concentration and temperature into four groups corresponding to hypolimnetic and non-hypolimnetic water for the Central and Eastern Basins of Lake Erie. For the stations which were common to all cruises within a year and were classified as being in the hypolimnion, initial DO concentrations and depletion rates were calculated and tests about their constancy were performed using weighted regression analysis and regression models with the time structure of the data explicitly incorporated in the models. The yearly uncorrected depletion rates from 1967-1980 were similar to values previously reported by several authors, indicating that this semi-objective clustering procedure provides a practical alternative to subjective selection of data. The conclusions about constancy of initial concentrations and depletion rates based on an unweighted regression analysis were shown to differ from those of weighted regression. Using regression with empirical weights, it was found that neither the initial DO concentration nor the depletion rate remained constant between 1967 and 1980 in the Central Basin but that the depletion rate remained constant and the initial DO concentrations varied in the Eastern Basin. (Author's abstract)
W85-01609

DISSOLVED OXYGEN CONCENTRATIONS IN LAKE ERIE (U.S.A. - CANADA); 2. A STATISTICAL MODEL FOR DISSOLVED OXYGEN IN THE CENTRAL BASIN OF LAKE ERIE,
National Water Research Inst., Burlington (Ontario).
A. H. El-Shaarawi.
Journal of Hydrology, Vol. 72, No. 3/4, p 231-243, June, 1984. 6 Fig, 1 Tab, 12 Ref.

Descriptors: *Lake Erie, *Dissolved oxygen, *Statistical models, *Hypolimnion, Water temperature, Phosphorous, Anoxic conditions, Oxygen depletion, Water pollution effects, Model studies, Physicochemical properties.

A statistical model for dissolved oxygen (DO) concentrations in the hypolimnion of the Central Basin of Lake Erie was developed using data collected during the period 1967-1979. The model uses the lake water level, the hypolimnion temperature and the total phosphorus (TP) concentrations as explanatory variables. The model estimates the probability of anoxia occurrence in the Central Basin and predicts the TP concentration when the DO depletion rate and the water level are specified. DO depletion rate was completely independent of temperature and depended only on water level and TP. The initial DO concentration in the hypolimnion was found to be a function of temperature, TP, and the interaction between temperature and water level. The increase in depletion is related to the increase in the level of TP. There is always a high chance for anoxia to occur and this chance increases with the increase in the level of TP. It is possible to improve the anoxic conditions in a lake by controlling TP loading. (Collier-IVI)
W85-01610

RAPID NUMERICAL METHOD FOR HORIZONTAL FLUID FLOW IN UNSATURATED SOILS,
Warren Spring Lab., Stevenage (England).
J. M. Kirby.
Journal of Hydrology, Vol. 72, No. 3/4, p 391-400, June, 1984. 3 Fig, 8 Ref.

Descriptors: *Unsaturated flow, *Aeration zone, *Horizontal flow, *Mathematical analysis, *Model studies, Infiltration, Conductivity, Vertical flo
Flow, Soil moisture.

Solutions for horizontal infiltration in unsaturat
soils; scaling methods are often used which a
quick and accurate, but are limited to this type
problem. A rapid numerical method for the ho
zontal flow of water was developed which can
used for solving problems other than infiltration.
is based on the approximation for conductivity
= k sub 0 exp (alpha psi). A simple expression f
the velocity of flow was obtained, which produc
accurate solutions to horizontal infiltration pro
lems even with very large time and length step
provided that the time step is below a certain lim
which is related to the length step. An expressi
for estimating the maximum permissible time st
was developed. The model has been used for bo
horizontal and vertical flow. The solutions are al
economic (in terms of the time and necessary co
puter power). (Collier-IVI)
W85-01619

EVALUATION OF THE INCREMENTA METHODOLOGY FOR RECOMMENDING I STREAM FLOWS FOR FISHES,
Oklahoma Cooperative Fishery Research Un
Stillwater.
For primary bibliographic entry see Field 6
W85-01623

MACROINVERTEBRATES ASSOCIATE WITH VARIOUS AQUATIC MACROPHYTE IN THE BACKWATERS AND LAKES OF TH UPPER CLUTHA VALLEY, NEW ZEALAN
Ministry of Works and Development, Chris
church (New Zealand).Water and Soil Scienc
Centre.
B. J. F. Biggs, and T. J. Malthus.
New Zealand Journal of Marine and Freshwat
Research, Vol. 16, No. 1, p 81-88, 1982. 2 Fig,
Tab, 17 Ref.

Descriptors: *Macroinvertebrates, *Macrophyte
*Clutha Valley, *New Zealand, *Lake Wanak
*Lake Roxburgh, *Upper Clutha River, Ecolog
Abundance, Ecological distribution, Biomas
Habitats, Aquatic habitats.

The invertebrate communities associated with
native aquatic macrophytes (Potamogenton che
semanii, Myriophyllum propinquum and Char
ceae) and 3 adventive species (Elodea canadensi
Lagarosiphon major, and Ranunculus fluitans)
Lakes Wanaka and Roxburgh and several backw
ters of the Upper Clutha River were studied
February-March 1980. Underwater divers obtaine
a total of 24 x 1 sq m macrophyte samples, fro
which the invertebrates were removed. 26 inverte
brate taxa were identified, several of which ha
not previously been recorded from macrophy
communities in New Zealand. The communitie
were all dominated by the gastropod Potamopy
gus antipodarum, with Physa sp. (Mollusca) c
Chironomidae (Diptera) being sub-dominan
Overall, the mean abundance of invertebrates wa
1585/sq m, and the mean biomass of invertebrate
was 0.994 g/sq m. The Characeae had the highe
mean abundance and biomass of invertebrates, an
P. cheesemanii the lowest. Significant difference
in invertebrate abundance and biomass occurre
between some of the macrophyte habitats, bu
there appeared to be no preference by the inverte
brate fauna for either indigenous or adventive ma
crophyte species as a habitat. (Author's abstrac
W85-01630

EFFECTS OF FLUCTUATIONS IN WATE LEVEL AND GROWTH OF LAGAROSIPHO MAJOR ON THE AQUATIC VASCULA PLANTS IN LAKE ROTOMA, 1973-80,
Auckland Univ. (New Zealand). Dept. of Botan
J. S. Clayton.
New Zealand Journal of Marine and Freshwat
Research, Vol. 16, No. 1, p 89-94, 1982. 1 Fig,
Tab, 20 Ref.

Descriptors: *Mosses, *Macrophytes, *Lak
Rotoma, *New Zealand, *Ecological effect

/ater level fluctuations, Plant populations, Flora, kes, Erosion, Silting, Drying, Habitats.

ıctuations in water level and the growth of the roduced exotic Lagarosiphon major (Ridley) ɔss have significantly influenced the submerged getation of Lake Rotoma, New Zealand, over period 1973-80. Low lake levels temporarily luced the proportion of native vascular plants by noving available shallow-water habitats through sion, siltation, or desiccation. High lake levels ve allowed native vascular plants to re-establish m seed and rhizomes. Fluctuations in water el appear to have reduced the long-term re- cement of native species by L. major, which has ne the less spread progressively around the lake. terlevel fluctuations enhanced its rate of frag- ntation, and thus its dispersal and establishment. e annual increase in the proportion of L. major been primarily at the expense of the shallow- ter characean algae but also partly by competi- e displacement of native vascular plants. The thwest inlet of Lake Rotoma had an exception- y high plant density, with up to 3518 g/sq m dry ight of L. major (believed to be a world record submerged plant biomass); this is attributed to al enrichment and protection from wave expo- e. (Author's abstract)
35-01631

. Water In Plants

E OF A WET-SURFACE WEIGHING LYSIM- ER SYSTEM IN RAINFALL INTERCEP- ON STUDIES OF HEATHER (CALLUNA LGARIS),
titute of Hydrology, Wallingford (England).
. Calder, R. L. Hall, R. J. Harding, and I. R. ight.
rnal of Climate and Applied Meteorology, Vol. No. 3, p 461-473, March, 1984. 7 Fig, 5 Tab, 46 f, 1 Append.

scriptors: *Killin, *Scotland, *Heather, *Lysim- r, *Rainfall interception, *Aerodynamic resist- ce, Water vapor, Penman-Montieth equation, nopy, Heat transfer, Moisture meters, Air tem- ature, Wet-bulb depression, Interception.

portable, wet-surface lysimeter system, for meas- ng the in situ interception characteristics of rt to medium height vegetation was developed. e system, comprising an electronic balance and teorological sensors linked to a microcomputer, been used successfully at a number of U. K. s of widely varying topography. The method ows direct measurement of the aerodynamic re- ance (r sub v) to the transport of water vapor m a source to a reference position, by solution the Penman-Monteith equation, using vegetation mples in situ; it makes no assumptions about the ality of the resistances to latent and sensible t transfer. Two sites near Killin in Scotland, getated predominately with heather, were moni- ed over the period 31 August-17 September 1. Meteorological variables monitored were air perature and wet-bulb depression, at 1.2 m ve the top of the plant canopy, net radiation l the wind speed at 2 m above the top of the opy. The canopy surface temperature and soil t flux were also monitored. The lysimeter was ced in a pit and the removed vegetation, with its t system undisturbed, was placed on top of a erglass tray which rests on the electronic bal- ce. The aerodynamic resistance was found to be ub v = (20.0 + or - 2.0) x u(-(0.60 +/- 0.06)), ere u is the mean windspeed; the canopy capac- of intercepted water was found to be (1.4 +/-) mm. (Collier-IVI)
35-01154

IL, WATER AND NUTRIENT CONSERVA- ON BY CERTAIN RIPARIAN HERBS,
naras Hindu Univ., Varanasi (India). Centre for dvanced Study in Botany.
r primary bibliographic entry see Field 2J.
35-01156

MULATION OF THE UTILIZATION OF ATER AND OF PLANT PRODUCTION OF A SAHELIAN PHYTOCENOSE IN SENEGAL (SIMULATION DE L'UTILISATION DE L'EAU ET DE LA PRODUCTION VEGETALE D'UNE PHYTOCENOSE SAHELIENNE DU SENEGAL),
Centre National de la Recherche Scientifique, Montpellier (France). Centre d'Etudes Phytosociologiques et Ecologiques Louis-Emberger.
S. Rambal, and A. Cornet.
Acta Ecologica/Ecologia Plantarum, Vol. 3, No. 4, p 381-397, 1982. 7 Fig, 3 Tab, 46 Ref.

Descriptors: *Senegal, *Sahelian zone, *Model studies, *Plant production, *Water use, *Simulation, Phytocenose, Productivity, Rainfall distribution, Evaporation, Evapotranspiration.

Located in the sahelian zone of Senegal, the investigated site consists of grassland on sandy soil, dominated by annuals, C sub 4 grasses with associated legumes. The ARFEJ model described, uses simplified characteristics of the system to predict soil water and plant production, under the assumption that water is the limiting factor. Three model coefficients were calculated with the data of 1975 and 1976. The model was then tested using the 1977 to 1978 data. The results show (a) the effect of rainfall distribution on evaporation from bare soil; the mean of this evaporation was 28 % (range 22-34 %) of total actual evapotranspiration, (b) during the short period of fast growth, the ratio of produced dry matter to transpired water was about 0.88 g dry matter/kg H2O. (Author's abstract)
W85-01179

DRAINAGE-TILLAGE INTERACTION ON CLERMONT SOIL,
Agricultural Research Service, Columbus, OH.
For primary bibliographic entry see Field 2G.
W85-01184

LEAF WATER POTENTIALS FOR MANAGEMENT OF HIGH FREQUENCY IRRIGATION ON APPLES,
Agricultural Research Service, Prosser, WA. Irrigated Agriculture Research and Extension Center.
For primary bibliographic entry see Field 3F.
W85-01190

TEST AND ANALYSIS OF A MODEL OF WATER USE BY SOGHUM,
C. H. M. van Bavel, R. J. Lascano, and L. Stroosnijder.
Soil Science, Vol. 137, No. 6, p 443-456, June, 1984. 7 Fig, 1 Tab, 26 Ref.

Descriptors: *Water use, *Soil-water-plant relationships, *Model studies, *Sorghum, Moisture stress, Soil water, Water balance, Evapotranspiration, Simulation.

A well developed sorghum crop was used to validate a water use and uptake model proposed by Van Bavel and Ahmed (1976, Ecol. Modeling 2: 189-212.). Test conditions involved both situations in which soil water supply was ample and in which it was restricting. The WATBAL model was intended to quantify, in a simple manner, plant-soil water relations as the quantity and the distribution of soil water available for root uptake varied. It does not entail local empiricisms, nor is it tailored to the climate of the location where it was tested. The model appeared adequate in calculating evapotranspiration and the amount of water in the soil profile, considering the uncertainty of both measurement and simulation. The prediction of the distribution of water in the profile over a 50-d period is less accurate, likely due to the assumption of a physically homogeneous profile and a simplified root distribution. Surface layer water content was correctly predicted. This could not have been possible without hypothesizing, in the basic algorithm for root water uptake, that water flows as readily out of the root system as into it, depending upon the direction of the hydraulic gradient between soil and root system. Speculations based on WATBAL suggest that there will be a large variation in the crop canopy-air temperature differential and that this differential will be closely correlated to canopy water stress, but not to the daily transpiration. (Baker-IVI)
W85-01278

2J. Erosion and Sedimentation

ALLUVIAL STRATIGRAPHY AND RADIOCARBON DATING ALONG THE DUCK RIVER, TENNESSEE: IMPLICATIONS REGARDING FLOOD-PLAIN ORIGIN,
Arizona Univ., Tucson. Dept. of Geosciences.
G. R. Brakenridge.
Geological Society of America Bulletin, Vol. 95, No. 1, p 9-25, January, 1984. 9 Fig, 1 Tab, 47 Ref.
TVA contract TV-49244AA.

Descriptors: *Duck River, *Tennessee, *Carbon radioisotopes, *Stratigraphy, *Alluvial deposits, Sedimentation, Pollen, Flood plains, Environmental effects, Hydrological regimes, Agriculture, Sediments, Accretion, Aggradation.

The Duck River is an ingrown meandering river in Tennessee. Artificial exposures of the stratigraphy were created by 18 backhoe trenches along a 32 km reach of the river. On the basis of these excavations and radiocarbon dates, a history of flood-plain sedimentation was traced. Analysis of pollen was used for paleoclimactic determinations. Four lithostratigraphic alluvial formations and eight chronostratigraphic subdivisions occur along the middle Duck River Valley. Each late Quaternary flood-plain accumulation consists of about 2 m of sandy and gravelly bottom-stratum facies overlain by 2.5 to 4 m of clayey and silty top-stratum facies. An additional 1 to 2 m of clayey and silty 'terrace veneer facies' blankets all but the youngest accumulation. The last period of flood-plain stability ended in the early 1800s; the introduction of row crop agriculture into the basin at this time probably caused the historic episode of renewed accretion that is still under way. These results suggest the importance of environmental controls over fluvial systems at times scales of 100 to 10,000 yr. The stratigraphic information also indicates that after periods of stability and soil development and in response to altered hydrologic regimes, the Duck River forms new flood plains by lateral and vertical suspended load accretion on channel banks and in-channel bars. At the same time, the older flood-plain surface is covered by as much as several meters of the younger alluvium and becomes a terrace. In contrast, lateral accretion of point-bar sands and gravels is not an important flood-plain-forming process along this river. (Collier-IVI)
W85-01131

RAINFALL-RUNOFF-SEDIMENT YIELD RELATION BY STOCHASTIC MODELLING,
Consiglio Nazionale delle Ricerche, Turin (Italy). Ist. di Ricerca per la Protezione Idrogeologica nel Bacino Padano.
E. Caroni, V. P. Singh, and L. Ubertini.
Hydrological Sciences Journal, Vol. 29, No. 2, p 203-218, June, 1984. 4 Fig, 6 Tab, 11 Ref.

Descriptors: *Rainfall-runoff relationships, *Sediment yield, *Model studies, Transfer functions, Noise techniques, Pigeon Roost Creek, Marshall County, Mississippi, Time series analysis.

Two single input stochastic models for obtaining estimates of sediment yield in rivers were developed based on transfer function plus noise techniques and calibrated using previously collected data from Pigeon Roost Creek, Marshall County, Mississippi. Stochastic modeling accounts for the time series nature of rainfall. These techniques are superior to traditional methods which make use of discharge-concentration rating curves. The models were fitted to a calibration set of eight events and then applied to predict and simulate sediment yield for four sets of events. Model calibration requires (a) derivation of an estimate of the impulse response function from the estimated cross-correlation function between the input and output series after 'prewhitening,' (b) fitting the model to the data by minimizing the residual sum of squares, (c) the Box-Pierce statistic obtained from the first k terms of the residual autocorrelation function. If

the model proved inadequate, the autocorrelation and cross-correlation functions involving the residuals of the rejected model indicated what modifications were to be made in the transfer function or the noise. The adaptability of these models to real time forecasting schemes was supported and they provided some information about the dependency of sediment yield on rainfall and runoff rates. (Collier-IVI)
W85-01138

SOIL, WATER AND NUTRIENT CONSERVATION BY CERTAIN RIPARIAN HERBS,
Banaras Hindu Univ., Varanasi (India). Centre for Advanced Study in Botany.
R. S. Ambasht, M. P. Singh, and E. Sharma.
Journal of Environmental Management, Vol. 18, No. 2, p 99-104, March, 1984. 3 Tab, 3 Ref.

Descriptors: *Riparian vegetation, *Riparian land, *River Gomti, *India, *Erosion control, Nutrient removal, Soil conservation, Water conservation, Organic carbon, Nitrogen, Soil porosity.

In the Indian plains, the dense human populaton prevents permanent afforestation of riparian ecosystems; ideally, afforestation would stabilize the system and check erosion and river meandering. In order to assess the quantitative roles of herbaceous plants in binding the soil, nutrient conservation and retarding water runoff and soil erosion, six species dominant on the banks of the River Gomti at Jaunpur (India) were selected and planted on sloping experimental plots in the Botanic Garden, Banaras Hindu University. Propagules of the following dominant rainy season species were selected: Cynodon dactylon, Phyla nodiflora, Cyperus rotundus, Croton bonplandianum, Crotalaria medicaginea, and Digitaria adscendens. Known quantities of water were sprayed on vegetated and bare plots, and runoff water and soil were collected in separate cemented reservoirs. The soil conservation value of selected grasses and sedge was found to range from 87.6 to 95.4%, and of dicotyledon weeds from 52.8 to 93.8%. The plants retarded water runoff by about 60%, compared with the bare plot. Water conservation values for herbaceous cover, compared with the bare plot values, ranged from 65 to 74% for grasses and sedge, and 27 to 72% for dicotyledon weeds. Organic carbon and nitrogen content were conserved and soil porosity and waterholding capacity were improved by C. dactylon, P. nodiflora, C. rotundus, and D. adscendens. (Collier-IVI)
W85-01156

EROSION ON LOGGING ROADS IN NORTHWESTERN CALIFORNIA: HOW MUCH IS AVOIDABLE,
J. D. McCashion, and R. M. Rice.
Journal of Forestry, Vol. 81, No. 1, p 23-26, January, 1983. 6 Fig, 2 Tab, 8 Ref.

Descriptors: *California, *Forest management, *Erosion rates, *Logging roads, Erosion control, Roads, Road construction.

A survey of logging roads in northwestern California to assess sources of erosion indicated that not all road-related erosion is preventable. The inventory included 344 miles of roads in Del Norte, Humboldt, Siskitou, and Trinity Counties; also included in the survey were 30,300 acres of commercial timberland. Erosion from a harvest area was compared to erosion on road rights-of-way. The roads surveyed included seasonal roads, all-weather secondary roads, and main-haul roads. Every 0.2 miles on the roads, the slope, grade, aspect, cut-and-fill heights, and other descriptors were recorded. Erosional events were classified as either naturally derived events, unavoidable road-related erosion, or avoidable road-related erosion. At most, about 24 percent of the erosion measured on the logging roads could have been prevented by conventional engineering methods (avoidable road-related erosion) and 37 percent was unavoidable (caused by site conditions and choice of alignment). On the timberland, an estimated 40 percent of the total erosion associated with management of the area was found to have been derived from the road system and 60 percent came from the logged area. (Collier-IVI)
W85-01164

SEDIMENT RETENTION EFFICIENCY OF SYNTHETIC FILTER FABRICS,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
L. S. Fisher, and A. R. Jarrett.
Transactions of the ASAE, Vol. 27, No. 2, p 429-436, March-April, 1984. 14 Fig, 6 Tab, 17 Ref.

Descriptors: *Erosion, *Subsurface drainage, *Filters, *Sediment retention, Soil filters, Suspended solids, Suspended load, Sand, Silt, Clay.

Improved land management practices are needed to reduce the excessive erosion resulting from rapidly changing land use. Several researchers have successfully used synthetic filter fabrics as soil retention barriers in subsurface drainage applications. Hence, synthetic filter fabrics have the potential to remove suspended soil particles resulting from erosion. Six synthetic filter fabrics were investigated for particle retention and water transmissibility when subjected to a flowing soil suspension. Four replicate tests were performed with sand, coarse silt, and silt-clay soil suspensions. All fabrics successfully removed sand particles (> 75 micro m) from suspension. Various amounts of coarse silt particles (75 to 37 micro m) were removed by the fabrics tested and these filter fabrics were generally ineffective filters of silt-clay particles (< 37 micro m). When significant quantities of soil particles were retained, filter clogging reduced each fabric's ability to transmit water. A definite compromise exists between a filter fabric's ability to remove soil particles while transmitting water flow. (Author's abstract)
W85-01189

TOWARDS A BETTER DEFINITION OF THE THREE TYPES OF SEDIMENT TRANSPORT (POUR UNE MEILLEURE DEFINITION DES TROIS TYPES DE TRANSPORT DE SEDIMENTS),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hydromechanik und Wasserwirtschaft.
A. Gyr.
Journal of Hydraulic Research, Vol. 21, No. 1, p 1-15, 1983. 4 Fig, 3 Tab, 20 Ref.

Descriptors: *Sediment transport, *Sedimentation, *Fluid mechanics, *Turbulent flow, *Statistical models, Bed load, Wash load, Saltation, Suspended load, Vortices, Eddies.

It is common to separate the sediment transport of rivers into bed load, wash load and suspended load; however, there are no unique criteria for distinguishing between the three types of loads. The distinction between saltation (leaping into the flow and then resting on the bed) and suspension delimits two methods of hydraulic transportation which follow different laws. Sediments which move as surface creep or saltation and which are supported by the bed, are called bed load. Sediments which are suspended and supported by flow are called suspended load. Wash load is that fraction of the total amount of transported sediment that is not in the bed layer. Using the concept of coherent structures for turbulent flow, only the shear events (burst phenomena) are able to transport the larger grain sizes of the sediment. Coherent structures are vortex elements or shearlayer areas which are interacting with each other in a deterministic way. The new description for sediment transport is composed of a determinate part for modeling the interaction of the sediment particles with the organized motion and a statistical formulation which takes care of the distribution of the events and of the statistical distribution of their convective motion. A consistent set of criteria for defining the three types of loads was developed. (Collier-IVI)
W85-01227

TRANSPORT OF NON-UNIFORM SEDIMENTS (TRANSPORT DE SEDIMENTS NON UNIFORMES),
Ministry of Works and Development, Wellington (New Zealand).
G. T. Proffitt, and A. J. Sutherland
Journal of Hydraulic Research, Vol. 21, No. 1, p 33-43, 1983. 5 Fig, 2 Tab, 16 Ref.

Descriptors: *Sediment transport, *Bed load, *Particle size, Fluid mechanics, Exposure correction, Model studies, River beds.

Sediment non-uniformity influences the water-sediment interaction; for most rivers with mean bed material size greater than 2 or 3 mm, the geometric standard deviation of the grading curve exceeds 1.3. Bed load transport prediction methods commonly adopted for non-uniform sediments by defining an exposure correction which allows for the increased mobility of coarse particles and the decreased mobility of fine particles in a mixture compared with their mobility in a uniform sediment bed. Laboratory experiments led to a way of modifying existing transport rate formulae so that transport rates and size distributions of transported material could be predicted knowing the hydraulic conditions and the bed-material grain size distribution. The Ackers and White and the Paintal transport formulas were modified accordingly and used successfully on laboratory data. When used with laboratory data in which the source material distribution is well defined and for which the experiment can be well controlled acceptable agreement between measured and predicted quantities was obtained. Difficulties in defining bed-material distributions and the possibility of overpassing in gravel systems are reflected in the results obtained using data from four rivers. (Collier-IVI)
W85-01229

ELECTROMAGNETIC DEVICE FOR AUTOMATIC DETECTION OF BEDLOAD MOTION AND ITS FIELD APPLICATIONS,
Birkbeck Coll., London (England).
I. Reid, A. C. Brayshaw, and L. E. Frostick.
Sedimentology, Vol. 31, No. 2, p 269-276, February, 1984. 5 Fig, 24 Ref.

Descriptors: *Sediment transport, *Measuring instruments, *Bed load, Sensors, Entrainment, Particles, Alluvial channels, Automation.

A new sensor for the continuous and unmanned detection and recording of bedload motion is described. The sensor acts in the same fashion as a conventional metal detector but is elongated and installed permanently in the bed of an alluvial channel. Artificial clasts are labelled with different lengths of ferrite rod and are seeded upstream of the sensor, replacing bed particles. It was initially hoped that particles of different size (encased in different lengths of ferrite rod) would be detectable. But the large range of possible travel attributes and transport velocities made this less certain and so, for the present, this was abandoned in favour of a standard particle size. The entrainment of such clasts takes them over the sensor where they distort the magnetic field and produce a characteristic inductance that is detected and recorded. A field installation demonstrates the value of the sensor in revealing for the first time in coarse-grained alluvium the spasmodic nature of particle motion reminiscent of kinematic waves. The study also demonstrates the importance of pebble clusters in determining particle entrainment. (Baker-IVI)
W85-01276

SIDE-SCAN TARGETS IN LAKE SUPERIOR: EVIDENCE FOR BEDFORMS AND SEDIMENT TRANSPORT,
Lamont-Doherty Geological Observatory, Palisades, NY.
R. D. Flood, and T. C. Johnson.
Sedimentology, Vol. 31, No. 3, p 311-333, June, 1984. 15 Fig, 33 Ref. NSF grants OCE 81-[illegible] and OCE 80-18339.

Descriptors: *Lake beds, *Bedforms, *Sediment transport, *Lake Superior, Sonar, Side-scan sonar, Sedimentology, Great Lakes, Measuring instruments, Currents, Morphology, Bottom cur-

A high resolution side scan sonar survey of the lake bed off the Keweenaw Peninsula, Lake Superior, demonstrates that bottom currents are affecting lake bed morphology at depths up to 240 mm. Numerous lineations which run parallel to the shore appear to be sand ribbons. A field of sedimentary furrows which occurs in one area demonstrates the long-term directional stability of the near bottom flow. Large, unusual ring-like or arcuate depressions, 100-300 m in diameter and 2-5 m deep, are common throughout the western half of Lake Superior. These rings themselves do not appear to have been formed by bottom currents, but may have developed as water was released by the rapid compaction of glacial sediments which underlie the lake bed. Off the Keweenaw Peninsula the forms of the rings have been modified by bottom currents. The bottom currents which have modified the lake bed are probably generated when storms cross the lake at times when it is poorly stratified. The study provides valuable insight into the present day sediment dynamics of a large lake, and suggests that lake beds may be more dynamic sedimentary environments than generally believed. Also demonstrated is the fact that there can be significant lateral variability in bottom character and structure over short distances, even in the center of the lake. (Baker-IVI)
W85-01277

EROSION OF EARTH COVERS USED IN SHALLOW LAND BURIAL AT LOS ALAMOS, NEW MEXICO,
Los Alamos National Lab., NM.
For primary bibliographic entry see Field 5G.
W85-01282

PROPOSAL ON AN ECOLOGICAL BASIS FOR THE CLASSIFICATION OF RECENT UNDERWATER SOILS IN RIVERS (EIN VORSCHLAG ZUR KLASSIFIZIERUNG REZENTER UNTERWASSERBODEN VON FLUSSEN AUF OKOLOGISCHER GRUNDLAGE),
Technische Univ., Munich (Germany, F.R.). Lehrstuhl fuer Bodenkunde.
For primary bibliographic entry see Field 5C.
W85-01370

DECOMPOSITION AND SEDIMENTATION PROCESSES IN OLIGOTROPHIC, SUBARCTIC LAKE THINGVALLA, ICELAND,
Odense Univ. (Denmark).
For primary bibliographic entry see Field 2H.
W85-01453

SUSPENDED SEDIMENT DISTRIBUTION IN WAVE FIELD,
National Water Research Inst., Burlington (Ontario). Hyrdraulics Research Div.
M. G. Skafel, and B. G. Krishnappan.
Journal of Waterway, Port, Coastal and Ocean Engineering, Vol. 110, No. 2, p 215-230, May, 1984. 11 Fig, 1 Tab, 17 Ref, 1 Append.

Descriptors: *Suspended sediments, *Wave action, *Mathematical models, Diffusion, Bed load, Shear velocity, Orbital velocity, Bed layer thickness, Resuspension, Particle size.

A simple mathematical model to predict suspended sediment concentration due to wave agitation is formulated using the diffusional approach. The classical Schmidt equation is solved to obtain the vertical distribution for time-averaged sediment concentration. The diffusion coefficient is assumed to be proportional to the product of shear velocity at the bed and orbital velocity just outside the boundary layer. A bed layer concept is proposed to evaluate the absolute values of sediment concentration as a function of the height from the bed knowing the wave parameters such as the wave height, period and the mean water depth and the sediment characteristics such as the grain size and the specific gravity. Laboratory experiments are used to evaluate the dimensionless diffusion coefficient and the bed layer thickness in terms of the dimensionless parameters controlling the phenomenon. The present formulation is compared with the experimental data of other investigators and a reasonable agreement between the two is obtained. (Author's abstract)
W85-01501

SUSPENDED SEDIMENT TRANSPORT AND BEACH PROFILE EVOLUTION,
Coastal Engineering Research Center, Fort Belvoir, VA.
W. R. Dally, and R. G. Dean.
Journal of Waterway, Port, Coastal and Ocean Engineering, Vol. 110, No. 1, p 15-33, February, 1984. 12 Fig, 16 Ref.

Descriptors: *Suspended sediments, *Sediment transport, *Beaches, Mathematical models, Computer models, Wave action, Storms, Tidal effects, Water level, Storm surges.

A simplified analytic investigation of the local suspended sediment transport in the onshore-offshore mode is performed, and is then adapted for computer solution to model beach profile evolution. The transport scheme involves both first order wave induced and mean 'return flow' currents, coupled with an exponentially shaped sediment concentration profile. Five criteria for a 'good' model are established, four of which are at least qualitatively satisfied by the present work. The model generates profiles of either the normal or storm types, depending on the wave conditions and sediment characteristics. The normal profiles are monotonic and concave upwards while the storm profiles contain one or more bars. The model responds to changes in water level due to tides, storm surge, or long-term fluctuations, and the relative rates of profile evolution appear to be correct. More research is required before quantitative accuracy can be achieved. (Author's abstract)
W85-01503

RIVER BED RESPONSE TO MAN-MADE CHANGES,
Florence Univ. (Italy). Dept. of Civil Engineering.
E. Paris.
Proceedings of the Institution of Civil Engineers, Part 2, Vol. 77, p 67-77, March, 1984. 5 Fig, 1 Tab, 20 Ref, 1 Append.

Descriptors: *Alluvial channels, *River beds, Channel morphology, Sediment transport, Bed slope, Hydraulic properties.

In spite of the complex nature of alluvial channel morphology, simplified models can be beneficial for evaluating the type and relative magnitude of river bed response. A method to estimate bed slope and flow depth variations, induced by human activity, in alluvial channels is developed using the Ackers and White (J. Hydraul. Div. Am. Soc. Civ. Engrs., 1973, 99, No. HY11, 2041-2060) sediment transport formulas and the White, Paris and Bettess (Proc. Instn. Civ. Engrs., 1980, 69, 737-750) friction relationships. Some examples are presented to show how artificial narrowing of a channel reach, or change in sediment concentration, may affect channel hydraulic characteristics. (Moore-IVI)
W85-01535

INITIATION OF SEDIMENT TRANSPORT IN GRAVEL STREAMS,
Hydraulics Research Station, Wallingford (England).
R. Bettess.
Proceedings of the Institution of Civil Engineers, Part 2, Vol. 77, p 79-88, March, 1984. 6 Fig, 5 Ref.

Descriptors: *Sediment transport, *Initiation of motion, *Gravel streams, Bed materials, Particle size, Friction, Turbulence, Roughness.

Using the Shields' curve, predictions can be made of the critical conditions at which initiation of motion will take place for sediment transport in sand channels of mild slope. The results for a number of experimental studies using coarse bed materials in steep channels do not seem to agree with the classical Shields' approach to initiation of motion. The Shields' equation and the rough-turbulent friction law may be combined to give a particularly simple method of determining critical conditions for the initiation of motion for sediments with diameters greater than 2.5 mm. In conditions of very large relative roughness, the critical mobility, instead of being constant, becomes dependent on the parameter d/k sub s, so that the Shields curve must be replace by a family of curves for different values of d/k sub s. (Moore-IVI)
W85-01536

MAGNETIC SUSCEPTIBILITY OF SEDIMENTING MATERIAL TRAPPED IN LOUGH NEAGH, NORTHERN IRELAND, AND ITS EROSIONAL SIGNIFICANCE,
Coventry (Lanchester) Polytechnic (England). Dept. of Geography.
J. A. Dearing, and R. J. Flower.
Limnology and Oceanography, Vol. 27, No. 5, p 969-975, September, 1982. 4 Fig, 14 Ref.

Descriptors: *Sedimentation, *Magnetic studies, *Erosion, *Lough Neagh, *Northern Ireland, Rainfall, Battery, Antrim Bay, Maine River, Six Mile Water, Channel erosion, Ferrimagnetic minerals.

The magnetic susceptibility of sedimenting material trapped at two sites in Lough Neagh has been measured over 1 year. Sedimenting material was collected at two sites in Lough Neagh: the Battery and Antrim Bay. The Battery site was in the open lake where the direct influence of riverborne sediment could be expected to be small. The Antrim Bay site was in the northeast arm of the lake near relatively large inflows from two rivers, the Maine and Six Mile Water. A close similarity was observed between the magnetic mineralogies of the two sets of sediments, suggesting that the internal mixing forces within Lough Neagh result in a deposition of sediments with similar assemblages of ferrimagnetic minerals over different parts of the lake bed. In view of the clear dominance by basaltic soils in the northeast of the catchment as sources of inwashed ferrimagnetic minerals, it seems likely that the magnetic properties of all Lough Neagh sediments reflect inputs of material from the River Maine and Six Mile Water. These two rivers have catchments consisting of almost entirely basaltic deposits and together provide about 26% of the total stream flow into the lake. There are no extensive areas of arable farmland in the Lough Neagh catchment, though formerly there was more tillage. Hence the major source of eroded allogenic sediment is unlikely to be the uppermost soil layers, but rather the sides of streams and river channels composed of subsoil and unconsolidated deposits. (Baker-IVI)
W85-01595

OVERLAND FLOW AND SEDIMENT DELIVERY: AN EXPERIMENT WITH SMALL SUBDRAINAGE IN SOUTHWESTERN PONDEROSA PINE FORESTS (COLORADO, U.S.A.),
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ. Forestry Sciences Lab.
B. H. Heede.
Journal of Hydrology, Vol. 72, No. 3/4, p 261-273, June, 1984. 3 Fig, 2 Tab, 18 Ref.

Descriptors: *Overland flow, *Sediment transport, *Pine Trees, *Arizona, *Coconino Plateau, *Surface runoff, *Erosion pavements, *Forest hydrology, Forest watersheds, Runoff volume, Runoff rates.

Overland flow and sediment delivery were studied in 14 small Ponderosa pine forest subdrainages within two 60 ha watersheds on the Coconino Plateau of the Colorado Plateau Physiographic Province near Flagstaff, Arizona. The study sites ranged in size from 0.02 ha to 0.3 ha. Runoff and sediment collectors at the bottom of the subdrainages conveyed the water-sediment mixtures into storage tanks. Sediment delivery from undisturbed forest floor practically was nil. Sources for sediment production were roads and erosion pavements and were not universally distributed on the watersheds. Most erosion pavements were the result of selected timber harvest 42 years ago.

When undisturbed forest floor was located between the source area and collector, the effect of the source area was offset; increased infiltration into the undisturbed forest floor was responsible by reducing overland flow. Buffer strips are important for reducing sediment delivery in this study area. (Collier-IVI)
W85-01612

2K. Chemical Processes

CARBON, NITROGEN, AND PHOSPHORUS TRANSPORT BY WORLD RIVERS,
Ecole Normale Superieure, Paris (France). Lab. de Geologie.
M. Meybeck.
American Journal of Science, Vol. 282, No. 4, p 401-450, April, 1982. 8 Fig, 11 Tab, 134 Ref.

Descriptors: *Rivers, *Cycling nutrients, *Nitrogen, *Phosphorus, *Carbon, Organic carbon, Dissolved solids, Precipitation, Water pollution sources, Fate of pollutants.

The various forms (dissolved and particulate, organic and inorganic) of carbon, nitrogen, and phosphorus in world rivers are reviewed. Specific topics of discussion include basic data and procedures used in river transport budgets; computation methods used in budgets, such as the use of simple extrapolation, typology, support parameters, use of small representative watersheds, and the direct estimate of additional inputs due to man's activities; and the origin of basic data. Major findings on organic carbon, nitrogen, and phosphorus levels and loads in rivers are described. World average concentrations and river loads of the various C, N, and P forms are listed tabularly. The influence of man's activity on river nutrient transport has been studied through comparisons of neighboring watersheds, the evolution with time of nutrient level in representative rivers since the beginning of intensive agriculture and the industrial era, and direct measurements of various pollutant sources such as urban wastes, discharges, and agricultural runoff. Results are presented from studies dealing primarily with the evolution approach to measurement. Rivers are a major link between continents and oceans. They can be considered from one viewpoint as an output of terrestrial ecosystems and land erosion processes, and from the other viewpont as an input to the ocean systems. These two viewpoints are considered together with the modification of the transfer rates resulting from man's activities. (Baker-IVI)
W85-01299

PYRITE AND SIDERITE FORMATION IN BRACKISH AND FRESHWATER SWAMP SEDIMENTS,
Copenhagen Univ. (Denmark). Inst. of General Geology.
D. Postma.
American Journal of Science, Vol. 282, No. 8, p 1151-1183, October, 1982. 16 Fig, 4 Tab, 49 Ref.

Descriptors: *Sediments, *Swamps, *Siderite, *Pyrite, Geochemistry, Brackish water, Natural waters, Vivianite, Phosphates, Interstitial water.

Siderite and pyrite are found in large amounts and spatially well separated in Skjerna delta swamp sediments. Small amounts of vivianite are found associated with siderite. Siderite occurs as loose aggregates of microcrystalline carbonate, while pyrite is present dominantly as framboids. Vivianite is mostly found as very small crystallites with the occasional occurrence of large crystals. Siderite is associated with freshwater sediments, while pyrite is found in brackish water. This conclusion was based on sedimentological data as well as on analyses of chloride concentrations in the pore waters. Vivianite is found together with siderite in freshwater sediments. The freshwater sediments contain much higher phosphate concentrations than brackish water sediments while the reverse is found in the pore waters. (Baker-IVI)
W85-01300

CONCENTRATION AND ISOTOPIC FRACTIONATION OF OXYGEN DISSOLVED IN FRESHWATER AND SEAWATER IN EQUILIBRIUM WITH THE ATMOSPHERE,
Amherst Coll., MA. Dept. of Physics.
B. B. Benson, and D. Krause, Jr.
Limnology and Oceanography, Vol. 29, No. 3, p 602-632, May, 1984. 4 Fig, 9 Tab, 22 Ref. NSF grant OCE-8019886.

Descriptors: *Oxygen isotopes, *Seawater, *Dissolved oxygen, Isotope studies, Salinity, Water temperature, Solubility.

Previous work on the solubility of oxygen in freshwater has been extended to seawater. Measurements of the Henry coefficient in the ranges 0 degrees < t < 45 degrees C and 0 < S < 50 fit the Setschenow relationship for the variation with salinity. The temperature dependence of the Setschenow coefficient for oxygen is found to be K = 0.0225034 - 13.6083/T + 2,565.68/T sq. The equation for the Henry coefficient as a function of temperature and salinity is used to calculate values for unit standard atmospheric concentrations (USAC) in freshwater and seawater in equilibrium with air at a total pressure of 1 atmosphere. It is estimated that the possible error in the new USAC values is no greater than +/- 0.1% and probably less. Tables and equations are presented for obtaining accurate USAC values in the ranges 0 degrees < t < 40 degrees C and 0 < S < 40. Simple procedures are given for calculating standard atmospheric concentrations at pressures different from 1 atm. The presence of sea salt has a negligible effect on the fractionation of the oxygen isotopes during solution. (Author's abstract)
W85-01334

KINEMATIC MODELS FOR SOIL MOISTURE AND SOLUTE TRANSPORT,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2G.
W85-01343

ASSESSMENT OF THE SPATIAL VARIATION IN THE CHEMICAL COMPOSITION OF BULK PRECIPITATION WITHIN AN UPLAND CATCHMENT,
Institute of Terrestrial Ecology, Bangor (Wales).
B. Reynolds.
Water Resources Research, Vol. 20, No. 6, p 733-735, June, 1984. 1 Fig, 2 Tab, 16 Ref.

Descriptors: *Precipitation chemistry, *Catchment areas, *Wales, Elevation, Aspect, Potassium, Collectors, Sampling.

Six bulk precipitation collectors were installed at four sites in the Cyff catchment and at two sites in the Gwy catchment of the Upper Wye on the eastern slopes of Plynlimon, in Wales. Bulk precipitation was collected weekly for chemical analysis over a period of 64 weeks at the six sites. For this remote uninhabited upland catchment, aspect and elevation appear to have little influence on the chemical composition of bulk precipitation. At this site, a single collector is adequate for estimating solute concentrations in bulk precipitation to within + or - 10% of the true mean for all ions except potassium, which would require two collectors. Additional collectors might be deployed to cope with sample contamination. To be within + or - 5% of the true mean, a large number of collectors, up to a maximum of 8 for potassium, would be necessary. The variations in rainfall catch and its dependence on elevation must also be taken into account for calculating the total input of solutes to moderate-sized catchments. (Moore-IVI)
W85-01348

GROUND-WATER CHEMISTRY OF DIBDIBA FORMATION, NORTH KUWAIT,
Kuwait Univ., Safat. Dept. of Geology.
F. Al-Ruwaih.
Ground Water, Vol. 22, No. 4, p 412-417, July-August, 1984. 10 Fig, 2 Tab, 4 Ref.

Descriptors: *Dibdiba Formation, *Kuwait, *Groundwater, *Chemical properties, Salinity, Sodium, Chlorides, Magnesium, Carbonates, Salin waters, Regional flow, Acidic water, Alkali water.

Chemical studies have been carried out on number of water wells from the Dibdiba Form tion northeast of Kuwait. Water salinity of th formation ranges between 3,300 mg/l to 7,000 m l, increasing with depth. The water entrapped Dibdiba Formation is mainly sodium chloride typ which can be differentiated into three differe groups according to the ranges of concentration the main cations and anions. These groups a (3331113) sodium chloride water type in which > Na, group (3333113) sodium chloride wat type in which Na > Cl. In both groups the s quence of dominant cations is Na > Ca > M Group (3333111) sodium chloride water type h Na > Cl and the sequence of dominant cations Na > Mg > Ca. Chemical ratios of Ca/Mg, N Cl, and Cl/HCO3 were worked out for Dibdi ground water. The ratio of Ca/Mg Dibdiba Fo mation ranges from 0.4 to 8.58, the ratio of Na/ ranges between 0.98 to 1.33, and the ratio of C HCO3 is 232. A plot of chemical analysis on trilinear diagram shows that Dibdiba Formati ground-water chemical properties are dominat by alkalies (Na > Ca) and strong acid (Cl > SO Water chemistry may reflect the history of t flow path indicating regional flow as shown increasing Na(+), Cl(-), SO4(--) and where Ca(+ Mg(+) achieve equilibrium. (Author's abstract)
W85-01528

2L. Estuaries

MINIMIZING THE POSSIBLE EFFECTS OF TIDAL POWER BARRAGE ON THE SHOR BIRD POPULATIONS OF THE SEVERN EST ARY,
University Coll., Cardiff (Wales). Dept. of Zoo gy.
For primary bibliographic entry see Field 6
W85-01158

HYDROLOGY-PLANT COMMUNITY REL TIONSHIPS IN THE OKEFENOKEE SWAM
National Audubon Society, Naples, FL. Ecos tem Research Unit.
M. J. Duever.
Florida Scientist, Vol. 45, No. 3, p 145-171, 1982 Fig, 2 Tab, 6 Ref.

Descriptors: *Swamps, *Plant populations, *Ok fenokee Swamp, Wells, Hydrology, Water tab Droughts, Waterlily, Cypress, Marsh, Shru Wetlands.

Seven shallow wells were monitored along a tra sect crossing all of the major habitats in the Oke nokee Swamp. Water levels, hydroperiods, a water table gradients were measured. Althou there are probably real (but minor) differences the hydroperiods of marsh, shrub, and cypr habitats, they are basically successional stages similar sites. Within major habitat types, degree structural development and/or species compositi was affected by other modifying factors, such depth of organic soil, type of mineral substra proximity of seed sources, nutrient availability a history of disturbance. While the differences tween habitats with regard to ground surface e vations are minor within the swamp, hydroperi varied from 246 to 346 da during 1977-19 Marsh, shrub, and cypress communities were for periods of a month or more during 27 of the yr of record, but waterlily communities were wi out surface water for a month or more only dur 16 yr. Ground water flows into the swamp fr the surrounding uplands except during drough when the flow is reversed, as indicated by water table gradient analysis. (Baker-IVI)
W85-01240

FEDERAL WETLANDS LAW: THE CAS AND THE PROBLEMS,
For primary bibliographic entry see Field 6E.
W85-01253

CHAVIOR OF ELEMENTS IN THE TAKAHA-II, JAPAN RIVER BASIN,
ayama Univ., Kurashiki (Japan). Inst. for Agri-ltural and Biological Sciences.
r primary bibliographic entry see Field 5B.
85-01292

RITE AND SIDERITE FORMATION IN RACKISH AND FRESHWATER SWAMP DIMENTS,
penhagen Univ. (Denmark). Inst. of General ology.
r primary bibliographic entry see Field 2K.
85-01300

ATER ENVIRONS OF OKEFENOKEE AMP: AN APPLICATION OF STATIC NEAR ENVIRON ANALYSIS,
orgia Univ., Athens. Dept. of Zoology.
C. Patten, and J. H. Matis.
ological Modelling, Vol. 16, No. 1, p 1-50, July, 2. 7 Fig, 4 Tab. 31 Ref.

scriptors: *Hydrologic budget, *Swamps, *Oke-okee Swamp, *Georgia, Model studies, Linear alysis, Environment, Watersheds, Water storage, ow, Environ analysis, Wetlands.

static water budget model is constructed for the efenokee Swamp watershed (swamp plus and portions) and decomposed into partition ts called environs. Flow, storage, intercompart-ntal transfer and residence time analyses of se units are performed by environ analysis to ermine qualitative and quantitative characteris-s of Okefenokee ecosystem hydrology. The del indicates that there are two relatively dis-te subsystems within the watershed. One is the face water compartment of the swamp proper. e other consists of the three upland surface-tershed subsurface compartments. These subsys-ns are each strongly connected within, but only derately connected between by virtue of sur-e flows off the uplands and into the swamp. is general conception, together with the specific nclusions of the results, with which it is consist-, may now be adopted qualifiedly to guide nagement activities and also future research on ter relations of the unique and important natural ritage of the Okefenokee Swamp ecosystem. aker-IVI)
85-01301

HAT VALUE WETLANDS,
erson Polytechnical Inst., Toronto (Ontario). pt. of Applied Geography.
J. Bardecki.
rnal of Soil and Water Conservation, Vol. 39, . 3, p 166-169, May-June, 1984. 2 Fig, 23 Ref.

scriptors: *Wetlands, *Management, Economic ects, Conservation, Natural resources, Water ality control, Recreation.

etlands are an important outdoor recreation re-rce for activities such as sport fishing, hunting, nping, picnicking, hiking, nature study, and otography. Wetland conservation efforts, where y do exist, are frequently based on the biologi-significance of such areas. Certain fish, water-vl, beaver and muskrat are but a few of those o depend on the wetlands for their existence. e second most often cited reason for wetlands otection is their supposed role in flood control. etlands act as important water storage reser-rs, but it is likely that only in those situations ere the wetlands act as groundwater discharge as do wetlands contribute much to base flow. ncerning the value of wetlands for water qual-, a broad range of recent studies deals with the pacts of wetlands on the quality of their dis-rge waters. Many wetlands have potential for moving plant nutrients from incoming waters. diments, pathogens, and toxic substances may be moved as well. Large wetlands often exert re-nal climatic effects. While it is not clear how se effects differ from those of a body of open ter, the high surface area to volume ratio and presence of vegetation may well play a signifi-nt role. Without strong policies to promote wet-land protection, wetlands will continue to disap-pear, and those benefits that people enjoy because of these areas will disappear with them. (Baker-IVI)
W85-01321

RADON-222 TRACING OF SEDIMENT-WATER CHEMICAL TRANSPORT IN AN ESTUARINE SEDIMENT,
North Carolina Univ. at Chapel Hill.
K. A. Gruebel, and C. S. Martens.
Limnology and Oceanography, Vol. 29, No. 3, p 587-597, May, 1984. 3 Fig, 6 Tab, 25 Ref. NSF grant OCE80-09245.

Descriptors: *Radon radioisotopes, *Sediment-water interfaces, *Solute transport, *White Oak River estuary, *North Carolina, Radium radioisotopes, Radioactive tracers, Estuarine environment, Diffusion, Benthic flux.

Chemical exchange between sediments and overlying waters is an influential factor in the overall chemical budget for a number of dissolved chemical species in coastal and estuarine environments. In order to compare methods for studying sediment-water transport processes using radon as a tracer, in situ benthic chamber flux measurements and Rn-222 deficiency core measurements were made in fine-grained sediments of the White Oak River estuary (North Carolina) during August through October 1980. Benthic chamber flux values ranged from 27 to 60 atoms/sq m/s; on a given date triplicate emplacements yielded a range of $< 30\%$. Apparent whole sediment diffusivities calculated from the fluxes measured yielded coefficients ranging from 0.00035 to 0.0016 sq cm/s, within the range expected for control of sediment-water transport by molecular diffusion. Although radon deficiency measurements in sediment cores can duplicate benthic flux measurements, they do not appear to be appropriate to model diffusion coefficients in these estuary sediments. The apparent sampling or measurement artifacts which influence the measured activities of radon and radium are not yet understood. The use of diagenetic models that incorporate the assumption that the whole-sediment diffusion coefficient for Rn is independent of porosity seems to be appropriate; for other dissolved species whose distribution in sediment porewaters is dominated by transport processes, such assumptions may prove to be unacceptable. (Moore-IVI)
W85-01331

PYRITE FORMATION AND THE MEASUREMENT OF SULFATE REDUCTION IN SALT MARSH SEDIMENTS,
Marine Biological Lab., Woods Hole, MA. Ecosystems Center.
R. W. Howarth, and S. Merkel.
Limnology and Oceanography, Vol. 29, No. 3, p 598-608, May, 1984. 7 Fig, 5 Tab, 21 Ref.

Descriptors: *Salt marshes, *Sulfates, *Pyrite, *Sediments, Sulfur radioisotopes, Measurement methods, Chemical reactions, Reduction, Marshes.

A new method, the reduction with chromium(II) of pyrite and elemental sulfur to hydrogen sulfide, was used to study the formation of pyrite plus elemental sulfur during S-35 labelled SO4(2-) reduction experiments in salt marsh sediments. The method is both more specific and more sensitive than the oxidation of pyrite and elemental sulfur to sulfate by aqua regia, which measures the formation of refractory organic sulfur compounds as well as pyrite and elemental sulfur. The two methods compare very well in a direct comparison in salt marsh sediments. The chromium(II) reduction method, combined with previous results, conclusively shows that pyrite is the major product of SO4(2-) reduction measurements in these sediments. The agreement between the two methods indicates that the formation of S-35 labeled, refractory organic matter is a minor process if it occurs at all. Both the aqua regia oxidation method and the chromium(II) reduction method, if used with care, are suitable for measuring incorporation of S-35 into pyrite and elemental sulfur during SO4(2-) reduction measurements in salt marsh sediments. Estimates of sulfate reduction in salt marshes which do not consider the formation of labeled pyrite and elemental sulfur clearly underestimate the importance of sulfate reduction. (Moore-IVI)
W85-01332

COUPLING OF NITRIFICATION AND DENITRIFICATION IN TWO ESTUARINE SEDIMENTS,
Maryland Univ., Cambridge. Horn Point Environmental Labs.
M. C. Jenkins, and W. M. Kemp.
Limnology and Oceanography, Vol. 29, No. 3, p 609-619, May, 1984. 4 Fig, 3 Tab, 47 Ref. EPA grants R805932010 and R807637, NOAA Office of Sea Grant NA81AAD 0040, NSF grant OCE 8203962.

Descriptors: *Nitrification, *Denitrification, *Estuarine environment, *Sediments, *Patuxent River estuary, Nitrogen isotopes, Tracers, Seasonal variation, Bacteria, Ammonia, Nitrates.

Nitrification and denitrification in estuarine sediments were measured by N-15 isotopic tracer techniques at two stations in the Patuxent River estuary for April and August. A close coupling of the two processes was demonstrated directly from the evolution of labeled N2 following N-15 NH(4+) amendments during spring experiments: $>99\%$ of the added N-15 NH(4+) which was oxidized to N-15 NO(3-) was subsequently reduced to N-15-labeled N2 during 48-h incubations, suggesting that the two reactions were occurring in close proximity to one another. In contrast, this coupled nitrification-denitrification was decreased by two orders of magnitude in the summer, even though the capacity for denitrification (N2 production from NO(3-) enrichment) remained similar to spring levels. This pattern of sharply seasonal nitrification was corroborated with measurements of bacterial relative abundance. Indirect evidence suggests low redox conditions (and reduced O2 concentrations) as the possible cause of decreased summertime nitrification. Ambient rates of nitrification-denitrification were inferred from N-15 experiments in these sediments. Estimated springtime rates of about 77-89 micro mol N/sq m/h are similar to previously reported values for denitrification supported by NO(3-) diffusion from overlying water to coastal sediments. (Author's abstract)
W85-01333

RIVER OUTFALLS, ESTUARIES AND THE MARINE ENVIRONMENT,
Severn-Trent Water Authority, Birmingham (England).
For primary bibliographic entry see Field 5B.
W85-01393

EFFECT OF SALINITY ON REAERATION COEFFICIENT OF RECEIVING WATERS,
National Cheng Kung Univ., Tainan (Taiwan).
C.-G. Wen, J.-F. Kao, L. K. Wang, and C. C. Liaw.
Water Science and Technology, Vol. 16, No. 5-7, p 139-154, 1984. 4 Fig, 2 Tab, 33 Ref.

Descriptors: *Reaeration, *Salinity, *Receiving waters, *Estuaries, *Tidal rivers, Chloride, Mathematical models, Water pollution effects, Effluents.

A practical method of determining reaeration coefficients would greatly aid design engineers in determining the degree of wastewater treatment required for a proposed effluent discharge. Many previous tidal river and estuary studies emphasized mainly the effects of flow conditions (such as velocity, water depth, turbulent intensity, hydraulic gradient, etc.) and temperature on stream aeration, and the effect of salts was not seriously considered. In this research a new mathematical model of reaeration coefficient considering the effect of salts has been developed for water quality analysis in tidal rivers and estuaries. The reaeration coefficient in saline water, K2s (/day, base e) at any chloride concentration C (g/l) and at 20 degrees C, can be expressed by K2s = K2f exp (0.0127C), in which K2f is the reaeration coefficient in fresh water at

20 degrees C. The correlation coefficient of K2s/K2f and C is 0.88. (Author's abstract)
W85-01398

LONG TERM MONITORING OF THE MACROBENTHOS OF THE UPPER CLYDE ESTUARY,
Clyde River Purification Board, East Kilbride (Scotland).
A. R. Henderson.
Water Science and Technology, Vol. 16, No. 5-7, p 359-373, 1984. 6 Fig, 1 Tab, 13 Ref.

Descriptors: *Invertebrates, *Clyde Estuary, *Scotland, *Water pollution effects, Benthic fauna, Species diversity, Population density, Water quality, Seasonal variation, Estuarine environment.

In the upper Clyde Estuary there has been a reduction in pollution loading due to industrial decline and sewage treatment works reconstruction. Intensive studies of the sublittoral macrobenthic invertebrate populations of the estuary between 1974 and 1980 have allowed the examination of species populations and fluctuations during this time. The fauna recorded between 1974 and 1976 was dominated by a relatively small group of organisms, characteristic of polluted, brackish estuaries. Between 1977 and 1980, species variety altered only slightly from earlier years, with a small increase in the numbers of freshwater and salt water species. Faunal density increased dramatically with increasing distance downstream from Glasgow and showed a close positive correlation to the number of contributing species. Temporal variation indicated not only the susceptibility of the fauna to environmental changes but also its ability to recover. Seasonal density declines were observed at all sites. Fluctuations in populations can be related to both seasonal variation in environmental conditions and long term improvements in water quality through a reduction in pollution loading to the estuary. (Moore-IVI)
W85-01412

STUDIES ON THE DISTRIBUTION OF ORGANIC MATTER CONTENT IN SEDIMENTS OF THE ASHTAMUDY LAKE, KERALA,
Cochin Univ. (India). Dept. of Marine Sciences.
K. Sajan, and K. T. Damodaran.
Bulletin of the Department of Marine Sciences University Cochin, Vol. 12, No. 2, p 155-160, December, 1981. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Sediments, *Organic matter, *Estuaries, *Ashtamudy Lake, *India, Clay, Sand, Distribution patterns, Sedimentation, Particle size, River mouth, Primary productivity, Biogenic activity, Tidal channels.

Astamudy Lake is one of the numerous estuaries which lie along rala coast. The lake is connected with abian sea at Neendakara through a tidal channel. The only major river which debouches into the lake is the Kallada. Sediment samples collected from selected stations in Ashtamudy Lake were analyzed for their organic matter content, which was found to vary from 0.3% to 12.35% by weight of dry sediment. The sediments showed variations in texture ranging from sand to clay. A gradual increase in the grain size of the sediments was noted from the river mouth, composed of clay and silty clay, towards the tidal channel, made up of medium to fine sand. Organic matter content was high in fine grained sediments (clay) and low in coarse grained sediments (sand). The high organic matter content in the river mouth sediments may be due to the high rate of sedimentation, high rate of primary productivity, greater depth as compared to other parts of the lake, and to the low or negligible rate of biogenic activity. The low organic matter content in the sediments at the tidal channel and the surrounding areas may be due to the coarse size of the sediments, high biogenic activity and to the shallow depth of the area. (Baker-IVI)
W85-01463

LINEARIZED TIDAL FRICTION IN UNIFORM CHANNELS,
Institut d'Hygiene, Geneva (Switzerland).
D. W. Ostendorf.
Journal of Hydraulic Engineering, Vol. 110, No. 7, p 867-885, July, 1984. 2 Fig, 5 Tab, 31 Ref, 2 Append. OWRT-B-080.

Descriptors: *Tidal friction, *Velocity, *Channels, Shear stress, Mathematical models, Roughness, Viscosity, Tidal effects.

A spatial application of Lorentz' principle of equivalent work is incorporated into the characteristic velocity and tidal friction factor estimates used to linearize the bottom shear stress in order to improve existing models of tidal motion in narrow, uniform channels. The characteristic velocity is evaluated using numerical integration and a steady flow analogy invoiced to relate the tidal friction factor to channel roughness and fluid viscosity. These parameters in turn yield expressions for the viscous wavenumber, damping modulus and damping frequency which describe the wave motion. The procedure is applied to existing analyses of closed end and sea level canals and models are tested against laboratory and field data with accurate and physically plausible results. The procedure may be useful as a global predictor of tidal velocities in sea level canals. (Moore-IVI)
W85-01556

DISPERSION SIMULATION IN TWO-DIMENSIONAL TIDAL FLOW,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 5B.
W85-01558

INTERRELATIONSHIP BETWEEN LULE CITY LAKES,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 2H.
W85-01560

PRELIMINARY OBSERVATIONS ON THE EFFECTS OF FLOODING AND DESICCATION UPON THE NET PHOTOSYNTHETIC RATES OF HIGH INTERTIDAL ESTUARINE SEDIMENTS,
California Univ., Santa Barbara. Marine Science Inst.
R. W. Holmes, and B. E. Mahall.
Limnology and Oceanography, Vol. 27, No. 5, p 954-958, September, 1982. 2 Fig, 1 Tab, 14 Ref. Univ. of California Sea Grant R/CZ-52.

Descriptors: *Estuarine environment, *Sediments, *Photosynthesis, *Flooding, *Mugu Lagoon, *California, Carbon dioxide, Intertidal areas, Dessication, Littoral zone.

Sediment samples were collected from the high intertidal in the east arm of Mugu Lagoon about 15 km south of Oxnard, Ventura County, California. Measurements of gaseous carbon dioxide exchange from the sediments revealed that net photosynthetic rates of water saturated, but unflooded, sediments were maximal. Flooding of saturated sediments with 1-2 mm of agitated seawater reduced net photosynthetic rates by 48-66%. Respiration rates likewise decreased upon flooding. The sequence of environmental changes (light or dark immediately before and after flooding) apparently had no effect on these results. When moist sediments lost 10-15% of their water content, carbon dioxide uptake decreased, and high rates of carbon dioxide evolution were observed later as water losses continued. It is clear that methods of measurement of primary productivity which involve the flooding of exposed intertidal sediments may significantly alter photosynthetic and respiratory rates and hence provide erroneous estimates of primary production in upper portions of the intertidal. (Baker-IVI)
W85-01594

CHEMISTRY OF THE DELAWARE ESTUARY. GENERAL CONSIDERATIONS,
Delaware Univ., Lewes. Coll. of Marine Studies.
J. H. Sharp, C. H. Culberson, and T. M. Church.
Limnology and Oceanography Vol 27 N
1015-1028, November, 1982. 25 Fig, 59 Ref.

Descriptors: *Estuaries, *Chemical a
*Delaware Estuary, Alkalinity, Phosphat
chemical oxygen demand, Eutrophication
ents, Dissolved oxygen, Algal blooms, Su
sediments.

A comprehensive introduction to the chem
the Delaware estuary is presented. Most
freshwater input and maximum values f
nonoceanic chemical constituents occur u
of the freshwater end member of the mod
solved oxygen is significantly depleted in th
portion of the estuary, but rapidly reco
saturation or supersaturation. It appears t
upper estuary is dominated by heterotroph
esses while the lower portion is domina
autotrophy. Plant nutrients decrease fro
high values at the freshwater end of the est
low values at the mouth. Dissolved organic
is not as high in the upper estuary as i
rivers, both urbanized and nonurbanized
Some dissolved trace metals show nonconse
removal from the filterable fraction at lowe
ties suggestive of geochemical flocculation.
plankton standing stock and primary prod
were measured. Strong light attenuation a
seston in the region of the estuary measure
coincidental with reduced primary prod
and relatively low chlorophyll. No eviden
found that the Delaware estuary suffers
verse effects of strong eutrophication seen i
urbanized estuaries. Significant but not c
oxygen depletion (not below 35% satura
the upper end of the estuary is noted. Ve
nutrient inputs occur at the freshwater end
may support moderately high productivity
vigorous sports fishery throughout the low
ary. (Baker-IVI)
W85-01599

UTILITY OF ORGANIC MATTER IN EMS-DOLLARD ESTUARY,
Groningen Rijksuniversiteit (Netherlands).
of Microbiology.
F. B. Van Es, and R. W. P. M. Lane.
Netherlands Journal of Sea Research, Vol
300-314, December, 1982. 5 Fig, 1 Tab,

Descriptors: *Estuaries, *Organic matter,
Dollard Estuary, *Netherlands, Oxygen, Ni
Amino acids, Carbohydrates, Phytopl
Chemical analysis, Aquatic fauna, Nutrien
composition, Eutrophication.

The Ems-Dollard estuary receives fresh
from the river Ems and the Westerwoldse A
water is well mixed vertically, due to stron
current. Residence time of freshwater fr
Westerwoldse Aa is about 10 days in the I
and 40 days for the whole estuary. To chara
the large amounts of organic matter in the
in terms of suitability as a food source for
trophic organisms, decomposition expe
were carried out. Water samples were take
week intervals from May 1979 to August 19
incubated for 4 weeks in the dark at field te
ture. In the outer part of the estuary the
fractions of particulate organic carbon (PO
amino acids (PAC) were high in summer
could be ascribed to the local phytopl
bloom. In the inner part the labile fractions
and PAC were much lower. The labile fract
dissolved organic carbon (DOC) and amin
(DAC) were low though in the outer part
percentages were observed during phytopl
bloom. No significant decomposition of di
and particulate carbohydrates was note
labile fractions of all components investigate
smallest in the middle part of the estuary
was ascribed to the low local primary proc
and the long time needed for allochthonous
ic matter to reach that part of the estuary.
amounts of organic matter originating
wastewater were decomposed in the inn
part of the estuary, and had no effect on th
fraction of organic matter in the other parts
estuary. Ammonification was frequently n
the outer part, nitrification generally at all st

The relation between the low labile fractions of organic matter in the inner part, and the poor growth of filter-feeding macrofauna in that part of the estuary is discussed. (Baker-IVI)
W85-01625

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

TRANSIENT PERFORMANCE OF A SINGLE BASIN SOLAR STILL WITH WATER FLOWING OVER THE GLASS COVER,
Indian Inst. of Tech., New Delhi. Centre of Energy Studies.
G. N. Tiwari, and V. S. V. Bapeshwara Rao.
Desalination, Vol. 49, No. 3, p 231-241, March, 1984. 5 Fig, 22 Ref, 1 Append.

Descriptors: *Solar stills, *Desalination, Distillation, Condensation, Temperature, Climate, Mathematical equations.

A simple transient analysis of single basin solar still, which introduces the effect of flowing water over the glass cover is presented. Theoretically it is found that the daily distillate production is more than doubled for a typical set of parameters, because the glass cover temperature is reduced remarkably. This obviously increases the condensation rate. The effect of the climate, design and operational parameters on the performance of the system have been studied. Numerical calculations were made for a typical hot day in New Delhi. (Baker-IVI)
W85-01219

SIMPLE, MORE ACCURATE CRITERION FOR ECONOMIC EVALUATION OF DESALINATION PROJECTS,
Water and Electricity Dept., Abu Dhabi (United Arab Emirates).
J. P. Gerofi, and G. G. Fenton.
Desalination, Vol. 49, No. 3, p 255-270, March, 1984. 7 Tab, 4 Ref, 1 Append.

Descriptors: *Desalination, *Economic evaluation, *Operating costs, Costs, Estimated costs, Capital costs, Economic feasibility.

Economic evaluation of desalination projects is usually done by calculating a unit cost of water from the capital charges plus first year's operating costs. In this paper we show that this method can be unduly harsh on projects with high capital and low operating costs, such as solar plants, under inflationary economic conditions which are now the norm in Western societies. Standard economic evaluation methods for engineering projects are examined and it is found that none is ideal for selecting desalination processes. A new criterion - the EVAC (equal value annual cost) is introduced. It has the following advantages: 1) it is relatively easy to calculate 2) it is based on rigorous economic criteria and allows sound decisions to be made 3) it can be used as the basis for pricing water. The EVAC makes allowances for cost escalation and inflation. (Author's abstract)
W85-01220

ANALYSIS OF WATER DESALINATION AND POWER GENERATION EXPANSION PLANS FOR THE EMIRATE OF ABU DHABI - A PRELIMINARY STUDY,
Water and Electricity Dept., Abu Dhabi (United Arab Emirates).
A. M. El-Nashar, and A. El-Baghdady.
Desalination, Vol. 49, No. 3, p 271-292, March, 1984. 15 Fig, 4 Tab, 7 Ref.

Descriptors: *Desalination plants, *Power plants, *Abu Dhabi, *United Arab Emirates, *Expansion, *Economic evaluation, Costs, Planning, Steam turbines, Gas turbines, Flash distillation, Reverse osmosis, Distillation, Membrane processes.

Continued expansion of the electrical generating and desalination capacities of the Abu Dhabi Emirate will be needed to meet water and electricity needs in the future. A comparative economic study was conducted of a number of different expansion schedules for power and desalination plants required to meet a forecasted demand in electricity and water. For power generation, steam turbine and gas turbine plants were considered and for desalination both multistage flash distillation and reverse osmosis (RO) processes were investigated. Nine combinations of power and desalination plants were selected and a present worth economic analysis was conducted. Capital and operating cost figures used are those typical of the local conditions at Abu Dhabi. Based on the capital and operating cost assumptions used, the lowest cost systems among the plans considered in this study are two plans which represent 160 MW and 250 MW steam power plants connected to 5 mgpd RO units. The minimum capital cost system comprises 60 MW gas turbines connected to a 5 mgpd RO unit; this plan has a very high fuel cost associated with it which makes its total present worth higher than that of the above steam turbine plans. (Collier-IVI)
W85-01221

SOLAR DESALINATION USING THE VACUUM FREEZING EJECTOR ABSORPTION (VFEA) PROCESS,
Enersol Consulting Engineers, Glebe (Australia).
A. M. El-Nashar.
Desalination, Vol. 49, No. 3, p 293-319, March, 1984. 11 Fig, 2 Tab, 11 Ref.

Descriptors: *Abu Dhabi, *United Arab Emirates, *Desalination plants, *Vacuum freezing, *Freeze desalination, *Solar desalination, Capital costs, Economic Evaluation, Costs, Salinity, Solar collectors.

This paper consists of design analysis and economic evaluation of a solar-assisted vacuum freezing ejector absorption (VFEA) desalination plant with a capacity of 1 mgd and located in Abu Dhabi, UAE adjacent to the coast of the Gulf. The effect on the design and plant cost of variations in several of the operating parameters was investigated. These parameters are: the sea water salinity, the sea water temperature, and solar collector outlet temperature. Two collector outlet temperatures were used, namely 90 degrees C and 120 degrees C typical of flat plate and evacuated tube collectors, respectively. The absorber loop of the VFEA system uses a sodium hydroxide solution with concentration ranging from 0.5 (dilute stream) to 0.6 (concentrated stream). The results indicate that the capital cost of the VFEA system increases by increasing the sea water salinity and sea water temperature. The capital cost of the system decreases when using the higher value of collector outlet temperature (120 degrees C) typical of evacuated tube collectors. The thermal load on the concentrator is also affected by the sea water salinity and collector outlet temperature with the load increasing with increasing the sea water salinity. The load drops substantially for the collector outlet temperature of 120 degrees C as compared to 90 degrees C. Life cycle savings in fuel costs of the solar-assisted VFEA plant were also estimated using a set of economic ground rules with the objective of specifying the optimum collector area which yields the maximum life cycle savings. It was observed that the optimum area increases with increasing the sea water salinity. (Author's abstract)
W85-01222

BASIC CONSIDERATIONS INFLUENCING THE CHOICE OF MATERIALS FOR THERMAL SEAWATER DESALINATION PLANTS,
Fichtner, Beratende Ingenieure fuer Energie- und Waermewirtschaft G.m.b.H. und Co. K.G., Stuttgart (Germany, F.R.)
R. F. Elsaesser, and H. E. Hoemig.
Desalination, Vol. 49, No. 3, p 335-345, March, 1984. 6 Tab.

Descriptors: *Desalination plants, *Construction materials, *Construction costs, *Maintenance, Economic evaluation, Model studies, Investment, Economic aspects.

Model calculations were used to ascertain in what circumstances extra investment in better materials pays off for thermal seawater desalination plants. The most important result obtained is that such expenditure is definitely worthwhile in all cases in which it allows plant lifetime to be prolonged by several years. The study reveals that in such cases even substantially increased investment cost can lead to a marked reduction in production cost and for this result to be achieved it is sufficient for plant lifetime to be extended by only a few years. A plant with an investment cost nearly 50% higher produces water at lower cost than the cheaper plant if plant lifetime is increased by as little as two years; availability is improved by 14%, and annual maintenance cost is halved, the decisive factor, however, is the increased lifetime. (Author's abstract)
W85-01224

INFLUENCE OF NONCONDENSABLES ON MODERN THERMAL DESALINATION,
Indian Inst. of Tech., Madras. Dept. of Mechanical Engineering.
J. Bharadwaj, and V. R. Raghavan.
Desalination, Vol. 49, No. 3, p 357-365, March, 1984. 3 Tab, 11 Ref.

Descriptors: *Desalination plants, *Thermal desalination, *Condensation, Heat transfer, Leakage, Dissolved gases, Costs, Economic evaluation, Economic aspects.

Due to rising costs of fuel and competition from other processes, thermal desalination may face extinction unless its system economics are improved. It is general practice in thermal desalination to counter the adverse effects of noncondensable gases by eliminating dissolved gases from the feed brine and by providing condensers with ejectors. Ejectors maintain the condenser pressure level but do not keep the condenser free from noncondensables; it only keeps their concentration low. Even at low concentrations noncondensables impair heat transfer, especially in thermal desalination processes with augmented heat transfer. Vents or ejectors are not the complete solution to the problem of noncondensables. Use of leak-resistant systems would lead to significant savings in ejection costs in addition to cutting down on capital and running costs through requiring a smaller heat transfer area and pumping power, and by enabling units with better performance. The development of leak resistant systems is a necessary step towards improving the economy of thermal desalination units. (Collier-IVI)
W85-01226

3B. Water Yield Improvement

FOREST MANAGEMENT FOR INCREASED TIMBER AND WATER YIELDS,
Resources for the Future, Inc., Washington, DC.
M. D. Bowes, J. V. Krutilla, and P. B. Sherman.
Water Resources Research, Vol. 20, No. 6, p 655-663, June, 1984. 10 Tab, 16 Ref.

Descriptors: *Forest management, *Water yield improvement, *Watershed management, *Colorado, Joint production, Snow management, Vegetation management, Costs, Roads.

Subalpine forests in Colorado, and perhaps the Central Rocky Mountains, may not be economical for timber production. If timber is managed in conjunction with watershed augmentations programs, the joint product, even though not captured by the market for the owner, will have a value that will exceed joint resource management costs exclusive of access to the candidate sites. The release of water available for streamflow from the reduction in evapotranspiration and other features of a vegetation manipulation-snow management regime is the basic mechanism for joint production. Whether the net benefits from timber and water combined will exceed the cost of access in addition to other management costs depends on a combination of

factors dealing with the construction and maintenance costs of the road access. For West Slope and Lower Basin uses, the feasibility of joint production will also depend upon the water augmenting management regime. (Moore-IVI)
W85-01338

ENHANCEMENT OF CONVECTIVE PRECIPITATION BY MESOSCALE VARIATIONS IN VEGETATIVE COVERING IN SEMIARID REGIONS,
National Center for Atmospheric Research, Boulder, CO.
R. A. Anthes.
Journal of Climate and Applied Meteorology, Vol. 23, No. 4, p 541-554, April, 1984. 9 Fig, 4 Tab, 62 Ref.

Descriptors: *Convective precipitation, *Semiarid lands, *Vegetation, Weather modification, Albedo, Evapotranspiration, Runoff, Moist static energy, Atmospheric circulation, Irrigation.

It is hypothesized that planting bands of vegetation with widths of the order of 50-100 km in semiarid regions could, under favorable large-scale atmospheric conditions, result in increases of convective precipitation. These increases, which could be greater than those associated with the uniform vegetating of large areas, would occur through three major mechanisms. The first would be the modification of the environment to a state more conductive to the formation of moist convection through an increase of low-level moist static energy. This increase would be associated with a decrease in albedo, an increase in net radiation, and an increase in evapotranspiration. The second important mechanism would be the generation of mesoscale (horizontal scale of 20-200 km) circulations associated with the surface inhomogeneities created on this scale by the vegetation. The third mechanism would be the increase of atmospheric water vapor through decreased runoff and increased evaporation. A number of observational and theoretical studies which have a bearing on the above hypothesis are reviewed. Although individual studies may contain large uncertainties, taken together they provide considerable support for the hypothesis. In these studies, convective rainfall appears to be associated with increases in vegetation and with variations in surface characteristics in many parts of the world on scales ranging from 10 km to large fractions of continents. A review of recent agricultural research indicates that a variety of plants that thrive in semiarid regions (some under irrigation with saline water) could be suitable for cultivation. Many of these have potential economic value, which could defray or even exceed the cost of the cultivation. Finally, a preliminary estimate of the preferred horizontal scale of the vegetation bands is made using a linear model. For bands of width less than about 20 km, horizontal mixing limits the vertical penetration of the surface heating perturbation to heights too small to be effective in generating moist convection. For larger scales (widths about 100 km), however, it appears that vertical circulations with order of magnitude 10 cm/s that extend to heights of 1 km or more are possible. When combined with increases in low-level moist static energy, circulations of this magnitude and scale appear to be capable of initiating and enhancing moist convection under appropriate atmospheric conditions. Further studies with more realistic models are necessary to obtain a more definitive evaluation of the hypothesis. (Author's abstract)
W85-01541

3C. Use Of Water Of Impaired Quality

WATER QUALITY FORECASTING FOR REAL-TIME CONTROL OF IRRIGATION PUMPING SCHEDULES,
Mekorot Water Co., Tiberias (Israel).
H. Dexter, and J. Petch.
Water Science and Technology, Vol. 16, No. 5-7, p 419-434, 1984. 6 Fig, 5 Tab, 8 Ref.

Descriptors: *Water quality, *Impared water use, *Chlorides, *Jordan River, *Forcasting, Irrigation water, Salt springs, Seasonal variation, Stochastic process, Model studies, Real-time.

A problem in using the River Jordan as a source of irrigation water for agricultural settlements in the area between Lake Kinneret and the Dead Sea is that the river is polluted by chlorides from salt springs and the levels are very variable. Chloride concentrations vary seasonally, being low during high winter flows and high during summer low-flow conditions. The concentrations also vary considerably within the seasons due to a number of natural and man-made events that occur within the system. A forecasting model for chlorides is proposed which will operate with a real-time system in order to minimize loads applied to crops. The Box-Jenkins methodology provides a suitable model with the severe constraints of data availability. Chloride concentration variability in the Lower Jordan River is the result of a modellable stochastic process. The ARIMA models chosen gave a good reduction in the variance of the data series, but this was not sufficient for complete operational adequacy and other components will have to be included. Examples of such components are intervention analysis with real-time communication of the occurrence of events within the system to the model user and inclusion of discharge measurements from the sources. (Moore-IVI)
W85-01417

3D. Conservation In Domestic and Municipal Use

PRICE RIGIDITY AND QUANTITY RATIONING RULES UNDER STOCHASTIC WATER SUPPLY,
Utah Water Research Lab., Logan.
S. H. Fakhraei, R. Narayanan, and T. C. Hughes.
Water Resources Research, Vol. 20, No. 6, p 664-670, June, 1984. 2 Tab, 17 Ref. Department of the Interior contract 14-34-0001-1271.

Descriptors: *Pricing, *Rationing, *Water shortage, Stochastic process, Water supply, Utilities, Model studies, Probability.

When the quantity of water available falls short of 'normal' water supply, the typical response of municipalities is to impose some form of rationing. Quantity rationing introduces distortions in the marginal rate of substitution between water and other goods among consumers with different demands. Two forms of quantity rationing are proposed and the long-run prices which maximize the expected net benefits are derived with only the knowledge of the demand distribution. The models indicate that the optimal long-run prices are to be set higher than the marginal cost. They also reveal interesting differences between the two rationing schemes in terms of the prices and the probabilities of rationing, as well as the ease of implementation of ration rules. The models could be extended to analyze cases involving multiple groups, different rate structure, discriminatory pricing among user groups, and multiple supply sources. (Moore-IVI)
W85-01339

ROLE OF WATER AUDITS IN WATER CONSERVATION,
Donohue and Associates, Inc., Waukesha, WI.
G. A. Gagnon.
Journal of Water Resources Planning and Management, Vol. 110, No. 2, p 129-140, April, 1984. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Water conservation, *Water audits, *Water loss, Leakage control, Water metering, Surveys, Municipal water, Domestic water.

Significant levels of water conservation can be achieved through control of leakage from a water distribution system. One of the best means of determining the level of water conservation which can be achieved is by conducting a complete water audit. The volume of water which can be conserved through a leakage control program may exceed the level of conservation available thro the use of consumer oriented water conserva devices. A complete water audit generally con of three phases. These are master meter test leak detection and quantification, and system ventory. However, the scope of water audit often varied in order to meet an individual com nity's needs. Six case histories of successful w audit/leakage control programs are presen These programs resulted in water savings rang from approximately 12% to as high as 75% of average daily pumpage. (Author's abstract)
W85-01572

WATER CONSERVATION AND CAPACI EXPANSION,
M.G.A., Caracas (Venezuela).
J. Rubinstein, and L. Ortolano.
Journal of Water Resources Planning and Mana ment, Vol. 110, No. 2, p 220-237, April, 198 Fig, 3 Tab, 12 Ref, 2 Append.

Descriptors: *Santa Clara County, *Santa C Valley, *California, *Water conservation, *W supply development, *Water demand, Mana ment planning, Conservation, Mathemat models, Model studies.

In recent years, managers of water systems h extended their perspective beyond traditi supply augmentation projects to consider the of demand management projects under rou non-drought conditions. A forward-stepping namic programming optimization algorithm used to select projects to be implemented fro given set of alternative supply augmentation demand management projects. The algorithm determines the date by which projects should on-line to optimize given criteria. Two optim tion criteria were considered: (1) Minimizatio the present value of the cost of implementing projects; and (2) minimization of the expe value of the costs to cope with emergencies in supply of water. The tradeoffs between the objectives were examined through the deve ment of the set of noninferior solutions using Non-Inferior Set Estimation method. In a study involving the Santa Clara Valley Water trict in Santa Clara County, California, solut that implemented demand management proj earlier tend to have a lower present value of and a higher expected value of the cost of co with emergencies, than solutions that rely mor supply augmentation projects. (Collier-IVI)
W85-01579

3E. Conservation In Industry

REDUCING WATER CONSUMPTION COOLING TOWERS,
Munters Corp., Fort Myers, FL.
M. R. Lefevre.
Chemical Engineering Progress, Vol. 80, No. 55-62, July, 1984. 9 Fig, 9 Tab, 27 Ref.

Descriptors: *Cooling towers, *Water loss, *E oration, Blowdown, Water conservation, W management, Dry towers, Water consumpt Scaling.

The only true losses in a wet tower are evap tion and blowdown. The blowdown is necessar prevent the concentration of dissolved solids f increasing to the point where it may precip and scale up heat exchangers and the coo tower fill, or reach unacceptable levels for o reasons. Evaporation depends on a large numbe factors including ambient dry bulb air temperat ambient air relative humidity and barometric p sure. The influence of various factors is det including barometric pressure, design param for air flow, influence of range, salinity, and c flow vs counterflow construction. Possible co nations of wet and dry towers are conside While nothing will ever replace evaporating w as the most economical way to dissipate w heat, this combination approach of wet towers dry coolers, either as separate units or comb

ems, is the only known practical method to ıce evaporation. (Baker-IVI)
5-01460

. Conservation In Agriculture

TOMATED WEATHER DATA COLLEC-ON FOR RESEARCH ON IRRIGATION HEDULING,
icultural Research Service, Bushland, TX.
primary bibliographic entry see Field 7B.
5-01181

L SENSOR CONTROL OF HIGH-FRE-ENCY IRRIGATION SYSTEMS,
icultural Research Service, Fresno, CA.
. Phene, and T. A. Howell.
nsactions of the American Society of Agricul-l Engineers, Vol. 27, No. 2, p 392-396, March-il, 1984. 7 Fig, 10 Ref.

criptors: *Irrigation practices, *Automation, il water, *Sensors, Trickle irrigation, Crop d, Feedback, Roots.

h-frequency irrigation can be controlled accu-ly by an electronic feedback soil moisture or installed in the root zone of row crops. A dating experiment conducted with processing atoes in a fine sandy loam soil indicates that control method can be used successfully to rove crop yield and quality, and provide pre-automatic control of trickle irrigation systems. sensor was used in these experiments in a back mode to maintain a portion of the root e at nearly constant soil water potential, within ptimum range. Trickle irrigation systems con-ed by a single soil sensor in a high frequency le can be used effectively to replace the water from the root zone consumptively. This vali-ng experiment was conducted in semi-arid irri-d agricultural area and demonstrated that this eduling method should be easily adaptable to y situations warranting precise irrigation con-such as high frequency irrigation, in particular n practiced in sandy soil with low soil water age capacity. (Baker-IVI)
5-01182

IGATION SYSTEM CAPACITIES FOR RN PRODUCTION IN NEBRASKA,
nessee Univ., Knoxville. Dept. of Agricultural ineering.
D. von Bernuth, D. L. Martin, J. R. Gilley, and G. Watts.
nsactions of the ASAE, Vol. 27, No. 2, p 419-and 428, March-April, 1984. 12 Fig, 2 Tab, 5

criptors: *Irrigation, *Crop production, *Corn, braska, Simulation, Hydrologic budget, Tran-ation, Water stress, Soil water, Crop yield.

gation system capacity requirements for corn duction in Nebraska were determined using a puter simulation model. A daily water balance used to calculate moisture depletions and ulti-ely, to estimate the amount of transpiration by crop. Yield reductions were estimated using ratio of the seasonal crop transpiration to the ntial seasonal transpiration for a crop without er stress. Using the daily soil moisture deple-and seasonal yield reduction data, histograms cumulative density functions of soil moisture letion and crop yield reduction were developed various soils, locations and system flow rates. phical relationships between soil moisture de-ion and system capacity and between crop d reduction and system capacity were devel-d. The yield reduction-system capacity rela-ships developed were dependent upon the type rrigation management strategy employed and soil type. Four sites in Nebraska were studied, system capacity recommendations for two sites e chosen as representative of the climatic varia-y across the state. (Author's abstract)
5-01187

LEAF WATER POTENTIALS FOR MANAGEMENT OF HIGH FREQUENCY IRRIGATION ON APPLES,
Agricultural Research Service, Prosser, WA. Irrigated Agriculture Research and Extension Center.
J. Peretz, R. G. Evans, and E. L. Proebsting.
Transactions of the ASAE, Vol. 27, No. 2, p 437-442, March-April, 1984. 6 Fig, 2 Tab, 20 Ref.

Descriptors: *Irrigation, *Apples, *Leaves, *Water potential, *High frequency irrigation, Fruit crops, Stomatal conductance, Soil water, Plant water status.

Under all forms of high-frequency irrigation of fruit trees, the questions concerning irrigation management are not when to irrigate but rather how much to apply and how to accurately evaluate the water status of the tree. Leaf water potentials (psi sub L) offer a reliable means to evaluate the water status of apple trees if the values are adjusted to compensate for diurnal and daily changes associated with weather changes. A strong linear relationship suitable for field use has been found to predict psi sub L from a known atmospheric vapor density gradient (delta rho sub va) where stomatal conductance is high for both nondeficit and deficit irrigated trees. The slopes of linear equations for trees grown under nondeficit and deficit irrigation regimes differ significantly which indicates that conventional predawn measurements of psi sub L are not adequate for establishing the plant water status of apples. This relationship appears to be independent of the type of irrigation system. A late morning reading more accurately reflects the plant water status rather than the soil moisture status and is a better indicator of deficit irrigation levels. (Collier-IVI)
W85-01190

FOLIAR FLUORIDE ACCUMULATION UNDER SPRINKLE IRRIGATION,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 5B.
W85-01192

MODEL FOR SCHEDULING PECAN IRRIGATION WITH MICROCOMPUTERS,
Texas A and M Univ., El Paso. Agricultural Research Station.
S. Miyamoto.
Transactions of the ASAE, Vol. 27, No. 2, p 456-463, March-April, 1984. 7 Fig, 3 Tab, 17 Ref.

Descriptors: *Pecans, *Irrigation, *Computers, *Scheduling, Nuts, Soil water, Soil moisture retention, Orchards, Weather, Air temperature, Wind, Solar radiation.

A model was developed to schedule irrigation of pecan orchards using weather, soil and crop data. The crop data considered were tree trunk diameter, planting density, and tolerance to water and salt stresses. Crop coefficients were estimated with an empirical equation involving these tree parameters and cumulative heat units. Weather data included daily maximum and minimum temperatures, wind run and solar radiation. The daily potential evaporation rates were computed from these data, using a Jensen-Haise type of equation calibrated against the Penman combination method. Soil data considered were soil water retention properties, evaporation and drainage characteristics, soil salinity and soil variability. A computer program adaptable to microcomputers (CPU $>$ 48 K) was subsequently developed for predicting soil water storage and irrigation needs. The program was tested on 260 ha at two commercial orchards in the middle Rio Grande Basin. The test results indicated reasonable agreement between the measured and the predicted soil water storages ($r = 0.97$). The model is sensitive to input data related to field capacity or the estimate of irrigation efficiency when irrigation rates per application are equal to or less than prior soil water depletion. (Author's abstract)
W85-01193

RESIDENTIAL LAWN IRRIGATION MANAGEMENT,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
R. Aurasteh, M. Jafari, and L. S. Willardson.
Transactions of the ASAE, Vol. 27, No. 2, p 470-472, March-April, 1984. 2 Fig, 3 Tab, 6 Ref.

Descriptors: *Irrigation, *Lawns, *Evapotranspiration, Turf grasses, Water use efficiency, Crop yield, Sprinklers, Distribution uniformity, Water users, Urban areas, Lysimeters.

In arid areas, turf maintenance can put a heavy seasonal demand on local urban water resources. Water application, distribution uniformity, irrigation water use, and management efficiency were measured on 20 private lawns in Logan, Utah. Lawn quality was evaluated weekly. Distribution uniformity (DU) for solid-set sprinkler systems was higher than for hand-move systems; however, the DUs were generally low compared to normal agricultural values, indicating poor potential application efficiencies. Homeowners were, generally, unaware of evapotranspiration requirements of their lawn grass and landscape vegetation, and did not measure the amount of water applied. Little correspondence was found between the amount of weekly water applied by homeowners and actual plant water needs as compared by a lysimeter. The yard with the highest lawn quality had a water use ratio (water actually applied/estimated water requirements) of 0.91; during the experiment period it was still possible to maintain the highest lawn quality and still apply less than the estimated requirements on at least one quarter of the lawn area. (Collier-IVI)
W85-01195

LAND USE PLANNING IN DENMARK: THE USE OF SOIL PHYSICAL DATA IN IRRIGATION PLANNING,
Ministry of Agriculture, Jejle (Denmark).
H. B. Madsen, and S. W. Platou.
Nordic Hydrology, Vol. 14, No. 5, p 267-276, 1983. 2 Fig, 6 Tab, 19 Ref.

Descriptors: *Model studies, *Irrigation programs, *Land use, *Planning, *Denmark, Soil properties, Sand, Climate, Soil water, Root zone, Irrigation demand.

A model has been developed for calculating the amount of water needed for irrigation. The model incorporates information on soil types and their geographical distribution, soil water retention and root development in relation to soil types, and climatic conditions such as water deficits. The model is based on digitized soil maps from 35,000 texture analyses in combination with the above information. The available water content in soil layers, the root zone capacity and the effective root depth are defined and used as basic parameters. The calculations show that the average potential need of water for irrigation (APW) is very high for grass in all soil types and especially in the coarse sandy soils. For winter sown cereals, spring sown cereals, and for beets, the APW is very low except in the coarse sandy soils. This is particularly due to a shallow effective root depth for crops in the coarse sandy soils. (Baker-IVI)
W85-01234

PRACTICABLY IRRIGABLE ACREAGE AND ECONOMIC FEASIBILITY: THE ROLE OF TIME, ETHICS, AND DISCOUNTING,
New Mexico Univ., Albuquerque. Dept. of Economics.
For primary bibliographic entry see Field 6E.
W85-01251

IMPROVEMENT AND SENSITIVITY ANALYSIS OF THE CORNGRO MODEL,
Irrigation and Industrial Development Corp., New York.
S. S. Kundu, G. V. Skogerboe, and W. R. Walker.
Ecological Modelling, Vol. 16, No. 2/3/4, p 209-239, August, 1982. 8 Fig, 32 Ref.

Descriptors: *Model studies, *Plant growth, *Crop yield, *Corn, Simulation, Prediction, CORNGRO

model, Evapotranspiration, Evaporation, Irrigation programs, Soil water, Plant water potential, Permeability coefficient.

A systematic description of the CORNGRO model is presented. Modifications were made to the model so that better simulation of corn growth processes and predictions of final yields could be obtained. These modifications include improved estimates of degree-days to tasseling, DDYTAS, and calibration of the leaf area expansion coefficient, ALPHA. The model is broadly divisible into two major parts: a moisture flow program, which computes the changes in soil moisture content through the soil profile and also determines the leaf water potential, root water extraction, evapotranspiration (ETP) and drainage or upward flow during any time step depending on the plant growth stage and climatic conditions, and the plant growth program. Input data requirements are classified as: plant characterization parameters; irrigation and daily climatic data; and soil characteristics. Sensitivity analyses revealed that the simulation process of the CORNGRO model is moderately sensitive to the soil moisture characteristic curve, the hydraulic conductivity curve, and highly sensitive to the input values of daily potential evapotranspiration. The sensitivity analyses indicated that yield parameters relate better with seasonal transpiration than seasonal ET. The plant growth parameters are more sensitive to the input values of daily ETP for adequate moisture treatments than for moisture stress treatments. (Baker-IVI)
W85-01304

SAVINGS UP, HEADACHES DOWN DUE TO SATELLITE-AIDED SCHEDULING,
J. G. White.
Irrigation Age, Vol. 18, No. 10, p 6-7 and 10, June/July, 1984.

Descriptors: *Irrigation scheduling, *Computers, *Satellite technology, *Oregon, Planning, Water management, Farming, Water conservation, Irrigation efficiency.

Scheduling irrigation times and rates can lead to tremendous savings. In Umatilla and Morrow Counties, Oregon, computerized scheduling is the third leg of an ongoing scheduling program that began several years ago with daily newspaper accounts of scheduling information including evapotranspiration ratings, wind speed, ground moisture, solar radiation and other important information. Now the farmers in the area use a personal computer and modem to link, via phone line, to a series of models in the main-frame computer at the Umatilla Electric Cooperative Association (UEC). The program begins at an automatic weather station located in Boardman. There pertinent climatic data is beamed to a communication satellite every three hours, which in turn sends the information back to an earth receiving station located in Boise, Idaho. From Boise the information is fed via modem to the UEC headquarters. The data is entered into computerized models for the area based on soil type, type of irrigation, crop, and other infomation which a farmer taps for his water management program. (Baker-IVI)
W85-01459

CONCEPTS FOR ENERGY-EFFICIENT IRRIGATION SYSTEM DESIGN,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8C.
W85-01504

MODEL AND PRODUCTION FUNCTION FOR IRRIGATION MANAGEMENT,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
D. L. Martin, D. G. Watts, and J. R. Gilley.
Journal of Irrigation and Drainage Engineering, Vol. 110, No. 2, p 149-164, June, 1984. 7 Fig, 1 Tab, 16 Ref, 2 Append.

Descriptors: *Irrigation operation, *Crop yield, *Model studies, Irrigation requirements, Simulation, Soil water, Evaporation, Transpiration, Irrigation systems, Rainfall.

A simulation model was developed to estimate the effect of deficit irrigation upon crop yield. The model was designed to provide relative yield estimates for numerous combinations of irrigation system, crop growth and irrigation management parameters. A daily soil moisture balance was used to predict evaporation and transpiration from which crop yields were estimated. Gross irrigation water requirements were estimated from net irrigation requirements, irrigation efficiencies, irrigation system limitations, and effective rainfall. Crop production functions that use physically defined parameters were also developed to relate crop yields to gross irrigation requirements. The production functions worked well on a limited test compared to field data. The model and production functions are general since they depend upon readily available information or physical parameters, and can be used to evaluate irrigation management alternatives. (Author's abstract)
W85-01508

DIMENSIONLESS RUNOFF CURVES FOR IRRIGATION BORDERS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
M. Yitayew, and D. D. Fangmeier.
Journal of Irrigation and Drainage Engineering, Vol. 110, No. 2, p 179-191, June, 1984. 18 Fig, 2 Tab, 13 Ref, 1 Append.

Descriptors: *Irrigation borders, *Runoff, Mathematical models, Water reuse, Irrigation uniformity, Irrigation systems, Irrigation efficiency.

A method that promises to increase efficiency and uniformity by controlling runoff in addition to saving energy in surface irrigation is the use of a properly designed reuse system. One of the most important variables in the design of reuse systems is the quantity of runoff. The zero-inertia mathematical model was used to: identify pertinent open channel hydraulic variables affecting runoff characteristics in sloping free outflowing borders; and develop predictive graphical solutions for calculating runoff from border irrigation. Nondimensional runoff curves useful in the design of reuse systems are presented for free outflow irrigation borders. Pertinent open channel variables affecting runoff in border irrigation include inflow rate, surface resistance, border slope, soil infiltration characteristics, application time, and length of border. Maximum advance distance, which is of interest in designing border irrigation systems, is also given by the zero runoff curves. (Moore-IVI)
W85-01510

WATER USE PLANNING FOR ALKALI SOILS UNDER RECLAMATION,
Central Soil Salinity Research Inst., Karnal (India).
N. K. Tyagi, and V. V. D. Narayana.
Journal of Irrigation and Drainage Engineering, Vol. 110, No. 2, p 192-207, June, 1984. 10 Fig, 7 Tab, 17 Ref.

Descriptors: *Alkaline soils, *Water use, *Planning, *Land reclamation, *India, Linear programming, Crops, Water resources management, Mathematical models, Diversion, Groundwater mining, Water export.

A method to determine optimal water use in alkali soils under reclamation is developed. The procedure involves a deterministic linear programming model for allocation of surface and ground water for irrigation of crops within the project area and for water export; development of a technique to estimate the system parameters which are of a transient nature; and generation of system response at different stages of soil reclamation. The dynamic nature of the agricultural system and the nonlinearity of the crop water production function are incorporated by using separate input data for each time increment in the model and by introducing multiple activities for each crop, respectively. The model is applied to a representative alkali area in the Indo-Gangetic plains in India. Optimal cropping patterns over a period of 20 yr at five discrete stages of reclamation are determined. Parametric analysis is used to determine optimal water sources management policies with regard to ca water diversion, ground water mining, and exp water. (Author's abstract)
W85-01511

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

DELAWARE RIVER BASIN, DROUGHT MA AGEMENT,
W. B. Whitall.
Environmental Forum, Vol. 3, No. 3, p 32-39, Ju 1984. 2 Fig, 2 Tab.

Descriptors: *Drought, *Water manageme *Planning, *Delaware River Basin, River basi Agreements, Legislation, Salinity.

The described agreement consists of inter-rela management steps designed for the most part improve drought preparedness. They are or nized around a long-term salinity standard to achieved in stages by means of new water stor and flow augmentation capacity, water conser tion, drought management plans, regulation of pletive water used, and other measures. The co mission's salinity standard adopted in 1967 is to replaced by a new operating objective designed limit salinity in the estuary to a maximum 30 average of 180 mg/l of chlorides and 100 mg/l sodium at a control point. To provide new cap ity required by the salinity control objectives series of structural measures is scheduled over next twelve years. During periods of water sh age, diversions to New York City and New Jers and compensating downstream releases to Delaware from the city's three headwater re voirs will be reduced in accordance with an in state operations formula. A regulatory progra to be developed by the commission to limit fut depletive water uses to the extent required to ance existing, new, or expanded uses with availability of flow augmentation capacity su cient to maintain salinity control objectives. general basinwide policy is to be adopted with requirement that conservation measures be pla into effect during drought periods designed order to reduce depletive water use by 15%. coordinated plan will be developed for the op ation for existing reservoir impoundments in central and lower basin during drought perio and criteria for defining drought warning drought conditions in those areas. (Baker-IVI)
W85-01121

AUTOMATION IN RESERVOIR CONTROL.
Wasser, Energie, Luft, Vol. 74, No. 11/12, p 2 292, 1982. 1 Ref.

Descriptors: *Automation, *Reservoir operati Data acquisition, Data processing, Monitori Water level, Temperature, Hydraulic pressu Seepage, Interstitial water.

Advantages of automatic measurement and reco ing of data include provision of continuous m urement and, where data are recorded in a con ually manned central control room, availability data when weather conditions render the reserv inaccessible. Automation should complem rather than replace, existing control procedu since visual observation often provides the b for interpreting data, and manual measuremen needed as a control. Automatic data collect may be restricted to the most important areas, s as monitoring of water level, one or more relev temperatures, selected measurements of hydra pressure to prevent deformation in concrete da seepage water volume, and, for earth dams, p water pressures. Another method of partial au mation is to transmit data collected manually

ote data processing facility, preferably by tele-
ne so that questionable measurements can be
estigated promptly. Automation does not neces-
ly result in cost and personnel savings, though
oes improve control performance. (Gish-IVI)
5-01254

**TA TRANSMISSION FOR AUTOMATIC
M CONTROL (AUTOMATISIERUNG IN
R TALSPERRENUBERWACHUNG),**
wn, Boveri und Cie A.G., Baden (Switzer-
).
Croci.
sser, Energie, Luft, Vol. 74, No. 11/12, p 293-
January, 1982. 3 Fig.

criptors: *Automation, *Dam control, Moni-
ng, Data acquisition, Data processing, Comput-

en automating dam monitoring systems a care-
balance has to be struck between what is de-
ded and what is feasible. Data acquisition,
smission, processing and display can be effect-
n various ways and with different degrees of
. The range of products in the field of automa-
and control increasingly backed by modern
tronic technologies and frequently employing
ro-computers, enables solutions to be devised
ch satisfy all demands. (Author's abstract)
5-01255

**IS FOR AUTOMATION OF CONTROL OF
E THUNERSEE (DIE GRUNDLAGEN FUR
ATOMATISIERUNG DER THUNERSEER-
ULIERUNG),**
sser- und Energiewirtschaftsamt des Kantons
n (Switzerland).
Neumann.
sser, Energie, Luft, Vol. 75, No. 4, p 83-87,
. 4 Fig, 1 Tab.

criptors: *Automation, *Lake of Thun, *Aare
er, *Switzerland, Fisheries, Hydroelectric
er, Cooling water, Water level, Shipping,
ess control, Dams, Sluices.

ew automated control system for the Lake of
n and flow of the Aare river, Switzerland was
ned to accomodate changes in use of the lake
river and began operation in 1981. The Lake
hun has a surface area of 48.5 sq km, a storable
me of 82 billion cu m, with a controllable
me between high and low water of 58 million
n. Below the lake outlet lies the 1,200-m long
basin, below which the Aare divides into two
, each dammed and controlled by sluices.
e had to be refurbished in preparation for
mation. The main planning difficulty lay in
hing the various interests of lake and river
s. Among fishermen, there were those more
ested in lake water level, and those more
ested in river flow volume; requirements also
d seasonally. The Thun and Bern hydroelec-
power stations were interested in maintaining
levels high enough to cover periods of low
r supply, while the Muhleberg nuclear power
wanted an Aare flow of not less than 35-40
n/sec during low water for use as cooling
r. Shipping on the lake required a high lake
from Easter to October for the tourist season.
necessitated more frequent control in smaller
, i.e., frequent measurements of lake level and
flow volume, which were compared with
prescribed by the new control program so
deviations could be quickly corrected by
ing or closing the sluices. This could only be
ved through automation in the form of proc-
ontrol. The automated system included three
al control programs: river flow volume con-
, lake level constant, and lake level not falling.
n-IVI)
-01260

**NITORING OF DAMS (DIE LAUFENDE
RWACHUNG VON TALSPERREN),**
or-Columbus Ingenieurunternehmung A.G.,
n (Switzerland).
chnitter.
ser, Energie, Luft, Vol. 75, No. 11/12, p 268-
January, 1983. 2 Fig.

Descriptors: *Monitoring, *Safety, *Dams, Dam stability, Dam failure.

The monitoring of a dam during operation is an important element in assuring its safety. It is based on observations by the operators and on measurements. The preliminary evaluation of both for rapid detection of anomalies must be the responsibility of the operators. If necessary, they have to inform the specialists in charge of checking regularly the dam's behavior. (Author's abstract)
W85-01270

5-YEAR-DAM-INSPECTION. AIMS AND PROCEDURES; GEODETIC DEFORMATION MEASUREMENTS (ZIEL UND VORGEHEN BEI DER 5-JAHRES-EXPERTISE SOWIE HINWEISE AUF DIE BEDEUTUNG DER GEODATISCHEN DEFORMATIONSMESSUNG),
Electrowatt Engineering Services Ltd., Zurich (Switzerland).
B. Gilg.
Wasser, Energie, Luft, Vol. 75, No. 11/12, p 270-273, January, 1983. 1 Tab.

Descriptors: *Safety, *Dams, *Inspection, *Switzerland, *Geodetic deformation, Dam stability, Dam failure, Maintenance.

In Switzerland government regulations require that dams be thoroughly inspected by a recognized expert at least once every 5 years. A safety report is prepared, based on preliminary examination, the construction history of the particular dam, site investigations, measurements, operation reports and direct observation. If the expert considers it necessary, the hydrological and geological conditions are re-examined. In addition to a general assessment of the dam, the report also contains recommendations concerning maintenance procedures and provides an operation scheme to ensure maximum safety. (Author's abstract)
W85-01271

MONITORING DROUGHT FOR GRAZING LAND MANAGEMENT,
Department of Agriculture, Ottawa (Ontario). Crop Production Div.
J. A. Dyer.
Journal of Soil and Water Conservation, Vol. 39, No. 3, p 176-178, May-June, 1984. 2 Fig, 8 Ref.

Descriptors: *Drought, *Monitoring, FoDEWS, Forage Drought Early Warning System, Soil water, Water conservation, Grazing, Pasture management, Planning, Prediction, Computer models.

Early warning of probable low soil moisture levels can enable producers to avoid overgrazing and ensure financial stability. A computer based system to provide early warning is now operational in western Canada, where the beef industry is particularly sensitive to drought. The system (FoDEWS) uses a combination of current year's weather data and historical weather data for late winter and early spring to project likely moisture reserves by late spring. The important resource management aspect of drought monitoring is prevention of overgrazing caused by overstocking. Drought's impact in any region relates closely to the carrying capacity of that region's grazing land. Carrying capacity in an area depends on regional climate and the impact of drought in each region. Defining drought severity by its expected return period is a major concept behind FoDEWS. The main component of the FoDEWS drought-monitoring system is a computer model that calculates soil moisture from daily weather records. This model budgets rainwater or snowmelt over a number of soil layers to account for daily plant water use during the growing season. While the system is as yet not able to predict drought with absolute certainty, it represents an improvement over random guessing. (Baker-IVI)
W85-01322

DISPOSAL OF DRAINAGE WATER FROM IRRIGATED ALLUVIAL PLAINS,
Taylor (John) and Sons, London (England).
For primary bibliographic entry see Field 5G.
W85-01392

ROUTING OF DAM BREAK FLOODS,
Motor-Columbus Ingenieurunternehmung A.G., Baden (Switzerland).
For primary bibliographic entry see Field 2E.
W85-01550

LONG-RANGE RESERVOIR OUTFLOW TEMPERATURE PLANNING,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6G.
W85-01565

COST ANALYSIS OF AQUATIC WEED CONTROL: FISH VERSUS CHEMICALS IN A FLORIDA LAKE,
Florida Univ., Gainesville. Aquatic Plants Research Center.
J. V. Shireman.
Progressive Fish Culturist, Vol. 44, No. 4, p 199-200, October, 1982. 1 Tab, 7 Ref.

Descriptors: *Aquatic weed control, *Lake Baldwin, *Florida, *Grass carp, *Cost analysis, Herbicides, Economic aspects, Fish stocking.

Lake Baldwin, Orange County, Florida, was stocked with fingerling grass carp for control of Hydrilla. Costs of herbicide treatment before the grass carp were stocked were considerable and control was temporary. A combination of herbicide treatment and stocking with grass carp resulted in complete removal of Hydrilla, and lower costs. Greater cost benefits would have accrued if larger grass carp had been originally stocked, as control would have been achieved sooner. The advantage of using the two methods simultaneously should be more effective and longer term control. (Baker-IVI)
W85-01584

4B. Groundwater Management

COMMERCE CLAUSE CURBS STATE CONTROL OF INTERSTATE USE OF GROUND WATER: CITY OF EL PASO V. REYNOLDS,
For primary bibliographic entry see Field 6E.
W85-01244

IMPACT OF WATER DEGRADATION ON REGIONAL AGRICULTURAL ECONOMY,
Sung Hydropower Association, Bern (Switzerland).
P. Mean, and O. Helweg.
Journal of Irrigation and Drainage Engineering, Vol. 110, No. 2, p 218-234, June, 1984. 5 Fig, 13 Tab, 13 Ref.

Descriptors: *Groundwater irrigation, *Saline water, *Cost benefit analysis, *Kern county, *California, Irrigation water, Groundwater management, Salt tolerance, Mathematical models, Imported water, Semiarid lands.

Agricultural groundwater supplies have entered an era of scarcity due to increasing pumping costs and decreasing quality as a result of salt accumulation. Few if any measures have been implemented to control the salinity build-up. One reason for this inaction may be that decision makers and the public do not have a clear idea of the potential benefit from controlling ground water degradation. A methodology is provided to evaluate the impact of a future degradation of water quality in a regional agricultural production. Areas of Kern county, in the San Joaquin Valley, were selected as representative of not only California but many semi-arid areas of the world. A mathematical model was developed to simulate the response of the agricultural production system to changes in water availability, prices, and quality. There is no strong economic incentive for the conservation of groundwater resources in the two water districts studied. Two major reasons account for this: in both districts, the proportion of salt-tolerant crops is important; and the percentage of imported surface water entitlements represents over half of the total irrigation requirements for both districts.

Whether an economic incentive might exist in an area where blending was impractical is not clear. (Moore-IVI)
W85-01513

4C. Effects On Water Of Man's Non-Water Activities

HYDROLOGIC IMPACTS OF A LARGE-SCALE MOUNTAIN PINE BEETLE (DENDROCTONUS PONDEROSAE HOPKINS) EPIDEMIC,
Montana Univ., Missoula. School of Forestry.
D. F. Potts.
Water Resources Bulletin, Vol. 20, No. 3, p 373-377, June, 1984. 3 Fig, 3 Tab, 9 Ref.

Descriptors: *Forest watersheds, *Jack Creek watershed, *Montana, *Streamflow, *Pine beetles, Water yield, Forest management, Snowmelt, Flood peak, Tree mortality.

Forest ecosystems are affected regularly by catastrophic events such as wildfire or decimation by diseases or insects, but there has been a lack of observations on the hydrologic impacts of such events. The mountain pine beetle (Dendroctonus ponderosae) epidemic in 1975-1977 in the Jack Creek watershed in southwestern Montana presented a rare opportunity for such a study. The mountain pine beetle killed an estimated 35% of the total timber on the 133 sq km watershed. USGS streamflow data for four years prior to and five years after mortality were analyzed. The death of 35% of all timber in the drainage has apparently produced an average increase in annual water yield of about 15%. The reduction of evapotranspiration and interception loss following mortality and needle-fall is probably similar to that produced by timber harvest of the same magnitude. Post-epidemic snowmelt timing has been advanced two to three weeks. Because of desynchronization, even the estimated 15% increase in post-epidemic average annual water yield does not produce a great difference in the highest monthly (June) average water yield. This suggests that, in the absence of major site disturbance and soil compaction, timber harvest may not increase peak discharges. (Moore-IVI)
W85-01375

CASE FOR CARBON DIOXIDE,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
S. B. Idso.
Journal of Environmental Sciences, Vol. 27, No. 3, p 19-22, May/June, 1984. 21 Ref.

Descriptors: *Carbon dioxide, *Greenhouse effect, *Climate, *Evapotranspiration, Water yield, Water use, Air pollution, Streamflow, Environmental effects.

It has been postulated that the rapidly rising carbon dioxide content of Earth's atmosphere will lead to an unprecedented global warming (the Greenhouse Effect), but an alternative hypothesis suggests that over much of the Earth's surface, CO2 should actually behave as an inverse greenhouse gas tending to cool the planet. An increase in atmospheric CO2 may increase streamflow by reducing evapotranspiration of plants. Atmospheric CO2 enrichment will be a great boon to agriculture, allowing tremendously increased yields to be produced with but a fraction of the water which is currently required. The favorable biological effects of atmospheric CO2 enrichment are considered to enormously outweigh any adverse climatic effects. (Moore-IVI)
W85-01440

AMAZON BASIN: A SYSTEM IN EQUILIBRIUM,
Centro de Energia Nuclear na Agricultura, Piracicaba (Brazil).
For primary bibliographic entry see Field 2A.
W85-01499

4D. Watershed Protection

MANAGEMENT PROPOSALS TO COUNTER UNDESIRABLE SEDIMENT ACCUMULATION IN THE KEURBOOMS ESTUARY,
Port Elizabeth Univ. (SouthAfrica). Dept. of Geology.
J. S. V. Reddering, and K. Esterhuysen.
Transactions of the Geological Society of South Africa, Vol. 86, No. 2, p 87-91, May-August, 1983. 2 Fig, 13 Ref.

Descriptors: *Estuaries, *Sediment accumulation, *Erosion control, *Keurbooms Estuary, *South Africa, Wind erosion, Wave erosion, Dunes, Inlets, Sediment management, Barriers, Tidal effects.

Environmentally and recreationally undesirable sediment accumulation is occurring in the floodtide dominated Keurbooms Estuary, located in the southern Cape Province. The sediment consists mainly of marine calcareous sand and enters the estuary by barrier overwash and through the tidal inlet. This sediment accumulation could be countered by stabilizing the overwash channals and by fixing the position of the migratory inlet in a position where the longshore current sediment supply to the inlet is reduced. Barrier washover channels should be blocked by vegetation to establish and stabilize the dune ridges. This would stop a considerable amount of the barrier overwash and associated aeolian sediment transport of sand into the lower estuary. The tidal inlet of the estuary should also be stabilized in an area of lower wave energy where the longshore sediment supply to the estuary would be reduced. Recreational constraints work against the inlet being fixed in the best possible position but by compromise an adequate site can be found. The migratory inlet can be stabilized by fixing the position of the southern inlet margin about 800 m from the southern end of the barrier. Two sets of adverse conditions would be generated by this but both could be effectively countered. Firstly, wave erosion of property on the landward bank of the back-barrier lagoon could be avoided by constructing a suitable wave baffle in a position opposite to the proposed fixed site of the inlet. Secondly, unwanted accumulation of sediment in the southern part of the back-barrier lagoon, which could not be flushed by either tidal action or freshwater floods, would have to be dredged at suitable intervals. (Baker-IVI)
W85-01180

GLOBAL LOSS OF TOPSOIL,
Worldwatch Inst., Washington, DC.
L. R. Brown.
Journal of Soil and Water Conservation, Vol. 39, No. 3, p 162-165, May-June, 1984. 4 Fig, 2 Tab.

Descriptors: *Soil erosion, *Farm management, Soil conservation, Natural resources, Agriculture, Planning, Topsoil, Crop yield, Sedimentation.

An unprecedented quadrupling in world food demand within 50 years has put more pressure on many of the world's soils than they can sustain. Soil erosion is accelerating under the strain. This loss is not widely recognized because the intensification of cropping patterns and the plowing of marginal land that leads to excessive erosion over the long run can lead to production gains in the short run, creating the illusion of progress and a false sense of food security. Although soil erosion data are not available for most countries, a rough estimate of the excessive worldwide loss of topsoil from croplands is needed. Without such an estimate, assessments of the world food prospect are unrealistic. In addition to broad-brush estimates of soil loss at the continental level, other sources of more detailed information on soil erosion from cropland include governmental surveys, data on sedimentation of reservoirs and river sediment loads, reports from research plots, and observations by agriculturalists. The United States and India are two of the few countries who have prepared a national estimate of soil erosion loss. Because of the shortsighted way in which one-third to one-half of the world's cropland is being managed, the soils on this land have been converted from a renewable resource to a nonrenewable one. (Baker-IVI)
W85-01320

PHOTOGRAMMETRIC TECHNIQUE FOR MEASURING SOIL EROSION,
Georgia Univ., Athens. Dept. of Geography.
For primary bibliographic entry see Field 7B.
W85-01323

PROCESS BASED MODEL OF FAECAL BACTERIAL LEVELS IN UPLAND CATCHMENTS,
Leeds Univ. (England). School of Geography.
For primary bibliographic entry see Field 5B.
W85-01420

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DETERMINATION OF SUBNANOGRAM PER LITER LEVELS OF EARTHY-MUSTY ODORANTS IN WATER BY THE SALTED CLOSED-LOOP STRIPPING METHOD,
Southern California Metropolitan Water District, La Verne. Water Quality Branch.
C. J. Hwang, S. W. Krasner, M. J. McGuire, M. S. Moylan, and M. S. Dale.
Environmental Science and Technology, Vol. 18, No. 7, p 535-539, 1984. 3 Fig, 4 Tab, 21 Ref.

Descriptors: *Earthy-musty odorants, *Closed-loop stripping analysis, *Gas chromatography, *Mass spectrometry, Air stripping, Detection limits, Geosmin, Isopropyl-methoxypyrazine, Methylisoborneol, Isobutyl-3-methoxypyrazine, Trichloroanisole, Sodium sulfate.

Grob closed-loop stripping analysis (CLSA), coupled with gas chromatography/mass spectrometry (GC/MS), has been used to analyze for low levels of earthy-musty odorants in potable water supply systems. An increase in both sensitivity and stripping rate has been achieved by raising the ionic strength of the water samples with sodium sulfate (Na2SO4) before stripping. Concentrations from 0 to 300 g/L Na2SO4 were studied. A practical condition of 80 g/L Na2SO4 was combined with a shorter 1.5-h stripping time to double the sensitivity of the unsalted 2-h CLSA. A detection limit of 0.8 ng/L was achieved for each of the following earthy-musty compounds: 2-isopropyl-3-methoxypyrazine, 2-methylisoborneol, 2-isobutyl-3-methoxypyrazine, geosmin, and 2,3,6-trichloroanisole. The method was validated by comparison, precision, and accuracy studies using natural source-water samples. Recoveries of dosed geosmin and 2-methylisoborneol were 105 + or - 15% and 106 + or - 15%, respectively. This salted procedure is a valuable modification of the CLSA when higher sensitivity or reduced stripping time is required. (Author's abstract)
W85-01126

METHOD FOR THE ENUMERATION OF MALE-SPECIFIC BACTERIOPHAGES IN SEWAGE,
Rijksinstituut voor de Volksgezondheid, Bilthoven (Netherlands). Lab. for Water and Food Microbiology.
A. H. Havelaar, and W. M. Hogeboom.
Journal of Applied Bacteriology, Vol. 56, No. 3, p 439-447, June, 1984. 1 Fig, 4 Tab, 26 Ref.

Descriptors: *Bacteriophage, *Wastewater analysis, *Water pollution, Virus, Salmonella, Escherichia, Plasmids, Public health, Coliforms, Hepatitus, Norwalk virus, Rotavirus, Gastro-enteritis virus, Bacteria, Pollutant identification.

Human enteric viruses may survive water treatment processes better than pathogenic or indicator bacteria. There are at present no generally applicable methods to detect those viruses that appear

significant epidemiologically such as hepati- virus, Norwalk-like viruses, rotavirus, and sified gastro-enteritis viruses. Male-specific iophages adsorb to F-pili and thus can only male host strains. A method was developed ie selective enumeration of these phages, on the observation that in sewage there are hages capable of infecting F(-)-salmonellas - y less than 10 pfu/ml. Using a male Salmo- train, constructed by the introduction of the d F'42 lac::Tn5 into Salmonella typhimur- hage type 3, plaque counts in secondary it were found to be in the range of 60-8200 l. Practically all the phages detected had a ange restricted to male Salmonella or Es- hia coli strains, were resistant to chloroform, eir infectivity was inhibited by RNase. Elec- icroscopy of lysates revealed phage particles ere morphologically identical to the male- c single-strand RNA phages. Similar results btained with a strain of Salm. indiana carry- 42 lac. A derivative of the Salm. typhimur- T2 strain carrying an F-plasmid (F'42 lac fin derepressed for fertility inhibition by the it plasmid pSLT was equally sensitive to pecific phages, but from sewage samples other phages infecting F(-) E. coli but not almonella were isolated using this host strain. r-IVI)
1149

PARATIVE STUDY ON SALMONELLA ATION FROM SEWAGE-CONTAMINAT- ATURAL WATERS,
cia Univ. (Spain). Dept. of Microbiology.
aide, J. P. Martinez, and E. Garay.
l of Applied Bacteriology, Vol. 56, No. 3, p 1, June, 1984. 1 Fig, 4 Tab, 32 Ref.

ptors: *Salmonella, *Bacterial analysis, ewater pollution, *Albufera Lake, *Spain, ncia, Pollutant identification, Water tempera- gars, Culture media, Bacteriology.

fects of five factors influencing the isolation nonellas from sewage-contaminated natural were compared: pre-enrichment, enrich- broth, plating medium, sampling site, and temperature. Samples were obtained from ra Lake, near Valencia, Spain, over a two eriod (March 1980 to March 1982). A total salmonella strains belonging to 36 different pes were recovered. All five factors consid- the study have shown a significant effect on covery of salmonellas. During a cold period tal numbers of salmonellas decreased. The of pre-enrichment in buffered peptone water mpared with single-step enrichment in NR th incubated at 43 degrees C. A modification :10 has been compared with the original sition. Bismuth sulfite agar (BSA), Hektoen agar (HE) and brilliant green agar (BGA) een used as plating media. The combination ct enrichment in NR10, followed by BSA or plating media was most effective for the n of Salmonella; BGA was less selective, me non-fermentative Gram negative bacilli metimes to confusion on the primary plates. SA and HE the distinct morphology of sal- as enhances a correct identification. These nedia were used to avoid selective inhibition tain Salmonella serotypes more related to l environments. (Collier-IVI)
1150

CHROMATOGRAPHIC DETERMINA- OF HYDROGEN SULPHIDE IN ANOXIC RS,
natsu Univ. (Japan). Dept. of Chemistry.
inose, K. Nakamura, and C. Shimizu.
l of Chromatography, Vol. 292, No. 2, p 1, June, 1984. 5 Fig, 7 Tab, 6 Ref.

ptors: *Hydrogen sulfide, *Gas chromatog- *Anaerobic conditions, *Chemical analysis, ion limits, Acetone, Ethanol, Hydroxyla- ydrochloride.

mination of hydrogen sulfide content of is difficult because samples must be analyzed fter being taken due to the rapid oxidation of hydrogen sulfide by oxygen in the air. Moreover, there is a danger that hydrogen sulfide in a sample from a great depth will escape because of a change in pressure. To solve these problems, reducing agents were added to the organic solvents in which the hydrogen sulfide is more soluble and stable than in water, and water samples were taken with a syringe containing these solvents; either acetone or ethanol was mixed with the sample, and a small amount of hydroxylamine hydrochloride was added. The hydrogen sulfide in this solution was determined by gas chromatography. The proposed method is easy to perform and determination is possible for several days after the sampling. The limit of detection was about 0.1 ppm; the average of coefficients of detection was 9.2%. The precision and accuracy of this method compared well with ordinary spectrophotometric techniques when tested for concentrations of hydrogen sulfide in acetone-lake water (7:3) solutions and ethanol-lake water (7:3) solutions; it is satisfactory for hydrogen sulfide determinations in anoxic lake waters. (Collier-IVI)
W85-01151

EVALUATION OF ELUTRIATE TEST PARAM- ETERS FOR AN ORGANIC HYDROPHOBIC POLLUTANT, KEPONE,
Virginia Inst. of Marine Science, Gloucester Point.
D. R. Burris, and R. J. Huggett.
Environmental Pollution, (Series B), Vol. 8, No. 1, p 63-69, 1984. 2 Tab, 10 Ref. Army Corps of Engineers contract DACW65-82-C-0001.

Descriptors: *Elutriate test, *Sediments, *Kepone, *James River estuary, Organic compounds, Pesticides, Path of pollutants, Sediment contamination.

Elutriate tests were employed to assess the amount of a contaminant which will dissolve in water due to a sediment disturbing process such as dredging or disposal. Water and bottom sediment from the turbidity maximum region of the James River estuary were used. Kepone was the contaminant studied. A factorial analysis of variance indicates that Kepone concentration on sediment is one factor which controls concentrations in the elutriate water. Mixing time and sediment concentration appeared to have little effect. These findings agree with analyses of samples taken during a dredging operation near the site of sediment collection for the elutriate tests. The Kepone elutriate results indicate that a relatively low sediment concentration of 1% is adequate to obtain meaningful elutriate results. This suggests that the standard elutriate test may, at 20%, prescribe an excessive amount of sediment which may impart an unnecessary burden on the analyst. (Baker-IVI)
W85-01319

USE OF FREE-LIVING NEMATODES AS A BIOASSAY FOR ESTUARINE SEDIMENTS,
City Coll., New York. Dept. of Biology.
J. H. Tietjen, and J. J. Lee.
Marine Environmental Research, Vol. 11, No. 4, p 233-251, 1984. 4 Fig, 5 Tab, 14 Ref. NOAA grant NA81RAD00003.

Descriptors: *Bioassay, *Nematodes, *Estuarine environment, *Sediment contamination, Hydrocarbons, Aromatic compounds, Heavy metals, Benthic fauna, Toxicity.

A bioassay technique using free-living nematodes has been developed to assess the environmental quality of estuarine sediments. Nematodes offer the advantages of (a) generally being the most abundant metazoan in sediments; (b) having short life histories and no pelagic larvae; and (c) being relatively easy to maintain in laboratory culture. Small individual body size and rapid generation time (two weeks) render nematodes especially useful in evaluating effects of potential toxicants on populations, rather than on single individuals. The bioassay technique was developed using two species, Chromadorina germanica and Diplolaimella punicea, and sediments from the Hudson-Raritan estuarine area. The life histories and feeding habits of both species are known. Test sediments were taken from eight stations that represent a gradient from lightly to heavily impacted. Concentrations of potential toxicants measured in these sediments included polychlorinated hydrocarbons, polynuclear aromatic hydrocarbons, and heavy metals. Control sediments, taken from 100 km distant, were almost total toxicant-free. Nematodes were incubated in the dark at 25 degrees C for two weeks at 1:1 and 1:10 concentrations (volume/volume) of sediments prepared with sterile sea water. Food consisted of bacteria from nematode stock cultures. Intrinsic rate of natural increase (r) of the nematodes was used as the indicator of sediment quality; r has units (daily increase in number of generations), is easily computed, and can be treated statistically. Both species grew better in control and other sediments containing low concentrations of PCBs, PAHs, and heavy metals. In sediments having PCB and PAH concentrations (ppb) of more than 270 and 8700, respectively, population growth of both species tended to be less than half that found at lower concentrations. Significant inverse correlations between r and toxicant concentration occurred at 1:1 sediment-water concentrations. At 1:10 concentrations the correlations remained negative, but not at the 0:05 level of significance. Use of the nematodes Chromadorina germanica and Diplolaimella punicea offers a quick, easy and statistically testable means of assessing the quality of marine sediments on populations, rather than single individuals, of marine benthic invertebrates. (Author's abstract)
W85-01354

CONTAMINANT ANALYSIS OF FILLETS FROM GREAT LAKES COHO SALMON, 1980,
Environmental Protection Agency, Chicago, IL. Great Lakes National Program Office.
J. R. Clark, D. DeVault, R. J. Bowden, and J. A. Weishaar.
Journal of Great Lakes Research, Vol. 10, No. 1, p 38-47, 1984. 1 Fig, 4 Tab, 15 Ref.

Descriptors: *Salmon, *Great Lakes, *Pollutants, Lake Superior, Lake Erie, Lake Michigan, Lake Huron, Pesticide residues, Mirex, Foods, Public health.

Analyses of coho salmon from each of the Great Lakes by a single laboratory produced residue data on the accumulation of environmental contaminants which have been banned, severely restricted, or are currently permitted in the basin. Coho salmon from Lake Superior contained only trace amounts or low levels of most toxic substances quantified; Lake Erie fish were contaminated with low levels of number of pesticides and industrial compounds; relatively higher residues were detected in coho from Lake Huron and Lake Michigan; and the highest concentrations for a number of compounds were found in fillets from coho from Lake Ontario. Contaminant concentrations in migratory coho salmon indicate open lake contaminant problems rather than point source or near-shore conditions. Tissue residues were less than USFDA action levels, used by many agencies in assessing the severity of fish contaminant problems. Only mirex concentrations in fish collected from Lake Ontario exceeded a USFDA action level. The data reported in this study generally agree with recent findings from individual state contaminant monitoring programs. Problems with varying analytical and sampling techniques preclude direct comparisons with previously published data of other studies. (Author's abstract)
W85-01358

EFFECTS OF PETROLEUM HYDROCARBONS ON THE CYTOCHROME P450 CONTENT OF THE MOLLUSC BIVALVE MYTILUS GALLO- PROVINCIALIS,
Endoume Marine Station and Oceanography Centre, Marseille (France).
For primary bibliographic entry see Field 5C.
W85-01367

OBJECTIVES OF A WATER QUALITY MONI- TORING PROGRAMME FOR THE INTERNA- TIONAL RIVER BASINS IN A DEVELOPING COUNTRY IN SOUTHERN AFRICA - MOZAM- BIQUE,

Direccao Nactional de Aq
S. J. Hugman.
Water Science and Technology, Vol. 16, No. 5-7, p 33-39, 1984. 1 Fig, 1 Tab, 3 Ref.

Descriptors: *Water quality, *Monitoring, *Mozambique, *Developing countries, Water resources development, Data acquisition, Resources development.

Mozambique lies on the south-east coast of Africa. Its Independence, in 1975, was particularly difficult and severely disrupted the economy. All its major rivers rise in neighboring countries and several, in particular those from South Africa and Swaziland, are already heavily used before crossing the border. Since 1977 the National Water Directorate has been responsible for management and development of water resources. The Directorate includes a hydrology department which maintains field-teams throughout the country. Virtually no water quality data are available from before 1972, when irregular sample collection began. Since Independence, sampling has continued but the Directorate has redefined the objectives of the program to obtain maximum benefit from very limited resources. These objectives were chosen for economic, hydrological and political reasons. The long-term objectives are to provide the data required for agricultural and industrial development projects, to manage and maintain the quality of Mozambiques water resources, and to meet international obligations. In practice, the capacity of the hydrological service is insufficient to meet these objectives. The targets for the existing program were therefore chosen to satisfy the most important objectives and to be feasible with present resources. The routine program is being completely operated by technicians who have no more than nine years schooling. (Author's abstract)
W85-01391

CALCULATION OF THE COMPLIANCE OF DISCHARGES WITH EMISSION STANDARDS,
Anglian Water Authority, Huntingdon (England).
A. E. Warn, and P. J. Matthews.
Water Science and Technology, Vol. 16, No. 5-7, p 183-196, 1984. 4 Fig, 4 Tab, 10 Ref.

Descriptors: *England, *Wales, *Water quality standards, *Sampling, Water pollution control, Rivers, Water quality, Wastewater disposal.

It is the policy of Water Authorities in England and Wales to control river quality through the achievement of River Quality Objectives. The Emission Standards for discharges which could achieve the River Quality Objectives are called Long Term Consent Conditions and methods of calculating them have been devised which ensure a correct match with River Quality Objectives. Methods of assessing compliance with Emission Standards must be set up carefully because the results may decide priorities for river quality control. The Performance Value Method allows the use of sampling to estimate compliance with standards defined as percentiles. The method also provides estimates of the proportion of time a discharge spent in excess of a particular limit and the probability that the discharge has failed to achieve the standard. The method provides a quantitative basis for deciding how often to sample. (Moore-IVI)
W85-01401

OPTIMIZATION OF WATER QUALITY MONITORING NETWORKS,
Waterloopkundig Lab., Delft (Netherlands).
For primary bibliographic entry see Field 7A.
W85-01406

AUTOMATIC MONITORING OF RIVER WATER QUALITY,
National Board of Waters, Helsinki (Finland).
T. Kohonen.
Water Science and Technology, Vol. 16, No. 5-7, p 289-294, 1984. 6 Ref.

Descriptors: *Automation, *Water quality, *Monitoring, *Finland, Water temperature, Hydrogen ion concentration, Conductivity, Dissolved oxygen, Turbidity, Sampling frequency, Wastewater.

Since 1972 the Finnish National Board of Waters has taken an active part in development of the automatic water quality monitoring. Eleven automatic stations have been used mainly for continuous monitoring of river water quality. The parameters used; temperature, pH, conductivity, DO and turbidity, are only the indicators about the change in loading. Automatic monitoring has in several cases revealed previously undetected variations in water quality. Continuous monitoring has produced useful information about the proportional magnitude and durability of variations in water quality. The abundance of data makes the use of statistical methods possible for determining optimal sampling frequencies. In the near future new parameters can be used for controlling contents and thus also loadings. Then the automatic monitoring should be broadened to waste water treatment plants and to processes of factories. In that case it should be possible already to prevent waste water discharges before the watercourse. (Author's abstract)
W85-01407

MONITORING STATIONS AND WATER QUALITY MEASUREMENTS ON THE RIVER LIPPE; EQUIPMENT - RESULTS - COSTS,
Emschergenossenschaft, Essen (Germany, F.R.).
H. Baumgart, and F. Sperling.
Water Science and Technology, Vol. 16, No. 5-7, p 327-346, 1984. 18 Fig, 2 Tab.

Descriptors: *Water quality control, *Monitoring, *River Lippe, *West Germany, Economic aspects, River flow, Rivers, Drinking water, Costs, Measurement instruments, Chemical analysis, Water analysis.

Water quality management tasks are discussed in relation to the River Lippe and a four part scheme for monitoring water quality. Attention is in particular devoted to the monitoring stations employed along the Lippe for the past 30 years. Technical and organizational criteria for the construction and operation of monitoring stations, as well as technical details of production and processing of measured values, including annual costs, are provided. The Lippe is a typical plains river, flowing in an East-West direction along the Northern boundary of the Rhine-Westfalian industrial area. The water from two nothern tributaries of the Lippe - the Stever and the Haltern Muhlenbach (mill stream) is used to produce drinking water. The continuously measured parameters at the monitoring stations include oxygen content, water temperature, air temperature, translucency/turbidity, conductivity, pH value, fish test and solar radiation. The Lippe is also chemically examined once a month in respect to the following parameters; oxygen content, temperature, pH value, conductivity, chloride sulfate, BOD5, BOD5 with ATU, chemical oxygen demand, total organic carbon, organic chlorine, nitrogen (total, organic, nitrous and nitrate), and total phosphorous. An examination of the chemical and biological parameters, incorporating the most important contributing flows, is carried out twice a year. The principle of the examination is to observe a specific body of water during its passage over the river bed with regard to changes in its matter content. (Baker-IVI)
W85-01410

WATER QUALITY INDICES - A COMPARISON OF EXPERTS' OPINIONS,
Michigan Univ., Ann Arbor. School of Public Health.
R. A. Deininger, and D. H. Newsome.
Water Science and Technology, Vol. 16, No. 5-7, p 499-510, 1984. 5 Fig, 4 Tab, 9 Ref.

Descriptors: *Water quality control, *Water management, Decision making, Management, Public health, England, United States, Brazil, Ammonia.

Based on a sample of twenty-two responses from water quality experts in the United Kingdom and fifteen from Brazil, it appears that their views of water quality are identical to those of United States experts and that both can be reasonably predicted using the water quality index developed by Brown et al (Brown, R. M. Water and Sewage Works, Vol. 117, Oct. 1970.). There were, however, some areas of dispute. The NSF WQI does not include ammonia as a parameter of water quality. The view was expressed that unless an index takes ammonia into consideration, the index would be of no value in the United Kingdom. A review of the original questionnaires to the US experts more than ten years ago showed that ammonia was one of the parameters considered. The significance and role of this parameter was now judged to be too low by the US experts and therefore ammonia was not included in this index. The questionnaire in use contained values for nine individual parameters of water quality shown for twenty samples of river water. The participants were asked to rate the water quality of the twenty samples on a scale from 0 to 100 and also indicate a verbal rating from very bad to excellent. (Baker-IVI)
W85-01425

ACUTE TOXICITY OF A SYNTHETIC OIL, ANILINE AND PHENOL TO LABORATORY AND NATURAL POPULATIONS OF CHIRONOMID (DIPTERA) LARVAE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
P. J. Franco, K. L. Daniels, R. M. Cushman, and G. A. Kazlow.
Environmental Pollution (Series A), Vol. 34, No. 4, p 321-331, 1984. 3 Fig, 2 Tab, 29 Ref. DOE contract W-7405-eng-26.

Descriptors: *Midges, *Toxicity, *Aniline, *Phenol, *Oil, Bioassay, Water pollution effects, Synthetic fuels, Sensitivity analysis.

The acute toxicity of a water-soluble fraction of a coal-derived oil and two of its components, aniline and phenol, to larvae of four chironomid species was determined in 48-h bioassays. Three species, Clinotanypus pinguis, Einfeldia natchitocheae and Tanypus neopunctipennis, were collected from natural populations and the fourth, Chironomus tentans, was reared in laboratory culture. Bioassay data were examined using weighted least squares and probit analyses. The LC50 values calculated from regression equations for the water-soluble fraction ranged from 1.1% for E. natchitocheae to 2.0% for C. pinguis; for aniline, 287 mg/liter for T. neopunctipennis to 442 mg/liter for E. natchitocheae; and for phenol, 73 mg/liter for T. neopunctipennis to 187 mg/liter for C. tentans. Comparisons from sensitivity analyses revealed that the closer the taxonomic relationship between species, the more similar the response to a given toxicant. The data suggest that the laboratory population may be representative of natural midge populations in bioasays. (Author's abstract)
W85-01445

LIMITATIONS OF BODY BURDEN AS AN INDEX OF ENVIRONMENTAL CONTAMINATION: HEAVY METALS IN FISH COTTUS GOBIO L. FROM THE RIVER ECCLESBOURNE, DERBYSHIRE,
Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.
F. Moriarty, H. M. Hanson, and P. Freestone.
Environmental Pollution (Series A), Vol. 4, No. 4, p 297-320, 1984. 3 Fig, 9 Tab, 17 Ref.

Descriptors: *Body burden, *Fish, *River Ecclesbourne, *England, Lead, Cadmium, Sediment contamination, Body weight, Heavy metals, Pollution index.

Samples of miller's thumb Cottus gobio were taken from three sites on the River Ecclesbourne, whose sediments contained different concentrations of lead and cadmium. Measurement suggested that fish growth is allometric. However, multiple regressions (on tissue dry weight, total dry weight and total metal burden) for amounts of lead or cadmium in individual tissues or organs showed that most of the variations between fish in the

content of specific organs was related to
ıces in total body burden of metal, with no
ant additional contribution from the other
riables. There were two exceptions: cadmi-
liver and lead in gill covers. For the liver,
trations of cadmium changed significantly
ly with total burden but also with liver
liver also had a wider range of weights
her tissues. The results suggest that there is
antage to be gained from the use of concen-
rather than mass of pollutant in a tissue,
he latter can be given. An explicit statement
weight of tissue (or of organism) is also
le, and comparisons based on concentration
re usually inefficient, and can be misleading.
risons between fish taken from different
at different times were best based on total
metal in each fish. The data illustrate the
ties of comparing amounts of pollutant in
t samples, and analysis of covariance, with
veight as the covariate, appears to be the
propriate approach. If samples have signifi-
different body weights, comparisons will be
unless allowance can be made for the effect
weight. (Author's abstract)
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ATION OF A RAPID RANGE-FINDING FOR USE IN ACUTE LETHALITY STUDTH FISH,
esearch Ltd., Sittingbourne (England). Sitrne Research Centre.
tephenson.
mental Protection (Series A), Vol. 35, No. 31, 1984. 1 Fig, 8 Ref.

tors: *Residual oxygen test, *Toxicity, finding, *Fish, Trout, Dissolved oxygen, tural chemicals, Oil additives, Detergents, al Chemicals.

range-finding test for use in acute lethality with fish is described and evaluated. The ased on the increase in susceptibility of fish ants at low oxygen concentrations and is lly referred to as a residual oxygen test. wo sets of data were available for analysis. t consisted of a predicted 96-h LC50 value e rapid range-finding test and a measured 50 value determined in a static-water tox- with daily renewal of the test media. gairdneri, the rainbow trout, was used in ts. A wide variety of test substances were ncluding agricultural chemicals, oil addi- etergents, detergent intermediates, hydro- olvents, catalysts and other base, speciality ustrial chemicals. In the great majority of e rapid range-finding test predicted the d 96-h LC50 with sufficient accuracy for nitive test to be set up over the correct ration range. Generally, the predicted 96-h as within half an order of magnitude of the d value. The advantages of this rapid nding test over the widely used 24-h static- nge-finding test are given. (Author's ab-
450

FIED CONFIRMATORY TECHNIQUE RGANOCHLORINE RESIDUES,
Argentino de Oceanografia, Buenos
icano, and A. E. Pucci.
of Environmental Contamination and gy, Vol. 33, No. 2, p 138-143, August, ig, 1 Tab, 12 Ref.

ors: *Pollutant identification, *Pesticides, c compounds, Organochlorine compounds, Dieldrin, Heptachlor, DDT, Hexachloro- ane, Pesticide residues, Chromatography.

ple acid and alkaline treatments are com- hich are generally used in an independent lean-up techniques, but are not fully used lue laboratories in routine confirmatory This procedure, based on the different stabilities presented by some organochlor- cides when they are sequentially treated ncentrated sulfuric acid and ethanolic po- hydroxide solutions does not require any modification in the gas chomatographic system, such as those necessary for in line techniques. The method is inexpensive and very useful in the identification of organochlorine pesticides in freshwater, seawater and surface sediment samples. Seawater previously extracted with n-hexane-acetone and n-hexane was fortified with eleven chlorinated pesticides. Clean-up procedure was performed with partially deactivated alumina column. Acid products were obtained by adding 1 ml of concentrated sulfuric acid to 0.5 ml of sample extract. The hexane layer was allowed to separate for a few minutes and was then withdrawn. Alkaline products were obtained by adding 1 ml of 2% ethanolic-potassium hydroxide solution to the extract remaining from the acid treatment. Organochlorine pesticide identifications and quantifications were carried out on a gas chromatograph. (Baker-IVI)
W85-01456

PARTICULATE POLLUTION MONITORING IN THE ELEFSIS GULF: THE ROLE OF MINERAL MAGNETIC STUDIES,
Liverpool Univ. (England). Dept. of Geography.
F. Oldfield, and M. Scoullos.
Marine Pollution Bulletin, Vol. 15, No. 6, p 229-231, June, 1984. 3 Fig, 13 Ref.

Descriptors: *Monitoring, *Elefsis Gulf, *Magnetic studies, Particulates, Magnetic susceptibility, Saturation isothermal remanent magnetization, Soil erosion, Water pollution sources, Marine environment.

Measurements of 'quadrature' susceptibility (Xq) at low and high frequency on seabottom sediments of the Gulf of Elefsis supplement the results derived from the study of magnetic susceptibility (X) and saturation isothermal remanent magnetization (SIRM) (Scoullos et al., 1979, Mar. Pollut. Bull., 10, 287-291) and make possible the distinction between the background soil erosional fraction and that of anthropogenic combustion origin. New devices speed up the on-site appraisal of the impact of discharges on marine sediment quality. (Author's abstract)
W85-01486

FIELD AND LABORATORY ANALYSES OF WATER FROM THE COLUMBIA AQUIFER IN EASTERN MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
L. J. Bachman.
Ground Water, Vol. 22, No. 4, p 460-467, July-August, 1984. 5 Fig, 3 Tab, 7 Ref.

Descriptors: *Groundwater, *Water analysis, *Field tests, *Columbia Aquifer, *Maryland, Hydrogen ion concentration, Alkalinity, Specific conductance, Laboratories.

Field and laboratory analyses of pH, alkalinity, and specific conductance from water samples collected from the Columbia aquifer on the Delmarva Peninsula in eastern Maryland were compared to determine if laboratory analyses could be used for making regional water-quality interpretations. On the basis of 170 field pH and specific conductance measurements, 165 laboratory pH and specific conductance measurements, and 86 field and 135 laboratory alkalinity measurements, a significant difference at the 0.1-percent level was found between laboratory and field analyses of pH and specific conductance. No significant difference was found between laboratory and field analyses of alkalinity. In most samples, laboratory pH was greater than field pH, laboratory specific conductance was less than field specific conductance, and laboratory alkalinity was equally likely to be less than, the same as, or greater than field alkalinity. Kruskal-Wallis tests of field and laboratory data grouped by north-south and east-west coordinates and by land use indicate that the difference between field and laboratory values is usually not enough to affect the outcome of the statistical tests. Thus, laboratory measurements of these constituents may be adequate for making certain regional water-quality interpretations, although they may result in errors if used for geochemical interpretations. (Author's abstract)
W85-01533

DETERMINATION OF TOTAL REDUCED SULFUR IN NATURAL WATERS,
Marine Biological Lab., Woods Hole, MA. Ecosystems Center.
W. Kijowski, and P. A. Steudler.
Limnology and Oceanography, Vol. 27, No. 5, p 975-978, September, 1982. 1 Fig, 2 Tab, 12 Ref.
NSF grant DEB-78-03557.

Descriptors: *Water analysis, *Sulfur, *Salt marshes, *Pollutant identification, Natural waters, Tidal marshes, Marshes, Sulfate, Groundwater, Interstitial water, Rain, Seawater.

A method has been developed for determining small amounts of reduced sulfur in water (25-600 micrograms sulfur/liter) that is very specific and free from interferences from sulfate and most sulfate esters. It is based on alkaline digestion of a sample using Raney nickel as a reductant. Hydrochloric acid is added to the digestion mixture to liberate hydrogen sulfide, which is trapped in a zinc acetate solution and then determined spectrophotometrically as ethylene blue. The method affords excellent recoveries for the reduced sulfur compounds tested which included sodium sulfide, elemental sulfur, sodium thiosulfate, sodium tetrathionate, sodium sulfite, sodium sulfate, potassium thiocyanate, pyrite, thiourea, sulfamic acid, L-methionine, DL-methionine sulfoxide, methionine sulfone, taurine, L-cystine, L-cysteine, glutationine, phenol red, and sulfanilic acid. The detection limit was 1.25 micrograms S/sample, and the method worked with sulfur concentrations up to 30 micrograms S per sample. The method was successfully used to determine reducible sulfur in marsh, sea, rain, ground, and porewaters. (Baker-IVI)
W85-01596

RESULTS OF AN INTERLABORATORY TEST FOR HEAVY METALS IN ELBE WATER (ERGEBNISSE EINER RINGANALYSE VON ELBWASSER AUF SCHWERMETALLE),
Hamburg Univ. (Germany, F.R.). Inst. fuer Anorganische und Angewandte Chemie.
A. Knochel, and W. Petersen.
Fresenius's Zeitschrift fur Analytische Chemie, Vol. 314, No. 4, p 105-113, February, 1983. 2 Fig, 3 Tab, 11 Ref.

Descriptors: *Elbe River, *Heavy metals, *Quality control, *Laboratories, *Chemical analysis, *Errors, Research facilities, Chromium, Arsenic, Cadmium, Mercury, Nickel, Lead, Bromine, Photometry, Atomic absorption spectrophotometry, Photon activation, Polarographic analysis, Inverse voltametry, Plasma emmision spectroscopy, Neutron activation analysis, X-ray fluoresence.

The test was carried out with 33 research groups employing different analytical methods (AAS, photon activation, polarography, ICP, inverse voltammetry, XRF, NAA). The coefficient of variation was found to be between 7 and 50% for most of the elements, higher values were obtained for Cr and As (130%), Cd (80%), Hg (77%), Ni (72%), Br (65%), Pb (60%). The very high ranges of variation indicate various sources of systematic errors in the different working groups. In accordance with the results of other such tests it is obvious that a well reproducible method does not yet imply accurate results. (Author's abstract)
W85-01607

DETERMINATION OF NITRATE IN DRINKING WATER BY MEANS OF ION CHROMATOGRAPHY (NITRATBESTIMMUNG IM TRINKWASSER MIT HILFE DER IONENCHROMATOGRAPHIE),
Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene.
T. Darimont, G. Schulze, and M. Sonneborn.
Fresenius's Zeitschrift fur Analytische Chemie, Vol. 314, No. 4, p 383-385, February, 1983. 5 Fig, 2 Tab, 15 Ref.

Descriptors: *Nitrates, *Ion chromatography, *Potentiometry, *Drinking water, *Chemical analysis, Nitrites, Fluoride, Chloride, Phosphate, Sulfate, Bromide, Detection limits.

A comparison of the methods of ion-chromatography and potentiometry shows that ion-chromatography is suitable for the determination of nitrate in drinking water in a range between 1 and 100 mg/l. The standard deviation of this method in the upper range of 10-100 mg/l is between 2 and 0.5% and increases from 2 to 12% in the lower range of 1-10 mg/l. Regression in both ranges results in polynomials of the second degree. The analysis of drinking water by means of ion-chromatography covers, in addition to nitrate ions, the anions fluoride, chloride, phosphate, sulfate, bromide, and nitrite; the concentrations of the two last mentioned ions are generally below the detection limit. (Author's abstract)
W85-01608

5B. Sources Of Pollution

COPPER AND CADMIUM UPTAKE BY ESTUARINE SEDIMENTARY PHASES,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
R. J. Davies-Colley, P. O. Nelson, and K. J. Williamson.
Environmental Science and Technology, Vol. 18, No. 7, p 491-499, July, 1984. 10 Fig, 4 Tab, 32 Ref.

Descriptors: *Copper, *Cadmium, *Estuarine environment, *Sediments, Iron, Organic matter, Metal complexes, Trace metals, Manganese, Clay minerals, Aluminosilicates, Path of pollutants.

An understanding of the distribution of toxic trace metals and other materials of environmental interest among the different sedimentary phases is necessary to assess the hazard associated with pollution of aquatic sediments. A simple model, analogous to speciation in solution among soluble ligands, was developed to enable the distribution of metals within sediments to be estimated. The model requires the conditional metal binding constants (slopes of the linear portions of the adsorption isotherms) to be evaluated for a small number of model sedimentary phases in isolation, as well as knowledge of the composition of the sediment and water. The model has been applied to the distributions of copper and cadmium in estuarine sediments and predicts that iron and organic matter are the sedimentary constituents of greatest importance for these metals. Manganese phases may contribute to cadmium binding, but clay minerals and (probably) aluminosilicates are insignificant sinks for both copper and cadmium. The model predictions for copper and cadmium in estuarine sediments are in good semiquantitative agreement with the results of selective extraction studies on natural sediments reported in the literature and studies reported here of cadmium uptake by natural sediments. (Author's abstract)
W85-01122

NONSINGLE-VALUED ADSORPTION-DESORPTION OF BROMACIL AND DIQUAT BY FRESHWATER SEDIMENTS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
D. L. Corwin, and W. J. Farmer.
Environmental Science and Technology, Vol. 18, No. 7, p 507-514, July, 1984. 3 Fig, 8 Tab, 40 Ref.

Descriptors: *Bromacil, *Diquat, *Sediments, *Freshwater, *Adsorption, *Desorption, *Herbicides, Fate of pollutants, Organic carbon, Freundlich equations, Langmuir equations, Pesticides, Regression analysis, Isotherms, Model studies.

The adsorption and desorption of bromacil and diquat on eight freshwater sediments were studied. Nonsingle-valued adsorption-desorption isotherms of bromacil conformed to a set of Freundlich equations, while diquat nonsingular adsorption-desorption isotherms were best described by a set of Langmuir equations. A high degree of positive correlation was found to exist between the degree of bromacil adsorption and the sediment properties of organic carbon content and of charge density. Calculated Freundlich adsorption coefficients for bromacil ranged from 0.891 to 0.984 for 1/n and from 0.556 to 6.353 for K. The Langmuir affinity constant, k, for diquat adsorption on untreated sediments correlated well with the surface area while the adsorption maxima, b, correlated highly with the CEC for sediments treated for the removal of organic matter. For untreated sediments the Langmuir adsorption affinity constants ranged from 0.00052 to 0.0117 and the adsorption maxima ranged from 24,331 to 69,930. In general, the adsorption maxima for treated sediments decreased while the affinity constants increased when compared to the Langmuir coefficients of the untreated sediments. A surface charge density of approximately 0.2 C/sq m (60,000 esu/sq cm) was found to result in the greatest bonding energy of the sediments for diquat. Desorption studies for both bromacil and diquat revealed that a linear relationship existed between the slope of the desorption isotherms and the initial adsorbate concentration from which desorption started. (Author's abstract)
W85-01123

SEPTIC TANKS, LOT SIZE AND POLLUTION OF WATER TABLE AQUIFERS,
New Mexico Health and Environment Dept., Santa Fe. Environmental Improvement Div.
R. J. Perkins.
Journal of Environmental Health, Vol. 46, No. 6, p 298-304, May-June, 1984. 3 Fig, 1 Tab, 59 Ref.

Descriptors: *Groundwater, *Septic tanks, *Unconfined aquifers, *Water pollution sources, Regulations, Water pollution control, Model studies, Groundwater pollution.

As the pollution potential of septic systems becomes more widely recognized, and as pollution by septic systems becomes more widespread, pressure to develop and implement rational and effective standards will increase. At present, there is no uniform approach among regulatory agencies to setting standards. Past experience suggests that regulation of septic tank density is an effective means of minimizing pollution potential, and that regulation of penetration depth of wells into ground water and of separation distance between wells and drainfields are insufficient preventive measures when used alone. Density of septic systems is regulated through minimum lot size requirements. The range of lot sizes which provides a minimum reasonable protection of groundwater quality appears to be from 0.2 to 0.4 hectare (0.5 to 1.0 acre) based on reported data, and from 0.3 to 0.4 ha (0.75 to 1.0 acre), based on theory. However, the degree of protection desired varies with location, as do the physical parameters dictating the effects of septic tank effluent on groundwater. Where precise standards are desired, data relating local physical parameters to pollution potential are required. As various models are applied to diverse conditions, and the results reported, regulatory agencies will converge on an optimum strategy for minimizing the pollution potential from on-site sewage disposal. (Author's abstract)
W85-01155

TRANSPORT AND FATE OF MICROORGANISMS IN POROUS MEDIA: A THEORETICAL INVESTIGATION,
Delaware Univ., Newark. Dept. of Civil Engineering.
M. Y. Corapcioglu, and A. Haridas.
Journal of Hydrology, Vol. 72, No. 1/2, p 149-169, April, 1984. 2 Fig, 65 Ref. DOI Office of Water Policy project 370802.

Descriptors: *Bacteria, *Viruses, *Transport, *Fate of pollutants, *Soil environment, *Path of pollutants, Microbial studies, Groundwater pollution, Land application, Septic tanks, Mathematical studies, Diseases, Public health.

Methodology was developed that may be employed to study the microbial soil and groundwater contamination due to recharge of groundwater aquifers by treated sewage water, land application of municipal wastewater, and septic tank seepage. Bacteria and viruses found in groundwater are a proven health hazard as evidenced by the large number of outbreaks of water-borne diseases caused by contaminated groundwater. Various transport processes including dispersion, convection, Brownian motion, chemotaxis and tumbling of bacteria were studied; the differences between bacteria and viruses in their transport mechanisms, decay and growth kinetics were also investigated. Governing transport equations were developed from conservation of mass equations, incorporating the above factors. The rate of deposition terms can be incorporated by a first-order isotherm for bacteria and an adsorption isotherm for viruses. The movement of bacteria is coupled with the transport of a bacterial nutrient present in seeping wastewater. (Collier-IVI)
W85-01173

FOLIAR FLUORIDE ACCUMULATION UNDER SPRINKLE IRRIGATION,
California Univ., Davis. Dept. of Land, Air and Water Resources.
W. W. Wallender, and J. Keller.
Transactions of the ASAE, Vol. 27, No. 2, p 449-455, March-April, 1984. 7 Fig, 1 Tab, 25 Ref.

Descriptors: *Fluoride, *Sprinkler irrigation, *Irrigation, *Leaves, *Bioaccumulation, Path of pollutants, Trckle irrigation, Pottasium fluoride, Model studies, Simulation, Fick's law, Beans.

Increased demand for water has prompted the use of fluoride polluted water for sprinkle irrigation. A field research technique was used to evaluate tendergreen bush bean foliar fluoride accumulation as affected by sprinkler rotation speed, set time, evaporative demand, and fluoride concentration of irrigation water. Plots were sprinkle irrigated once to enhance germination and early growth, and then trickle irrigated to replace water lost to evapotranspiration without wetting the foliage. Pottasium fluoride was added to irrigation water to create a range of fluoride concentrations which is similar to that of many western U.S. waters. Results from the field tests showed fluoride accumulation increased with irrigation water fluoride concentration, set time and evaporative demand and decreased with slow sprinkler rotation. Foliar fluoride increased faster than applied water fluoride. A simulation model, based on a modified form of Fick's law, was constructed to estimate fluoride accumulation. The simulation results were extended beyond the field results to accentuate the nonlinearity which is introduced via the exponent on the concentration term of the transport equation. The model may be adjusted for other applied ions and for chemical and physical differences between plant materials. (Collier-IVI)
W85-01192

IMPLICATIONS OF TREATING WATER CONTAINING POLYNUCLEAR AROMATIC HYDROCARBONS WITH CHLORINE; A GAS CHROMATOGRAPHIC-MASS SPECTROMETRIC STUDY,
Minnesota Univ.-Duluth. Dept. of Chemistry.
A. R. Oyler, R. J. Liukkonen, M. K. Lukasewycz, D. A. Cox, and D. A. Peake.
Environmental Health Perspectives, Vol. 46, p 73-86, December, 1982. 8 Tab, 48 Ref.

Descriptors: *Drinking water, *Chlorination, *Hydrocarbons, Public health, Carcinogens, Mutagens, Oxidation, Water treatment, Aromatic compounds, Phenols, Quinones, Epoxides.

The products of aqueous chlorination reactions of 1-methylnaphthalene, fluorene, dibenzofuran, anthracene, phenanthrene, 1-methylphenanthrene, fluoranthene, and pyrene have been determined. The conditions employed for these reactions approximated those that might be encountered in water treatment facilities. Nearly all of the compound types produced in the chlorination reactions of polycyclic aromatic hydrocarbons have the potential for causing adverse biological response. An assessment of these effects can only be gathered at present from scattered literature reports of various screening tests made on individual compounds. Several of the nonchlorine-containing products of phenanthrene have been tested for mutagenic activity by the reversion of histidine-dependent Salmonella typhimurium and the rec assay with Bacillus subtilis. The 1,6- and 1,8-pyrenediones have

reported to be mutagens and enhancing
s to other mutagens. While anthraquinone
s little or no activity, certain derivatives are
mutagenic. Quinones of benzo(a)pyrene are
genic in the Ames assay without microsomal
ation. Phenols may be carcinogenic, mutagen-
id toxic and may bind to DNA, RNA and
ins. Chlorinated PAHs may be extremely
Chloromethyl and hydroxymethyl-substitut-
AHs may also have mutagenic and carcino-
activity. (Baker-IVI)
01207

IRONMENTAL WATER LAW,
rimary bibliographic entry see Field 6E.
01252

NT GROWTH POTENTIAL OF THE
R RHINE AND ITS TRIBUTARIES FROM
E CONSTANCE TO BASLE (1978/79) (DIE
NZLICHE PRODUKTIONSKRAFT DES
INS UND SEINER ZUFLUSSE VOM BO-
SEE-UNTERSEE BIS BASEL (1978/79)),
h Univ., Kilchberg (Swizerland). Hydrobio-
l-Limnological Station.
nanz, and H. Juon.
er, Energie, Luft, Vol. 76, No. 1/2, p 17-21,
ry 1984, 5 Fig, 2 Tab, 18 Ref.

iptors: *River Rhine, *Thur, *Toss, *Glatt,
ach, *Aare, *Ergolz, *Birs, *Plant growth
tial, Productivity, Algae, Periphyton, Season-
iation, Tributaries.

ges in the plant growth potential of the river
and seven of its tributaries (Thur, Toss,
Wutach, Aare, Ergolz, Birs) were followed
otests using periphyton from the river Rhine
d that the mean net production increases by
from Stein am Rhein to Basle. During the
f investigation the largest production values
observed between December and April and
nallest values between spring and autumn.
ivers Toss and Glatt had the largest net
ction of all the tributaries investigated; their
nent areas are densely populated. Together
the Thur and Wutach, these rivers were
to be the cause of an increase in mean net
ction of the river Rhine by about 45% be-
the sampling stations of Nohl and Koblenz.
vater of the river Aare had a slightly higher
growth potential than that of the Rhine.
ver because of its considerable mean dis-
e, the river Aare increased the net produc-
oad (= product of the mean discharge and
ean net production) of the river Rhine by
a factor of 3 (figure 5). The net production
tributaries during the year had peculiarities
were caused by differences in the discharge
(Author's abstract)
1274

ENTS ASSOCIATED WITH THE CAD-
I PHASE IN A HARBOR SEDIMENT AS
RMINED WITH THE ELECTRON BEAM
OPROBE,
ngton State Univ., Pullman. Coll. of Agri-
e Research Center.
ee, and J. A. Kittrick.
l of Environmental Quality, Vol. 13, No. 3,
340, July-September, 1984. 4 Fig, 2 Tab, 22

ptors: *Cadmium, *Sediment contamination,
ors, Bays, Fate of pollutants, Sulfides, Heavy
Zinc, Chemical reactions.

um is not an essential element for plants and
s and becomes toxic to nearly every living
m at relatively low levels, and therefore is
eme concern as an environmental contami-
heavy metal contaminated harbor sediment
amined with the electron beam microprobe
r to obtain specific information with regard
elements associated with the Cd phase(s).
ximately 44000 particles were scanned in
o locate 18 that produced > 100 counts/s
lpha X-radiation. Of these Cd-rich particles,
ere < 10 micro m in diameter. For these
es, Cd was most frequently associated with
S in about 89% of the particles, presumably as S(2-), rather than with the carbonate indicated by a chemical extraction method on the whole soil. Zinc was also significantly associated with Cd in about 72% of the particles. Cadmium appeared to be precipitated with the associated elements rather than being adsorbed on the surfaces of the selected 18 particles. The formation of Cd sulfides in the sediment can be predicted from thermodynamic calculations, combined with a few reasonable assumptions. (Baker-IVI)
W85-01279

ORGANIC POLLUTANTS IN LEACHATES FROM LANDFILL SITES,
Connecticut Agricultural Experiment Station, New Haven.
B. L. Sawhney, and R. P. Kozloski.
Journal of Environmental Quality, Vol. 13, No. 3, p 349-352, July-September, 1984. 2 Fig, 3 Tab, 23 Ref.

Descriptors: *Fate of pollutants, *Groundwater pollution, *Landfills, *Leachates, Organic compounds, Solvents, Methyl ethyl ketone, Phenols, Acetone, Hazardous wastes, Waste disposal, Path of pollutants.

A determination was made of the organic pollutants in leachates from a number of municipal landfill sites in response to growing concern over contamination of groundwater supplies. Different volatile compounds identified in leachates from landfill sites varied over a wide concentration range. Determinations of volatiles in leachates from the Southington, CT landfill site showed large concentrations of some common industrial solvents such as acetone and methyl ethyl ketone. Organic pollutants identified in the leachate samples include industrial and household solvents as well as degradation products of natural and anthropogenic chemicals. The presence of phenols in concentrations as high as 4 mg/L suggests that anaerobic conditions of landfills may facilitate the movement of phenols, and possibly other organic compounds, which are otherwise readily sorbed and transformed by soils and clays. The more volatile compounds of a pollutant may be lost by volatilization during disposal operations or movement through the landfill. (Baker-IVI)
W85-01280

UPTAKE BY PLANTS AND MIGRATION OF URANIUM AND CHROMIUM IN FIELD LYSIMETERS,
Atomic Energy of Canada Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
M. I. Sheppard, S. C. Sheppard, and D. H. Thibault.
Journal of Environmental Quality, Vol. 13, No. 3, p 357-361, July-September, 1984, 4 Fig, 5 Tab, 15 Ref.

Descriptors: *Plants, *Absorption, *Chromium, *Uranium, Water table, Path of pollutants, Waste disposal, Industrial wastes, Heavy metals, Soil contamination.

Plant growth, plant uptake, and the redistribution in soil of U and Cr were studied in field lysimeters. The objective of the experiment was to characterize the plant uptake and migration in the soil of U and Cr when placed at different depths in the unsaturated soil zone within the influence of a water table. Lysimeters with and without vegetation were studied and two soils, and two plant species were investigated. The plants absorbed a constant proportion of the applied Cr over eight orders of magnitude in soil Cr concentration. This may allow a prediction of how much Cr a plant can absorb for any soil concentration - a very useful tool for environmental assessment purposes. The depth of Cr placement in the soil did not influence Cr plant uptake, the plant probably only took up the more mobile oxidized Cr. The greater percentage of Cr was relatively immobile in both soils. Plants took up more U from shallow placement in sand than in loam and plant uptake was independent of species or treatment placement for loam. The presence of more roots in the shallow zone may have increased the uptake. Uranium did not migrate substantially in the loam soil, but did migrate in the sand soil. The U placed near the surface of the sand soil migrated predominantly upward, whereas there appeared to be some loss of U to the water table from the deep placement. (Baker-IVI)
W85-01281

SOIL CATION LEACHING BY 'ACID RAIN' WITH VARYING NITRATE-TO-SULFATE RATIOS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
A. R. Huete, and J. G. McColl.
Journal of Environmental Quality, Vol. 13, No. 3, p 366-371, July-September, 1984. 4 Fig, 4 Tab, 44 Ref. Univ. of California Project B-PSB-3664-H.

Descriptors: *Acid rain, *Leaching, *Nitrates, *Sulfates, Cations, Anions, Soil chemistry, Precipitation, Infiltration, Water pollution sources.

The influence of the anion compostion of simulated acid rain on cation leaching of three soils with different surface-charge properties was examined. Four mixtures of sulfuric and nitric acid, each with pH 3.5, but with varying nitrate to sulfate mole ratios were used to leach an Ultic-Alfisol (Cornutt series: fine, mixed, mesic Ultic Haploxeralfs), an Oxisol (unnamed Rhodustox), and an Entisol (Hanford series: coarse-loamy, mixed, nonacid, thermic Typic Xerorthents). The sulfate adsorption capacity of Alfisol was high because of its high ferric oxide content of 12 g/kg and high point-of-zero charge (PZC) of 6.0. The lower Fe2O3 content of Oxisol, although strongly weathered, was 5 g/kg and the PZC was 4.5. The Entisol was relatively unweathered, resulting from silicaceous alluvium with an Fe2O3 content of 3 g/kg and a lower PZC of 3.5. The Entisol represented a soil of fixed charge. Cation leaching of the Alfisol varied directly with the NO3(-) content of the leaching input due to the higher mobility of NO3(-) compared with sulfate that was adsorbed. Cation leaching of the Entisol was not affected by the relative nitrate/sulfate contents of inputs. Effects on leaching of the Oxisol were intermediate between those of the Alfisol and Entisol. The anion composition of acid rain plays a significant role in the cation leaching of soils with amphoteric-charge properties, which are able to adsorb sulfate. (Baker-IVI)
W85-01283

CHEMICAL PARTITIONING OF CADMIUM, COPPER, NICKEL AND ZINC IN SOILS AND SEDIMENTS CONTAINING HIGH LEVELS OF HEAVY METALS,
Oregon State Univ., Corvallis. Dept. of Soil Science.
M. G. Hickey, and J. A. Kittrick.
Journal of Environmental Quality, Vol. 13, No. 3, p 372-376, July-September, 1984. 1 Fig, 3 Tab, 34 Ref.

Descriptors: *Heavy metals, *Soil chemistry, *Cadmium, *Copper, *Zinc, *Nickel, Chemical reactions, Soil contamination, Sediment contamination Geochemistry, Fate of pollutants, Organic matter, Carbonates, Oxides.

Three soils and a sediment which had undergone prior massive additions of heavy metals were sequentially extracted so that Cd, Cu, Ni, and Zn could be partitioned into five operationally defined geochemical fractions: exchangeable, bound to carbonates, bound to Fe-Mn oxides, bound to organic matter, and residual. While the sequential extraction procedure employed in this study cannot identify the actual forms of a given metal in the soil, it appears to be useful for categorizing the metals within several general geochemical fractions. The various geochemical fractions are operationally defined by an extraction sequence that follows the order of decreasing solubility. The Fe-Mn oxide and residual fractions proved to be the most important for the soils and sediment examined in this study, and contained high levels of Cd, Cu, Ni, and Zn. The carbonate fraction, however, was of about equal importance, as the Fe-Mn oxides fraction, in binding metals for those samples containing appre-

ciable quantities of inorganic C. Copper was the only metal to evidence significant association with the organic fraction. A majority of the Cd and an appreciable portion of the Zn in the four samples was exchangeable, which is the first fraction to be extracted, and hence the most soluble. For the sequential extraction procedure used in this study, mobility and biological availability are assumed to decrease in the order of the metal extraction sequence. On this basis, the apparent mobility and potential bioavailability of the metals for the four highly contaminated soils and sediment are: Cd > Zn > Cu = Ni. (Baker-IVI)
W85-01284

FATE AND EFFECTIVENESS OF TEBUTHIURON APPLIED TO A RANGELAND WATERSHED,
Lilly (Eli) and Co., Indianapolis, IN. Lilly Research Lab.
W. E. Emmerich, J. D. Helmer, K. G. Renard, and L. J. Lane.
Journal of Environmental Quality, Vol. 13, No. 3, p 382-386, July-September, 1984. 2 Fig, 4 Tab, 18 Ref.

Descriptors: *Fate of pollutants, *Herbicides, *Tebuthiuron, *Rangeland, Brush control, Runoff, suspended solids, Range management, Groundwater pollution.

Tebuthiuron, a herbicide, was applied at a rate of 0.84 kg/ha to a rangeland watershed and test plots in pelleted and dissolved forms, respectively. The removal of tebuthiuron in the runoff water from the watershed was determined for each runoff event. The total tebuthiuron removed from the rangeland watershed in the runoff water and suspended sediment over two seasons was 0.47% of the amount applied. Tebuthiuron removal associated with the bedload sediment was negligible. The low total removal of tebuthiuron in runoff water was believed to be due to the timing of the application. Tebuthiuron was applied at a time when precipitation rates are expected to be less than the infiltration rate, but when winter precipitation would be sufficient to leach at least some of the chemical into the soil profile. It is recommended that this procedure be followed for tebuthiuron application to minimize the probability of removals in runoff. Tebuthiuron moved to a depth of 17 cm in 8 months with 326 mm of precipitation, and remained at that depth despite additional precipitation. The total tebuthiuron remaining in the test plots after 21 months was 38% of that applied. Regression equations were developed that predicted the tebuthiuron would persist from 2.9 to 7.2 yr before the amount in the test plots would fall below the detection limit. Significant differences in the estimated time required to reach the detection limit of tebuthiuron in the test plots emphasizes the difficulty in predicting precisely the disappearance of chemicals released in the environment and the need for longer periods of actual sampling and analysis. Tebuthiuron, applied at a rate of 0.84 kg/ha, was effective in reducing the dominate brush species on the watershed, producing 100% kill for tarbush, fourwing saltbush, and little leaf sumac after 615 d, and lower percentages for creosotebush (61%), whitethorn (92%), and graythorn (0%). (Baker-IVI)
W85-01285

POWER PLANT INFLUENCES ON BULK PRECIPITATION, THROUGHFALL, AND STEMFLOW NUTRIENT INPUTS,
Tennessee Valley Authority, Knoxville. Div. of Air and Water Resources.
J. M. Kelly.
Journal of Environmental Quality, Vol. 13, No. 3, p 405-409, July-September, 1984. 3 Fig, 2 Tab, 18 Ref. EPA contract EPA-IAG-D6-0721, TVA contract TV-41967A.

Descriptors: *Powerplants, *Precipitation, *Throughfall, *Stemflow, *Nutrients, Water pollution sources, Sulfates, Phosphates, Nitrogen, Potassium, Calcium, Magnesium, Forest watersheds.

Input estimates for sulfate, total nitrogen, phosphate, potassium, calcium and magnesium in bulk precipitation, throughfall, and stemflow were compared at two forest study sites, one located near a major point source of atmospheric emissions and a second located in an area removed from the possible local influences of a major point source. The Cross Creek Watershed located 19 km from the Widows Creek coal fired power plant was used to represent inputs to a forest site in the immediate vicinity of a large emissions source. The Camp Branch Watershed, having similar forest cover and soil types, but located in an area 99 and 76 km from the nearest major point sources, was used to represent inputs as a function of regional conditions. Interpretation of the results of this study are hampered by the inability to separate out contributions of natural processes and the general lack of a consistent response on the part of the elements and compounds evaluated. Even so the findings suggest that the local influence of power plant operation on the parameters investigated is limited and that the major factor influencing inputs is regional rather than local atmospheric loading. Local influences seemed to have their greatest impact on stemflow chemistry with only P and K failing to exhibit a statistically significant increase at Cross Creek. Although throughfall sulfate, potassium, calcium and magnesium values were higher at Cross Creek, they were not significantly higher than the Camp Branch values. Nitrogen and phosphate throughfall input values were lower at Cross Creek, but again lacked significance. This is in contrast to bulk precipitation where N and phosphate were significantly elevated at Cross Creek. (Baker-IVI)
W85-01286

MINED LAND RECLAMATION USING POLLUTED URBAN NAVIGABLE WATERWAY SEDIMENTS: I. TRACE METALS,
Argonne National Lab., IL. Energy and Environmental Systems Div.
A. Van Luik.
Journal of Environmental Quality, Vol. 13, No. 3, p 410-414, July-September, 1984. 2 Fig, 2 Tab, 24 Ref.

Descriptors: *Trace metals, *Sediment contamination, *Callumet-Sag Channel, *Illinois, Land reclamation, Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, Zinc, Fate of pollutants.

The concentrations of 11 trace metals were determined in 34 sediment samples from 10 cores from the Calumet-Sag Channel, Illinois (Cal-Sag). The sediments are being assessed for use as a mined land reclamation medium. The cores were taken at 2.4-km intervals along the length of the Cal-Sag using a gravity corer. The use of Cal-Sag dredged material as an agronomic soil may require the Zn levels to be monitored in the dredged material soil and crop plants to determine the likelihood of phytotoxicity related yield reductions, especially in leafy vegetable crops if they should be grown. If productive uses do not include the production of crops for human/livestock consumption, trace metal levels should have no negative impacts on the ecosystem of which the vegetated Cal-Sag sediment has become an integral part, provided that a favorable soil pH is maintained. Periodic (twice yearly, perhaps) replicated monitoring is recommended for soil pH and plant and soil solution trace metal levels for at least the first 10 yr, and annually thereafter, to ensure that long-term changes in organic matter and major base-cation levels do not enhance trace metal solubilities. (Baker-IVI)
W85-01287

MINED LAND RECLAMATION USING POLLUTED URBAN NAVIGABLE WATERWAY SEDIMENTS: II. ORGANICS,
Argonne National Lab., IL. Energy and Environmental Systems Div.
A. Van Luik.
Journal of Environmental Quality, Vol. 13, No. 3, p 415-422, July-September, 1984. 1 Fig, 6 Tab, 44 Ref.

Descriptors: *Calumet-Sag Channel, *Illinois, *Sediment contamination, *Organic compounds, Land reclamation, Water pollution sources, Volatile solids, Oil, Grease, Polychlorinated biphenyls, Phenols, Polycyclic aromatic hydrocarbons.

The levels of selected organic contaminants found in the Calumet-Sag Channel (Cal-Sag) sediments were investigated and attempts were made to provide some perspectives on the meaning of these contaminant levels in terms of the use of sediments as a reclamation medium. Ten sediment samples were taken at 2.4 km intervals along the length of the Cal-Sag using a gravity corer. No significant correlations existed between each organic pollution concentration and sediment sample depth, locations, or sediment silt or clay content. This suggests that the mean and the mean plus twice the standard deviation offered good approximations of the expected mean value and the expected (95% maximum value for these pollutants in Cal-Sag dredged material (volatile solids: 9.85 and 13.1 mg/kg; oil and grease: 11.9 and 22.7 g/kg; total phenols: < 2.4 and < 4.8 mg/kg; and total polychlorinated biphenyls: 7.0 and 17 mg/kg). Measured parent polycyclic aromatic hydrocarbon compound levels (46 compounds being measured) exceeded 80 mg/kg in only one sample. Alkyl-substituted PAH compound concentrations were measured for three parent compounds in three sediment samples and found to be highly variable in concentration. (Baker-IVI)
W85-01288

MINED LAND RECLAMATION USING POLLUTED URBAN NAVIGABLE WATERWAY SEDIMENTS: III. EXPERIENCE AT A DEMONSTRATION SITE,
Argonne National Lab., IL. Energy and Environmental Systems Div.
For primary bibliographic entry see Field 5G
W85-01289

NUTRIENT LOSSES IN RUNOFF FROM CONVENTIONAL AND NO-TILL CORN WATERSHEDS,
Maryland Univ., College Park. Dept. of Agronomy.
J. S. Angle, G. Mc Clung, M. S. Mc Intosh, P. M. Thomas, and D. C. Wolf.
Journal of Environmental Quality, Vol. 13, No. 3, p 431-435, July-September, 1984. 3 Tab, 24 Ref.

Descriptors: *Nutrient removal, *Runoff, *Tillage, *Corn, Agricultural watersheds, Nonpoint source pollution, Nitrogen, Phosphorus, Sediment transport, Sediment erosion.

Possible differences were investigated between the quantity and quality of runoff from conventional and reduced tillage corn. Over nine times more runoff originated from the conventional-till watershed when compared with the no-till watershed in 1982. A large difference between the two watersheds in suspended sediment content was also noted. Yearly sediment losses of 370 and 9 kg/ha from the conventional and no-till watersheds, respectively, were found for 1982. There was also a significant difference in the loss of soluble solids between the two watersheds. For 1982, there was over a 29-fold greater loss of soluble solids from the conventional-till watershed than from the no-till watershed. Losses of ammonia-nitrogen, nitrate-nitrogen, and total nitrogen from each watershed were very low. Large differences were noted between the two watersheds. The loss of all forms of P from each watershed was also very small. During 1982 161 g/ha of total P were lost from the conventional till watershed while only 8 g/ha were lost from the no-till watershed. The loss of orthophosphate and total soluble P was not significantly different between the two tillage treatments. Differences in both the volume of runoff and the quality of the runoff between the two tillage systems occurred most often after the spring cultivation and before the crop canopy fully covered the soil surface. Total runoff from both watersheds was much lower than previously reported data and resulted in a correspondingly low loss of nutrients. (Baker-IVI)
W85-01290

PPLICATION OF SEWAGE SLUDGE
REGARD TO CROPPING SYSTEMS
LLUTION POTENTIAL,
l., New Brunswick, NJ.
gins.
f Environmental Quality, Vol. 13, No. 3,
, July-September, 1984. 6 Fig, 5 Tab, 26

rs: *Sludge disposal, *Land disposal,
ollution sources, Waste disposal, Ground-
lution, Heavy metals, Soil types, Fertiliz-
Nitrates, Corn, Rye.

benefits of using sewage sludge on Sassa-
loam soil, typical of eastern coastal plain
a soil conditioner and fertilizer for the
n of agricultural crops were investigated.
bjectives were to determine the potential
ndwater pollution from disposal of high
ludge into Sassafras sandy loam soil, the
tion of salts and heavy metals in soil from
pplication, the accumulation of heavy
plant tissue from sludge application, and
mum sludge application rate based on
ater contamination. Sludge application of
of dry solids/ha on Sassafras sandy loam
her similar sandy loam soils, is the upper
nsure protection of the groundwater qual-
al applications of 44.8 Mg dry solids/ha
n gross contamination of the groundwater
-nitrogen and other salts. No contamina-
he groundwater by heavy metals was
at either rate. Fecal coliform levels were
ghout the duration of the study. Zinc and
ccumulated in the A soil horizon, but no
tion occurred in the B horizon. Corn and
s were greatly enhanced by the addition
but there was little difference in yield
he sludge loading rates. Uptake of heavy
the corn and rye occurred in response to
plication. Zinc was the only metal that
ly appeared at levels above the control.
VI)
91

OR OF ELEMENTS IN THE TAKAHA-
'AN RIVER BASIN,
Univ., Kurashiki (Japan). Inst. for Agri-
nd Biological Sciences.
ka, and M. Ogawa.
f Environmental Quality, Vol. 453-459,
ly-September, 1984. 2 Fig, 5 Tab, 20 Ref.

rs: *River basins, *Trace elements, *Ta-
River Basin, *Japan, Sediment contamina-
pended solids, Volatile solids, Dissolved
ams, Estuaries, Rivers, Interstitial water,
etals, Air pollution.

centrations of elements in suspended and
solids in river water and various frac-
interstitial waters of dam sediments were
ed. The mechanisms of the enrichment of
ments on fine particles and the relation
the processes of formation of such parti-
their enrichments in topsoil of the river
discussed. The study was conducted in
nashi River Basin on whose estuary stands
shima industrial area, one of the biggest in
he input of the volatile elements Zn, Cd,
nd Ag from the atmosphere was markedly
nan the theoretical concentration derived
basin rocks, due to the increased atmos-
llution in this basin. Cu, Cr, Co, Fe, Ni,
showed about the same tendencies. These
were already enriched, even in suspended
waters collected near the watershed. The
nts of trace elements in suspended solids
ır not only after being suspended in river
ut also in fine solids of topsoil of the
d. The increase of trace elements deliv-
n the atmosphere must bring about the
richments in suspended and dissolved
river as well as in topsoil and its interstit-
of the river basin. (Baker-IVI)
92

IENT OF NITROGEN SPECIES
GH THREE SOILS BELOW SEPTIC

Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
K. W. Brown, K. C. Donnelly, J. C. Thomas, and J. F. Slowey.
Journal of Environmental Quality, Vol. 13, No. 3, p 460-465, July-September, 1984. 5 Fig, 3 Tab, 20 Ref. EPA grant R802955-02-0.

Descriptors: *Septic wastewater, *Nitrogen, *Leaching, *Groundwater pollution, Wastewater disposal, Ammonium, Nitrates, Soil properties, Soil types, Sand, Clay.

Septic fields designed to meet current standards have the potential to saturate the available exchange sites of a sandy soil with ammonia-nitrogen. After saturation, the ammonia-nitrogen moves downward with the leachate water. Downward ammonia-nitrogen movement was measured at 100 cm/yr in Norwood sandy clay and Miller clay soils. During dry periods when the soil became aerated, some of the ammonia-nitrogen oxidized to nitrate-nitrogen which came out in the leachate water. Soil solution measurements indicated that these transformations occurred about 75 cm horizontally away from the septic line near the wetting front. After 2 yr of application, total N measurements indicated an accumulation of N directly under the septic line. Values as high as 1007 micro g/g were measured. Total N losses ranged from 0.45 to 2.19% of that applied but would be expected to rise sharply in future years since the sandy loam soil had become saturated with ammonia-nitrogen. When a septic field dries out during summer or is abandoned, much accumulated N will be converted to nitrate-nitrogen which is likely to leach to the groundwater. (Baker-IVI)
W85-01293

NITROGEN LEACHING FROM SOILS CROPPED WITH SUGARCANE UNDER THE HUMID TROPICAL CLIMATE OF MAURITIUS, INDIAN OCEAN,
Sugar Industry Research Inst., Reduit (Mauritius). Agricultural Chemistry Div.
K. F. Ng Kee Kwong, and J. Deville.
Journal of Environmental Quality, Vol. 13, No. 3, p 471-474, July-September, 1984. 1 Fig, 4 Tab, 28 Ref. Int. Atomic Energy Agency contract 1822/GS.

Descriptors: *Nitrogen, *Leaching, *Cropland, *Mauritius, *Sugarcane, Nitrates, Adsorption, Water pollution sources, Tropical regions, Rainfall, Potassium, Calcium.

Due to the conflicting and scanty information on the real leaching losses of nitrogen under the humid tropical climate where the annual rainfall may exceed 3000 mm, leaching of N in soils under sugarcane was studied under the high rainfall conditions prevailing in Mauritius. Leaching losses of cations such as K(+) and Ca(2+) were much more extensive than those of NO3(-). Control measures to attenuate leaching losses of cations from soils located under climatic conditions similar to those may be more urgently needed than measures to minimize leaching of N. Since more nutrients are lost from lysimeters, where normal surface runoff is not provided, than from under actual field conditions, pollution of natural waters through leaching of N is not a cause for concern in Mauritius. (Baker-IVI)
W85-01294

ADSORPTION OF PHOSPHATE, ARSENATE, METHANEARSONATE, AND CACODYLATE BY LAKE AND STREAM SEDIMENTS: COMPARISONS WITH SOILS,
Agricultural Research Service, Stoneville, MS. Southern Weed Science Lab.
R. D. Wauchope, and L. L. McDowell.
Journal of Environmental Quality, Vol. 13, No. 3, p 499-504, July-September, 1984. 3 Fig, 5 Tab, 29 Ref.

Descriptors: *Adsorption, *Lake sediments, *Stream sediments, *Methanearsonate, *Cacodylate, *Phosphates, *Arsenates, Agricultural chemicals, Soil types, Soil properties, Mississippi River flood plain, Clay, Iron, Aluminum, Fate of pollutants.

The sorption characteristics were measured of 14 lake sediments collected in the Delta Mississippi River flood plain for arsenate, phosphate, methanearsonate, and cacodylate. In runoff and stream flow the concentrations of dissolved P and arsenic are each typically < 1 mg/L in a well oxygenated, mixed sediment water flow. To simulate runoff-stream mixing dilute sediment mixtures spiked with the compounds to give 50 and 500 micro g/L As or P were used. For comparison with field soils from the same area the Bache-Williams index procedure was used. The results allow comparison of soils and sediments for sorption of these chemicals and provide insight into the relative ability of these sediments to act as sinks for runoff arsenicals and phosphate. In general, if the higher range of clay and hydrous oxides contents of these sediments are taken into account, their adsorptive capacity for phosphate, arsenate, methanearsonate, and cacodylate could be predicted from the trends found earlier for soils. Clay content remains the best single predictor of arsenical adsorption whether in field soils or in dilute water-sediment mixtures. Phosphate fixation at high P conditions is more specific for Fe and Al. Under dilute slurry conditions, P may adsorb or desorb depending on P added and P already in the sediment, but the amount of Fe/Al/clay content will determine the degree to which a sediment can act as source or sink. For these Mississippi Delta sediments, those with high clay content had a very large unfilled capacity to act as P or arsenical sinks. (Baker-IVI)
W85-01297

EFFECT OF LOCAL EMISSIONS ON WET AND DRY DEPOSITION IN SOUTHEASTERN MICHIGAN,
General Motors Research Labs., Warren, MI. Environmental Science Dept.
J. M. Dasch, and S. H. Cadle.
Atmospheric Environment, Vol. 18, No. 5, p 1009-1015, 1984. 4 Fig, 5 Tab, 9 Ref.

Descriptors: *Acid rain, *Precipitation chemistry, *Water pollution sources, *Air pollution, *Michigan, Sulfates, Nitrates, Calcium, Sodium, Chlorides, Urban areas.

Ambient particles, dry deposition, and precipitation were compared at two sites in southeast Michigan. The sites, which are within 66 km of one another, are expected to be equally affected by long-range sources, but local emissions are considerably higher at the urban site. The higher local emissions at the urban site were reflected in higher concentrations of sulfates, nitrates, calcium, sodium and chloride ions in ambient particles and dry deposition. Precipitation concentrations were compared by average values, volume-weighted means, total wet fluxes, and on an individual storm basis. None of these comparisons showed significantly higher rain water concentrations at the urban site, near the local sources. The only exceptions were Na(+) and Cl(-) which were higher in precipitation near the urban area, but this may result from dry deposition of NaCl during winter precipitation events. The widely different local emissions and the factor of two difference in ambient concentrations did not have an effect on rain water concentration. No evidence was found that local primary sulfate was dominating the sulfate concentrations in rain. Instead, the in-cloud processes and long range transport appear to dominate the chemistry of precipitation in this area. (Baker-IVI)
W85-01298

CARBON, NITROGEN, AND PHOSPHORUS TRANSPORT BY WORLD RIVERS,
Ecole Normale Superieure, Paris (France). Lab. de Geologie.
For primary bibliographic entry see Field 2K.
W85-01299

FACTORS AFFECTING THE BIOKINETICS OF TECHNETIUM (95MTC) IN MARINE MACROALGAE,

Cekmece Nuclear Research and Training Center, Istanbul (Turkey).
S. Topcuoglu, and S. W. Fowler.
Marine Environmental Research, Vol, 12, No. 1, p. 25-43, 1984. 7 Fig, 1 Tab, 26 Ref.

Descriptors: *Bioindicators, *Marine algae, *Technetium radioisotopes, Radioactive tracers, Algae, Bioaccumulation, Fate of pollutants, Plant metabolism.

Using technetium-m92 as tracer, Tc biokinetics were investigated in marine macroalgae. Tc (VII) was accumulated by green and red algae to a very low degree. However, a much higher affinity for pertechnetate was found in some brown algal species. Tc did not accumulate similarly in all species of the brown algae group. No significant differences in radionuclide uptake were noted between brown algae exposed to Tc in either the IV or VII oxidation states. Tc bioaccumulation appears to be a metabolically controlled process as uptake did not occur in heat killed individuals and both light and temperature significantly enhanced the accumulation of technetium in brown algae. The rapidly growing air bladder, leaf like laterals and small branches contained higher Tc concentrations and retained a greater fraction of the radioactivity than the older, cylindrical main axis. Pertechnetate retention in two brown algae was significantly different. Their biological half-lives for Tc differed by an order of magnitude. During depuration, loss took place more rapidly from the younger portions of the seaweed, as evidenced by the highest concentration and greatest fraction of Tc retained in the older, cyclindrical main axis. Brown algae such as Cystoseira compressa and S. vulgare would serve as good bioindicator organisms for the presence of Tc contamination in marine water provided certain precautions were taken. (Baker-IVI)
W85-01310

HEAVY METALS EXTRACTABLE FROM A CALCAREOUS SOIL TREATED WITH SEWAGE SLUDGE,
King Saud Univ., Riyadh (Saudi Arabia). Dept. of Soil Science.
For primary bibliographic entry see Field 5E.
W85-01318

ASSESSMENT OF THE SPATIAL VARIATION IN THE CHEMICAL COMPOSITION OF BULK PRECIPITATION WITHIN AN UPLAND CATCHMENT,
Institute of Terrestrial Ecology, Bangor (Wales).
For primary bibliographic entry see Field 2K.
W85-01348

SORPTION OF POLYCYCLIC AROMATIC HYDROCARBONS BY NATURAL ESTUARINE COLLOIDS,
Maryland Univ., Solomons. Chesapeake Biological Lab.
R. D. Wijayaratne, and J. C. Means.
Marine Environmental Research, Vol. 11, No. 2, p 77-89, 1984. 5 Fig, 1 Tab, 27 Ref.

Descriptors: *Hydrocarbons, *Aromatic compounds, *Estuarine environment, *Colloids, Sorption, Benzene, Naphthalene, Anthracene, Partition coefficients, Organic compounds, Fate of pollutants, Polycyclic aromatic hydrocarbons, Hydrogen ion concentration.

The sorptive behavior of natural estuarine colloids was investigated with benzene, naphthalene and anthracene. The equilibrium sorption isotherms were linear. Freundlich partition coefficients normalized to the organic content of the colloids for benzene, naphthalene, and anthracene were 920, 4060 and 510000, respectively. These values are at least an order of magnitude higher than those reported for corresponding soil/sediment systems. This suggests that hydrophobic compounds are more strongly bound to estuarine colloidal organic material. The effect of pH on sorption was also studied. A significant decrease in sorption was observed when the ambient pH (8.01) of natural water was decreased by a factor of 2. The experimentally determined Koc values were regressed against the water solubilities of PAHs and compared with a corresponding predictive relationship developed for a soil/sediment system. Such information greatly facilitates prediction of PAH phase partitioning in natural waters. (Author's abstract)
W85-01349

UPTAKE AND RELEASE OF 51CR(VI) AND 51CR(III) BY BARNACLES (BALANUS SP),
Universidade Federal do Rio de Janeiro (Brazil). Inst. de Biofisica.
M. van Weerelt, W. C. Pfeiffer, and M. Fiszman.
Marine Environmental Research, Vol. 11, No. 3, p 201-211, 1984. 4 Fig, 2 Tab, 7 Ref. FINEP contract B 76/79/074/0000/00.

Descriptors: *Barnacles, *Chromium radioisotopes, *Path of pollutants, Seawater, Sodium chromate, Chromic chloride, Metabolism, Suspended solids, Particulates.

Barnacles (Balanus sp) were used to examine the uptake and release of chromium-51 added to sea water in two different valence states, Cr-51(VI) and Cr-51(III). Hexavalent chromium-51 (sodium chromate) forms a true ionic solution in filtered sea water and barnacles were able to accumulate chromium in soft tissues 543 times the levels found in sea water. The experiments showed that incorporated Cr(VI), is released to the water in such way that only 20% of maximum uptake was lost by the organisms after 26 days. Addition of the hexavalent form to non filtered sea water showed that 2% of the total radioactivity was attached to the suspended particles. Here again chromium is mainly concentrated in soft tissues, showing a concentration factor of 380 related to total chromium available in aquarium (solution + suspended particles). From the total radioactivity incorporated by the organisms, 20% was released after 56 days in the clearance experiment. Chromium, as trivalent chromic chloride, when added to sea water precipitates and is quickly removed from the water by the filter activity of the barnacles. Unlike the hexavalent form, trivalent chromium is not concentrated in soft tissues of the barnacles and is quickly released to the water through the organisms digestive system. (Author's abstract)
W85-01353

FINITE ELEMENT ANALYSIS OF A RADIOACTIVE TRITIUM PATCH AND A WASTE HEAT PLUME OBSERVED NEAR THE PICKERING NUCLEAR POWER GENERATING STATION, LAKE ONTARIO,
Canada Centre for Inland Waters, Burlington (Ontario).
D. C. L. Lam, and R. W. Durham.
Journal of Great Lakes Research, Vol. 10, No. 1, p 59-67, 1984. 4 Fig, 19 Ref.

Descriptors: *Tritium, *Waste heat, *Finite element analysis, *Lake Ontario, Effluents, Eddy diffusion, Path of pollutants, Nuclear powerplants, Diffusion, Mixing, Plumes, Coastal diffusion.

Effluents from industrial outfalls often form a moving patch or a steady plume in the receiving water, depending on the duration of the release. Empirical studies of coastal diffusion have shown that the eddy diffusivity obeys a power law of the length scale of the patch or plume. By analyzing a moving patch of radioactive tritium concentration and a steady plume of waste heat, the one superimposing over the other as indicated by the observed data, it is found that the cross-flow eddy diffusivity for a given length scale of the patch is about twice as large as that of the plume. The analysis is based on a variable-grid finite element method, which is used to derive the flow field and also to simulate the transport and diffusion processes. The proposed method is found particularly suitable for domains with irregular coastal structures, such as water intakes and outfalls. (Author's abstract)
W85-01359

RELATIVE CONTRIBUTIONS OF FOOD AND WATER IN THE ACCUMULATION OF ZINC BY TWO SPECIES OF MARINE FISH,
National Marine Fisheries Service, Beaufort, NC Beaufort Lab.
J. N. Willis, and W. G. Sunda.
Marine Biology, Vol. 80, No. 3, p 273-279, June 1984. 6 Fig, 2 Tab, 25 Ref.

Descriptors: *Zinc, *Fish, *Fish food, *Bioaccumulation, Heavy metals, Zinc radioisotopes, Tracers, Path of pollutants.

Knowledge of the relative importance of food and water in the turnover and accumulation of trace metals by organisms is essential in understanding and predicting the pathways and rates of movement of metals in the environment. A model food chain, utilizing Zn-65 labeled and nonlabeled food organisms, was used to measure the relative contributions of food and water to Zn accumulation by Gambusia affinis and Leiostomus xanthurus. Chlamydomonas sp. was fed to Artemia sp. which in turn was fed to G. affinis and L. xanthurus. A trace metal-chelate buffer system was used to maintain a stable free Zn ion activity in the experiment seawater. Both species of fish accumulated Zn-65 much faster from food and water than from water alone. Food represented 78 to 82% of total accumulation of Zn-65 by the fish. Food cannot be ignored in assessing the accumulation and toxicity of trace metals. (Moore-IVI)
W85-01366

AVAILABILITY OF ARSENIC TO ESTUARINE AND MARINE ORGANISMS: A FIELD AND LABORATORY EVALUATION,
Marine Biological Association of the United Kingdom, Plymouth (England).
W. J. Langston.
Marine Biology, Vol. 80, No. 2, p 143-154, June, 1984. 8 Fig, 5 Tab, 17 Ref.

Descriptors: *Arsenic, *Estuarine environment, *Mollusks, *Algae, *Restronguet Creek, *England, Fucus, Mine wastes, Bioindicators, Path of pollutants.

Metalliferous mining in southwest England has resulted in the contamination of a number of estuaries, most notably Restronguet Creek, a branch of the Fal estuary system. The high concentrations of arsenic entering Restronguet Creek make this an ideal area for speciation and availability studies. A number of surveys and experiments were carried out between January 1978 and June 1981, designed to investigate As availability in selected estuarine and marine organisms. Seasonal variations in dissolved As inputs are reflected in the As content of the seaweed Fucus vesiculosus and also in two gastropod species, Littorina littorea and L. littoralis, which derive significant amounts of As by grazing on F. vesiculosus. No seasonal variation in As concentration was observed in tissues of the bivalve Scrobicularia plana. Transplant experiments and radiotracer studies confirm that sediments are the major source of As to this deposit-feeder. The mantle margin of S. plana has a significant, but as yet unknown, role in As accumulation. Transplant experiments with these and other estuarine and marine organisms have revealed differences in the relative availability of dissolved and particulate As. As accumulation in Mytilus edulis was negligible compared with other mollusks. The rapid changes in As concentrations in F. vesiculosus in respose to changes in As in water validates the use of this organisms as an indicator of dissolved As. (Moore-IVI)
W85-01368

IMPACTS ON GROUNDWATER DUE TO LAND APPLICATION OF SEWAGE SLUDGE,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5E.
W85-01381

WATER QUALITY CHARACTERISTICS OF AGRICULTURAL PUMPAGE IN THE UPPER ST. JOHNS RIVER, FLORIDA,

st. of Tech., Melbourne. Dept. of Envi-
Sciences and Engineering.
nger, and S. D. VanVonderen.
sources Bulletin, Vol. 20, No. 3, p 349-
1984. 2 Fig, 8 Tab, 17 Ref.

rs: *Agricultural pumpage, *St. Johns
lorida, *Water quality, Water pollution
Nutrients, Suspended solids, Nitrogen,
is, Eutrophication, Water level, Marshes,
Agricultural runoff.

rge agricultural pumps, located in the
Johns River Basin, Florida, and repre-
of the numerous pumps operating in the
re monitored during the spring and
f 1982. These pumps have rated capac-
ng from 36 to 334 cu ft/s and drain
antities of improved pasture, row crop,
land uses. The combined total pumping
f the pumps in this study is approximate-
to the average flow at US 192, near
e (691 cfs). Results indicate high nutrient
nded solids loading to the river, but the
agnitude of each parameter varies with
and date. The row crop/Mary A pump
/s capacity) exhibited the poorest water
the sampled pumps and appeared to have
st pollutional potential. The average sus-
lids loading rate from the Mary A pump
37,900 Kg/day). The average total nitro-
and total phosphorus (TP) discharge
tions at this pump were also high, with
3.96 mg/L and 0.7 mg/L, respectively.
ed, nutrient loading rates reflected dis-
es, to a large degree. Average TN load-
or the pumping stations varied from 86
g/day while TP loading ranged from 7
/day. Nutrients from pumping are con-
factors to the increasing aquatic plant
d algal blooms in the area. Poor quality
water, as well as rapid rises in water
the cumulative discharges resulting in
h vegetation and accompanying oxygen
been suggested as causative factors for
the area. (Author's abstract)
6

OUTFALLS, ESTUARIES AND THE ENVIRONMENT,
ent Water Authority, Birmingham (Eng-
ter.
ence and Technology, Vol. 16, No. 5-7,
984. 4 Fig, 3 Tab, 4 Ref.

rs: *Estuaries, *Marine environments,
ality, *Severn Estuary, *Trent Estuary,
Estuary, *England, Dilution, Mixing,
Water pollution sources, Legal aspects,
fe.

ty aspects of discharges from rivers to
direct discharges to estuaries, the twice
x of sea water mixing with the water
in the estuary and the effect of the
scharge on the adjacent marine environ-
discussed, based on the Rivers Medway,
Severn. The average and range of flows,
y and the flora and fauna of the river
factors which affect the environment of
y. In the estuary itself, the following
fect the environment: physical type of
se for navigation; use by industry and
ities; fisheries, fauna and flora; and the
and biological quality of the estuary.
n the marine environment involve the
forded by river flow, and littoral drift of
across the estuary mouth. Statutory law
control of estuarial pollution for the
ngdom is reviewed. The extent and dis-
n place and time of the oxygen sag in the
ary is recorded as also is the concentra-
dmium and ammonia in the Severn estu-
re-IVI)
3

BUTION OF RIVER SYSTEMS TO PUT OF POLLUTANTS TO THE ENVIRONMENT IN NORTHERN
,

Water Research Centre, Marlow (England).
R. F. Critchley.
Water Science and Technology, Vol. 16, No. 5-7, p 83-94, 1984. 1 Fig, 10 Tab, 15 Ref.

Descriptors: *Water pollution sources, *Marine environment, *Rivers, Estuaries, Ocean dumping, Sludge disposal, Industrial wastes, Atmospheric deposition, Biological oxygen demand, Nitrogen, Phosphorus, Cadmium, Chromium, Copper, Mercury, Nickel, Lead, Zinc.

Pollutants enter the marine environment by the following major routes: atmospheric deposition; rivers; direct discharges to coastal waters and estuaries; and dumping from ships (primarily industrial wastes, sewage sludge and dredging spoils). Published information on the input of pollutants to the North Sea was used to identify the major pollutant pathways. The pollutants examined are BOD, nitrogen, phosphorus, cadmium, chromium, copper, mercury, nickel, lead, and zinc. Rivers and atmospheric deposition are the main input routes for metals, with the Rhine/Meuse and the Elbe contributing over half the riverine input. The dumping of estuarine dredging spoils results in a very large input of metals, which cannot be fully accounted for as a redistribution of riverine material unless the river inputs have been grossly underestimated. Rivers provide the largest input route for nutrients, but a substantial contribution is also made by direct discharges to coastal waters and estuaries. Sewage sludge dumping contributes less than 5% to the pollutant load to the North Sea. (Moore-IVI)
W85-01395

SOURCES OF POLLUTION OF THE ESTUARY OF THE RIVER NERVION, SPAIN - A CASE STUDY,
Impolusa, Bilbao (Spain).
A. Azkona, S. H. Jenkins, and H. M. G. Roberts.
Water Science and Technology, Vol. 16, No. 5-7, p 95-125, 1984. 11 Fig, 12 Tab, 3 Ref.

Descriptors: *Water pollution sources, *Estuaries, *River Nervion, *Spain, Industrial wastes, Domestic wastes, Iron, Flocculation, Hydrogen sulfide, Effluents, Wastewater pollution.

A survey was made of the pollution loads from domestic sources and industry which were discharged to the fresh water and tidal reaches of four major tributaries in addition to the main River Nervion, Bilbao, Spain. The presence of iron in discharges from iron ore mining and metal processing aided in the flocculation of organic matter and the consequent deposition of sludge in the estuary. The domestic sewage of the study area receives treatment in septic tanks before discharging to rivers or the estuary. In spite of free hydrogen sulfide and high concentrations being present in the septic tank effluents, odor nuisance does not occur, because of the formation of ferrous sulfide. The hydrogen sulfide concentration in the atmosphere at a pumping station was above the safety level. The industrial load of impurity was estimated to be approximately 15% higher than the domestic load, but it is extremely difficult to find a rational basis on which comparisons may be made between domestic sewage and a mixture of industrial effluents containing substances inimical to biological activity. The industrial effluent was contained in a very large volume of water, much of it taken from the estuary for cooling or process water. It is calculated that if the industrial pollutants had been contained only in the fresh water used by industry the COD of the mixture would have been 1317 mg/l; the suspended solids 2143 mg/l; the ammonia nitrogen 191 mg/l; iron 1037 mg/l; other heavy metals 118 mg/l; fluoride as F 14.5 mg/l; cyanide as CN 8.1 mg/l; oil 196 mg/l; phenols 8.1 mg/l; mercury 0.13 mg/l; and the mixture would have had an excess of acidity of 5188 mg/l. Of the total oxygen demand discharged to the system of rivers and the estuary, approximately 50% entered the estuary from the main tributaries, the remainder being discharged directly to the estuary. (Moore-IVI)
W85-01396

EFFECTS OF THE YORKSHIRE RIVERS ON DISSOLVED OXYGEN IN THE HUMBER ESTUARY,
Yorkshire Water Authority (England).
A. M. C. Edwards, and P. W. Lai.
Water Science and Technology, Vol. 16, No. 5-7, p 127-137, 1984. 4 Fig, 2 Tab, 11 Ref.

Descriptors: *Humber Estuary, *England, *Dissolved oxygen, *Fate of pollutants, Computers, Simulation, Effluents, Tidal effects, Water temperature, River flow, Water quality, Estuarine environment.

The rivers flowing into the humber Estuary drain an area of approximately 26,000 sq km. The outer estuary is not seriously polluted but dissolved oxygen (DO) levels in some of the tidal rivers can be seriously depleted, particularly at times of low freshwater flow and warm weather. DO levels in the Humber estuary system are governed by the complex interaction of the tide, temperature, freshwater flow, river quality and effluent discharges. A suite of mathematical models has been developed to predict dissolved oxygen saturation and the concentration of related substances. Computer simulations using the models were carried out to assess the effects of freshwater flow and oxidizable pollutants on dissolved oxygen levels in the estuary system. The model shows that DO levels around Goole cannot be raised above a minimum of 10% saturation in warm weather, low flow conditions without both improving the quality of the Aire and Don and reducing the effluent load form some direct discharges to the tidal Ouse. The model can be used to obtain the dissolved oxygen criteria of the environmental quality standards which may be set for the Humber system. (Moore-IVI)
W85-01397

ESTIMATION OF ACCEPTABLE WATER QUALITY CONDITIONS IN THE TAMA RIVER, JAPAN,
Tokyo Univ. (Japan). Dept. of Urban Engineering.
A. Ichikawa, N. Tamai, Y. Nakayama, and K. Amano.
Water Science and Technology, Vol. 16, No. 5-7, p 207-218, 1984. 12 Fig, 2 Ref.

Descriptors: *Tama River, *Japan, *Water quality, *Self-purification, Fate of pollutants, Mathematical models, Effluents, Model studies.

The Tama River is located at the southwest edge of Tokyo Metropolitan District, Japan. Because of the changes in depth gradient and velocity which occur frequently over comparatively small stretches of the Tama River and because of the entry of numerous tributaries and discharges of effluent to the river, it is extremely difficult to determine the rate at which self purification is occurring by tracing the changes in composition of a given body of water flowing down the river. By taking frequent samples of water from different sections of the river, it was possible to determine water quality parameters for each section of the river, based on the examination of a mass of data for each section; these were defined as reasonable water quality parameters. The reasonable parameters were used in models based on the Streeter-Phelps equation describing self purification in a river. The results predicted by these model studies were then compared with the actual conditions in the Tama River. In some cases it was possible to make modifications to the model which improved the agreement between the predicted and the observed results; in other cases, this was not permissible. Self purification due to biological oxidation is described satisfactorily by the modified model, but factors such as pollutant removal by sedimentation and biological absorption still require further investigation. (Moore-IVI)
W85-01403

POLLUTION IN THE GANGES RIVER, INDIA,
Aligarh Muslim Univ. (India). Environmental Research Lab.
M. Ajmal, A. A. Nomani, and M. A. Khan.
Water Science and Technology, Vol. 16, No. 5-7, p 347-358, 1984. 1 Fig, 3 Tab, 27 Ref.

Descriptors: *Ganges River, *India, *Fate of pollutants, Self-purification, Color, Turbidity, Dissolved solids, Hydrogen ion concentration, Alkalinity, Chloride, Sulfates, Phosphates, Nitrates, Dissolved oxygen, Metals, Water pollution sources.

The physico-chemical characteristics of Ganges River water and distribution of nine metals in the submerged plant and fish has been studied. The parameters color, turbidity, total dissolved solids, pH, total alkalinity, chloride, sulfate, phosphate, NO3-N, NO2-N, dissolved oxygen, biochemical oxygen demand and chemical oxygen demand showed that at various sampling stations deterioration in the quality of water at downstream is severe. However, due to a self-purification phenomenon, significant increase in the dissolved oxygen at the next sampling station was noted. A high fluctuation in the accumulation of metals in the submerged plants (Eicchornia crassipes) and fish (Heteropnuestes fossilis) was found from one sampling station to another due to domestic sewage and industrial effluent discharged into river. The ranges of concentration of metals in fish were as follows: cadmium 0.01-0.09; cobalt 1.3-10.6; chromium 5.2-2100; copper 5.9-39.2; iron 463-1873; manganese 441-1880; nickel 5.6-23.3; lead 3.4-13.7; and zinc 17.8-232.5. In plants the ranges were, on a dry matter basis: cadmium 0-0.28; cobalt 0.67-7.25; chromium 1.9-24.9; copper 4.6-11.3; iron 134-1614; manganese 1.41-7.4; nickel 111.7-161.7; lead 3.8-21.2; and zinc 131-556. (Author's abstract)
W85-01411

RELATIONSHIPS BETWEEN THE POLLUTANTS IN THE SEDIMENTS AND IN THE WATER OF THE DELAWARE AND RARITAN CANAL,
Rutgers - The State Univ., Piscataway, NJ. Coll. of Engineering.
M. L. Granstrom, R. C. Ahlert, and J. Wiesenfeld.
Water Science and Technology, Vol. 16, No. 5-7, p 375-380, 1984. 1 Tab, 6 Ref.

Descriptors: *Delaware and Raritan Canal, *New Jersey, *Sediment contamination, Water pollution sources, Polychlorinated biphenyls, Pesticides, Trihalomethanes, Water treatment, Chlorination, Halogenated hydrocarbons, Spoil banks, Interstitial water, Water supply.

The 60-mile-long Delaware and Raritan Canal in New Jersey once served as a barge canal and for the last 30 years has served as a major interbasin water supply system. Approximately 78 mgd are withdrawn; of this, 68.5 mgd is sold to water purveyors for treatment and distribution to some 600,000 people. In addition to the water taken from the Delaware River, the canal receives runoff from 82.7 sq mi of urban and rural land. The canal is severely clogged by sediments in certain segments and to have adequate hydraulic capacity, removal is necessary. Sediments, interstitial water and the overlying water column were analyzed for pesticides, polychlorinated biphenyls (PCBs) and volatile organic halide compounds. PCBs and pesticides were found on some of the sediment samples analyzed. PCBs were found in the water column only in samples taken during a storm. Volatile organic halides including trihalomethanes exist in the water column and in the sediment water, and the concentrations increase significantly upon chlorination. Disposal of the sediments from some sections of the canal should be in landfill and not by spreading on crop lands. (Moore-IVI)
W85-01413

PROCESS BASED MODEL OF FAECAL BACTERIAL LEVELS IN UPLAND CATCHMENTS,
Leeds Univ. (England). School of Geography.
A. Jenkins, M. J. Kirkby, A. McDonald, P. Naden, and D. Kay.
Water Science and Technology, Vol. 16, No. 5-7, p 453-462, 1984. 3 Fig, 25 Ref.

Descriptors: *Fecal coliforms, *Process based models, *Model studies, Bacteria, Fate of pollutants, Catchment areas, Watershed management, Bacterial die-off, Washout, Sediment contamination.

A process based model of bacterial dynamics in a river is developed for use in the management of catchments where the waters are destined for potable supply. Fecal coliform bacteria was chosen for the model because it is an indicator in widespread use both in legislation and in practice and its significance is affirmed by the water industry. The argument for a process based model of bacterial stream dynamics is based largely on the concept of the watershed as a multiple storage and release system. The land surface store receives direct fecal input by excretion from animals and from agricultural practices such as slurry spreading. The concentration of bacteria in water is increased by fecal input and washout from sediment and is reduced by settlement and die off. Numbers of bacteria in sediment are increased by settlement and reduced by die off and washout. Sample output is provided to demonstrate that the model is capable of simulating some of the bacterial conditions for which data exist. The model could help to identify the amount of flushing required to reduce channel bacterial levels to within given standards. (Moore-IVI)
W85-01420

QUANTIFICATION OF ACCUMULATED LOADS ON ROAD SURFACES AND THEIR RUNOFF CHARACTERISTICS,
Kansai Univ., Osaka (Japan). Dept. of Civil Engineering.
Y. Wada, and H. Miura.
Water Science and Technology, Vol. 16, No. 5-7, p 463-472, 1984. 5 Fig, 5 Tab, 3 Ref.

Descriptors: *Mathematical models, *Roads, *Street sweeping, *Water pollution sources, Simulation, Nonpoint pollution sources, Pollution load, Storm runoff, Urban areas.

Pollutants caused by urban activities accumulate in the environment, and the accumulated pollution loades are flushed out from road surfaces and conveyed directly to the receiving waters. The quantity of accumulated load on the road surfaces, the composition and local distribution of accumulated load, and how these loads are flushed out by rainfall must be studied in order to provide information for use in the reduction of nonpoint-pollution loads. A model was developed for the accumulated loads on road surfaces. The accumulated load on road surfaces shows large differences among each area and is flushed out in greater quantities at a comparatively early stage in rainfall. The accumulated loads on road surfaces are much influenced by the frequency and efficiency of road surface cleaning. If the cleaning is carried out every three days, the runoff loads decrease by 4/9 to 3/7 of the load without cleaning. This method can be used to simulate the runoff accumulated loads on road surfaces, and to obtain useful information on the prevention of water quality deterioration. (Moore-IVI)
W85-01421

EFFECTS OF BIOLOGICAL FILMS ON BOD DECAY RATES IN RIVERS,
Exeter Univ. (England). Dept. of Chemical Engineering.
J. D. Boyle.
Water Science and Technology, Vol. 16, No. 5-7, p 643-651, 1984. 6 Fig, 3 Tab, 14 Ref.

Descriptors: *Fate of pollutants, *Biological films, *Biological oxygen demand, *Decay rate, Bacteria, Photosynthesis, Microorganisms, Velocity, Nutrients, Dissolved oxygen, Rivers, Surface area.

The measured dissolved oxygen sag below a papermill outfall could only be modelled if the BOD decay rate was assumed to be an order of magnitude greater than expected. Subsequently other cases of anomalously high decay rates have been found. A method was developed for measuring the separate factors of bacterial respiration and photosynthesis by attached and suspended organisms. Results confirmed that the decay rate is enhanced by the presence of an active biological film covering submerged surfaces. The prediction of decay rates in similar circumstances is complicated by two factors, the estimation of the active film surface area and the dependence of the film activity on both nutrient concentration and water velocity. The paper relates these phenomena to laboratory studies and shows how these factors affect the predictions of management models. (Author's abstract)
W85-01436

ORGANOCHLORINE PESTICIDE RESIDUES IN PADDY FISH IN MALAYSIA AND THE ASSOCIATED HEALTH RISK TO FARMERS,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
D. F. Chen, P. G. Meier, and M. S. Hilbert.
Bulletin of the World Health Organization, Vol 62, No. 2, p 251-253, 1984. 1 Fig, 1 Tab, 5 Ref

Descriptors: *Pesticide residues, *Organochlorine pesticides, *Malaysia, *Fish, Rice, Paddy farming, Aldrin, Dieldrin, HCH, DDT, Chlordane, Food contamination.

The dual cultivation of rice and fish in paddy fields is a common practice among paddy-farmers in Malaysia. As a result of the application of persistent and toxic insecticides to the rice, the fish cultured in these fields may be contaminated by a variety of pesticide residues. Paddy fish (Trichogaster pectoralis) were collected from five sampling locations in the District of Krian, State of Perak, Malaysia and analyzed for organochlorine residues. Ten farming families, chosen at random from each of the five sampling sites, were interviewed for information about the quantity of paddy fish consumed, the amount and type of pesticide used on the paddy-field, and the frequency of application. The pesticide residues found in the fish samples were aldrin/dieldrin, chlordane, HCH, and DDT. Only the projected maximum intake level for aldrin/dieldrin approached the acceptable daily intake as recommended by FAO/WHO; other residue levels were relatively low. The study considered only fish; the total daily intake of pesticide residues by the Malaysian paddy farmer may be considerably increased by consumption of other contaminated food. (Moore-IVI)
W85-01438

FOLIAR WASHOFF OF PESTICIDES (FWOP) MODEL: DEVELOPMENT AND EVALUATION,
Environmental Protection Agency, Athens, GA.
C. N. Smith, and R. F. Carsel.
Journal of Environmental Sciences and Health, Vol. B19, No. 3, p 323-342, 1984. 6 Fig, 5 Tab, 20 Ref.

Descriptors: *Pesticides, *Foliar washoff, *Model studies, Simulation, Leaves, Path of pollutants, Runoff, Carbaryl, Profenfos, Methyl parathion, permethrin, Toxaphene.

The Foliar Washoff of Pesticides (FWOP) Model was developed to provide an empirical simulation of pesticide washoff from plant leaf surfaces as influenced by rainfall amount. To evaluate the technique, simulations by the FWOP Model were compared to those by the foliar washoff alogrithm of the Chemical, Runoff and Erosion from Agricultural Management Systems (CREAMS) Model. The two algorithms were linked individually to the Pesticide Runoff Simulator (PRS) for the comparison. Five years of test data from a Mississippi watershed were used to evaluate six insecticides (carbaryl, profenofos, methyl parathion, permethrin, phorate, and toxaphene). Initially, the FWOP model was used to evaluate the relative impact of chemical distribution (foliage versus soil) on the subsequent foliar washoff and soil surface contributions to runoff losses. Results indicated that runoff losses were low if all of the insecticide was applied to the foliage whereas high losses occurred if applied only to the soil. When an assumed application was distributed between the plant and soil (i.e., 90% to foliage and 10% to soil), predicted runoff losses compared well with observed field data (< 3% of the application rate). Except for toxaphene, the FWOP model generally predicted less washoff and subsequent runoff losses than the CREAMS approach. Simulated toxaphene washoff losses

n good agreement with observed field data. ical comparisons of the two modelling ap- nes using the Kolmogorov-Smirnov test d differences in the two cumulative frequen- tributions for washoff but smaller differences noff. Average 5-year runoff losses, however, greater using the CREAMS approach--by s of 2, 3, and 3 for profenofos, methyl parath- d phorate, respectively. Results from this will be useful for upgrading current exposure nent models to more accurately address washoff losses of pesticides as well as for ng the impact of foliar-applied chemicals on nmental quality. (Author's abstract)
01441

TION OF ORGANIC SUBSTANCES BY S AND SEDIMENTS,
ultural Research Organization, Bet-Dagan). Dept. of Soil Residues Chemistry.
rstl, and U. Mingelgrin.
l of Environmental Science Health, Vol. No. 3, p 297-312, 1984. 3 Fig, 3 Tab, 32 Ref.

ptors: *Adsorption, *Soils, *Sediments, ion coefficients, Pesticides, Organic com- s, Fate of pollutants, Lake sediments, Solu- Minerals.

olubility, octanol/water partition coefficient and adsorption on soils and lake sediments myl, acetophenone, bromacil, napropamide, ion, trifluralin, and DDT were determined. ations between adsorption (on an organic basis) and either solubility or Kow enabled tes of adsorption to within an order of mag- . Systematic differences in adsorption be- the soils and lake sediments were observed. he exception of DDT, the Kom (distribution ient between soil organic matter and water) sediments relative to the soils increases as ubility decreases. The organic matter of the nts may differ considerably from that nor- found in soils due to different organic tran- ions which occur in the lake bottom envi- nt. A second possible explanation for the nts' different adsorptive capacity may result ifferences in the organic matter-mineral rela- The soil mineral components, especially the raction, may be an important adsorbent is not properly taken into consideration Kom is calculated. Although a good correla- etween Kom and Kow or solubility has been strated in numerous studies, this relationship universal but each group of soils or sedi- and substances may fit different functional ns. (Moore-IVI)
01442

ADATION OF METHOXYCHLOR IN MENTS UNDER VARIOUS REDOX CON- ONS,
tment of Fisheries and Oceans, Winnipeg toba). Freshwater Inst.
G. Muir, and A. L. Yarechewski.
l of Environmental Sciences and Health, 319, No. 3, p 271-295, 1984. 2 Fig, 6 Tab, 23

ptors: *Methoxychlor, *Sediment contami- , *Fate of pollutants, *Degradation, Lake nts, Redox conditions, Aerobic conditions, dation products, Insecticides.

legradation of methoxychlor (C-14-ring-la-) was studied under laboratory conditions in nd pond sediments (water-sediment ratio, 10- ncubated under various redox conditions at r 10 degrees C. Methoxychlor degraded rap- n sediments with half-lives of < 28 days nitrogen aeration (Eh < -50 mv), 49 to 55 nder static aerobic conditions and 115 to 206 n air-purged flasks (Eh 220 to 464 mv). The degradation products were dechlorinated xychlor (DMDD) and mono- and dihydroxy thylated) derivatives of methoxychlor and D. Dihydroxy- derivatives represented 15% ractable radioactivity in pond sediments and n lake sediments after 448 days of aerobic ation. Under nitrogen aeration, mono- and roxy- derivatives represented 44 to 65% of extractable C-14 after 28 days incubation. (Author's abstract)
W85-01443

FOREST GROWTH AS A POSSIBLE CAUSE OF SOIL AND WATER ACIDIFICATION: AN EXAMINATION OF THE CONCEPTS,
Sveriges Lantbruksuniversitet, Uppsala. Inst. foer Ekologi och Miljoevaard.
S. I. Nilsson, H. G. Miller, and J. D. Miller.
OIKOS, Vol. 39, No. 1, p 40-49, December, 1982. 3 Fig, 5 Tab, 49 Ref.

Descriptors: *Forests, *Soil chemistry, *Acidification, Acid rain, Cation accumulation, Humus, Hydrogen ion concentration, Root uptake, Anions, Rain, Water pollution sources.

Acidity consequent on root uptake was calculated as the excess cation accumulation in both stems and all above-ground tree components in a range of forest types, and values were derived for acidity resulting from the accumulated humus. In addition data from one pine stand was used to construct models of rate of accumulation of excess cations in trees and humus throughout the forest rotation. Rates of hydrogen ion production reaches a maximum very early in the life of a forest and the average annual permanent acidification resulting from removal of harvested material covers a wider range than either measured inputs in rainfall, including throughfall and stemflow, or estimated weathering rates. However, it is suggested that because rainwater inputs are episodic, include a mobile anion and may be channelled through the profile, whereas root generated acidity varies only gradually, does not involve the movement of an anion and occurs in intimate contact with the soil surfaces, rainwater acidity is the more likely to lead to streamwater acidification whereas root uptake will primarily acidify the soil. (Author's abstract)
W85-01452

ORGANOCHLORINE RESIDUES IN FISH FROM THE RIVER NILE, EGYPT,
National Research Centre, Cairo (Egypt). Water Pollution Control Lab.
O. A. Aly, and M. I. Badawy.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 2, p 246-252, August, 1984. 1 Fig, 2 Tab, 16 Ref.

Descriptors: *Fish, *Organochlorines, *Pesticide residues, *Nile River, *Egypt, Organic compounds, DDE, DDT, BHC, Lindane, Endrin, Insecticides.

Samples of Tilapia fish were taken during August 1981 and July 1982 from six stations along the Nile River and two canals, selected to represent different regions. The sites selected were, in order of decreasing pesticide concentrations in the fish at each site: El-Mahmodia Canal > Abo-El-Gheit Canal > El-Mansoura > Assiut > Faraskour > Adfinna > Cairo > Aswan. Organochlorine residues found in the fish included BHC, lindane, endrin, o,p-DDT, p,p'-DDT, and p,p'-DDE. Concentrations of p,p-DDT, and its metabolites were much higher than other oganochlorine insecticides, especially in areas of agricultural activity. The high levels of p,p'-DDT indicate a recent application of that insecticide. Endrin was the second most common residue being detected in all samples with the exception of one sample from El-Mahmodia canal. Its residue ranged from not detectable to 86 micro g/kg. Residues of BHC were found in all samples at low concentrations ranging from 0.5 to 30 micro g/kg. Lindane was found in all samples at low concentration but higher levels than BHC. The lowest residue was reported at El-Mahmodia canal, 0.6 micro g/kg. (Baker-IVI)
W85-01458

MICROBIAL INDICATORS AND PATHOGENS NEAR THE MOUTH REGION OF VEMBANAD LAKE,
Cochin Univ. (India). Dept. of Marine Sciences.
L. Samy, P. M. Chandrasekaran, I. S. B. Singh, and D. Chandramohan.
Bulletin of the Department of Marine Sciences, University of Cochin, Vol. 12, No. 2, p 103-119, December, 1981. 1 Fig, 3 Tab, 38 Ref.

Descriptors: *Vembanad Lake, *Cochin Backwater, *India, *Bacteria, *Sediments, Estuarine environment, Pathogenic bacteria, Resuspension, Path of pollutants, Public health, Coliforms, Water quality, Fisheries, Recreation.

Rapid industrialization and growth of population in and around Cochin, India contribute enormous amounts of industrial wastes and sewage effluents which are dumped into Cochin backwater (Vembanad Lake). Total viable aerobic heterotrophic bacteria, total coliforms, fecal coliforms, fecal streptococci, Staphylococcus, Salmonella, Vibrio like organisms, Vibrio parahaemolyticus like organisms, Vibrio parahaemolyticus, Aeromonas hydrophila and anaerobic bacteria Clostridium perfringens were enumerated in water and sediment samples collected in the estuarine environment near the mouth region of Vembanad Lake, during April-September, 1980. Indicator organisms and pathogens were present in greater numbers in sediment than the overlying water, indicating that sediment can act as a reservoir for these organisms. Heavy boat traffic, ships and dredging contribute to the continual resuspension of sediment in the water column in addition to the effects of tides, waves and currents. The backwater system contains a considerable number of indicators and pathogens which will pose a potential public health hazard and any further deterioration in the microbiological quality of water would adversely affect the fishery and recreational activities within the estuarine system. (Moore-IVI)
W85-01465

LAKEWIDE ODOURS IN ONTARIO AND NEW HAMPSHIRE CAUSED BY CHRYSOCHROMULINA BREVITURRITA NICH. (PRYMNESIOPHYCEAE),
Ontario Ministry of the Environment, Rexdale. Limnology and Taxonomy Section.
K. H. Nicholls, J. L. Beaver, and R. H. Estabrook.
Hydrobiologia, Vol. 96, No. 1, p 91-95, October, 1982. 3 Fig, 20 Ref.

Descriptors: *Chrysochromulina, *Odor, *Ontario, *New Hampshire, Dickie Lake, Crosson Lake, Cinder Lake, Austin Lake, Northwood Lake, Eutrophication, Algae, Recreation.

The planktonic alga Chrysochromulina breviturrita produced obnoxious 'rotten cabbage' odors in Dickie, Crosson and Cinder Lakes in Ontario, and Austin and Northwood Lakes in New Hampshire between 1978 and 1980. The odor was strong enough to interfere with recreational use of the lakes. In one case, CuSO4 was used to kill the organism and control the odor, but in the other four lakes, the species persisted for 4-6 weeks before populations declined and odors disappeared. Severe odors were associated with cell densities of approximately 3,000-9,000 cell/ml in both Northwood and Dickie Lakes, but serious odor developed on Crosson Lake with densities of only 500-960 cells/ml. Water temperature may be a very important factor governing odor production and release from lakewater. This is the first recorded instance of odor production by any member of the Prymnesiophyceae. (Moore-IVI)
W85-01467

HISTORICAL CHANGES IN THE CONDUCTIVITY AND IONIC CHARACTERISTICS OF THE SOURCE WATER FOR THE SHARK RIVER SLOUGH, EVERGLADES NATIONAL PARK, FLORIDA, U.S.A.,
Everglades National Park, Homestead, FL. South Florida Research Center.
For primary bibliographic entry see Field 6G.
W85-01483

HEAVY METALS AND POLYCYCLIC HYDROCARBON COMPOUNDS IN BENTHIC ORGANISMS OF THE UPPER GULF OF THAILAND,

Chulalongkorn Univ., Bangkok (Thailand). Dept. of Marine Science.
M. Hungspreugs, S. Silpipat, C. Tonapong, R. F. Lee, and H. L. Windom.
Marine Pollution Bulletin, Vol. 15, No. 6, p 213-218, June, 1984. 3 Fig, 3 Tab, 32 Ref. NSF grant INT81-16705.

Descriptors: *Heavy metals, *Hydrocarbons, *Benthic fauna, *Gulf of Thailand, Fate of pollutants, Mollusks, Polychaetes, Degradation, Aromatic compounds, Cadmium, Cobalt, Copper, Lead, Nickel, Benzo(a)pyrene, Polycyclic compounds.

Concentrations of heavy metals and polycyclic aromatic hydrocarbons (PAHs) were measured in bivalves collected in the Upper Gulf of Thailand. PAHs detected included acenaphthene, acenaphthylene, benzo(a)pyrene, fluoranthene, methylphenanthrene, phenanthrene and triphenylene. Benzo(a)pyrene was detected in all species at concentrations varying from 1.0 to 8.2 ng/g. Concentrations of cadmium, cobalt, copper, lead and nickel were significantly lower in bivalves from the Gulf than in green mussels collected from the mouth of the Chao Phraya River. No correlation was found between metal concentrations in animals and sediment, with the exception of copper. Copper concentrations in polychaetes and clams appeared to correlate with the copper:iron ratio of sediments. High rates of degradation were observed when radiolabelled chlorobenzene, phenanthrene and chrysene were added to water and sediment of the Chao Phraya River. Rates were lower in the waters and sediment of the Gulf of Thailand. The calculated half-lives of chlorobenzene in the Gulf of Thailand and the Chao Phraya River was about 130 and 68 days, respectively. (Author's abstract)
W85-01484

INHIBITIONS TO POLLUTANT DISSIPATION IN THE NORTH-EAST IRISH SEA,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
P. Foster.
Marine Pollution Bulletin, Vol. 15, No. 6, p 222-225, June, 1984. 5 Fig, 8 Ref.

Descriptors: *Density stratification, *Path of pollutants, *Irish Sea, *Density, Water quality management, Coastal waters, Dissipation, Seasonal variation.

Observations on the surface and sub-surface density fields in the north-east Irish Sea have been made during frequent cruises over a number of years. The presence and persistence of both lateral and vertical density discontinuities are important to the water quality management problems of this sea area. A lateral density discontinuity, essentially oriented north to south parallel to the English coast, provided a sharp line of demarcation between the physical characteristics of the offshore and coastal waters. The latitudinal density gradient associated with the discontinuity intensified between December and early May and then declined until by September there was no evidence of its presence within the study area. The orientation of the discontinuity, particularly in the southern sector of the area, was temporally variable. In March, for example, high density waters persisted along the North Wales coast almost as far as the Dee estuary. In contrast, the distribution in late May shows the density discontinuity running parallel to the North Wales coast with low density waters extending to the Isle of Anglesey. The presence of lateral and/or vertical density discontinuities are important features of the hydrography of the northeast Irish Sea for a considerable period of the year. Under normal meteorological conditions it would appear that only in autumn are there no major density inhibitions to the free mixing of waters either through the water column or between the offshore and coastal waters. (Baker-IVI)
W85-01485

RELATIONSHIP OF DDE/SIGMA DDT IN MARINE MAMMALS TO THE CHRONOLOGY OF DDT INPUT INTO THE ECOSYSTEM,
Barcelona Univ. (Spain). Facultat de Biologia.
A. Aguilar.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 6, p 840-844, June, 1984. 1 Fig, 2 Tab, 44 Ref.

Descriptors: *DDT, *DDE, *Marine mammals, *Chronology, Insecticides, Fate of pollutants, Marine environment, Metabolism, Mammals.

The DDE/sigma DDT (sigma DDT = DDT + DDE + DDD) ratios in the blubber of North Atlantic pinnipeds and odontocete cetaceans, as determined by several scientists and surveys, are compiled to obtain a biannual mean series. Conversion of DDT to DDE is interpreted as being due not only to the marine mammals but also to the overall detoxifying activity of the North Atlantic marine biota. The change of these ratios during the period 1964-81 is examined and a strong correlation between these ratios and time is found in both groups, which demonstrates that such an index can be tentatively used when one assesses the chronology of pollutant input into the ecosystem. An equilibrium value may be reached at the beginning of the next century when the ratio reaches a value of approximately 0.60, provided that no new inputs of contaminant into North Atlantic waters exist. (Author's abstract)
W85-01487

UPTAKE OF CHLORINATED ORGANICS FROM ANTHROPOGENICALLY CONTAMINATED SEDIMENTS BY OLIGOCHAETE WORMS,
National Water Research Inst., Burlington (Ontario). Environmental Contaminants Div.
B. G. Oliver.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 6, p 878-883, June, 1984. 1 Fig, 5 Tab, 24 Ref.

Descriptors: *Oligochaetes, *Chlorinated hydrocarbons, *Bioaccumulation, Sediment contamination, Lake Ontario, Polychlorinated biphenyls, Chlorobenzenes, Mirex, Concentration factors, Biological magnification, Fish foods.

Sediments from Lake Ontario are contaminated with a variety of chlorinated hydrocarbons such as chlorobenzenes, polychlorinated biphenyls, and mirex. Oligochaete worms, mainly Limnodrilus hoffmeisteri and Tubifex tubifex, were exposed to contaminated sediments from Lake Ontario for 110 d in laboratory aquariums. The worms accumulated many of the 24 chlorinated chemicals studied and for most compounds, concentrations factors (CF's) continued to increase over the 110-d study period. The mixture of chemicals found in the worms differed considerably from that in the sediments because of large variations in CF's between chemicals. Several individual PCB congeners were studied and found to have different CF's. Smaller differences in CF's for individual chemicals were due to different sediment types and to different worm size. Thus worm predators are subjected to a somewhat different chemical mixture than is found in the sediments, and macroinvertebrate analysis is essential for fish chemical exposure models. (Moore-IVI)
W85-01490

CONTAMINANT DISPERSION IN SOME TIME-DEPENDENT LAMINAR FLOWS,
University of Western Ontario, London. Dept. of Applied Mathematics.
C. Jimenez, and P. J. Sullivan.
Journal of Fluid Mechanics, Vol. 142, p 57-77, May, 1984. 10 Fig, 13 Ref, 2 Append.

Descriptors: *Dispersion, *Laminar flow, *Time-dependent flow, Path of pollutants, Estuaries, Mixing, Effluents, Mathematical equations.

Time-dependent flows occur naturally as in tidal estuaries and comprise many of the man-made flows of practical importance. A knowledge of the rate of mixing of a contaminant substance in such time-dependent flows is of paramount interest in the discharge of outfalls in estuaries. Contaminant spread in two specific and well-defined flows was studied to provide a basis for the interpretation of contaminant mixing in the more complex flow situations that normally prevail. In all cases considered, the initial contaminant cloud is taken to be a thin uniform sheet of contaminant over the flow cross-section. An extension of the probabilistic formulation of the streamwise dispersion of contaminant molecules is used to study time-dependent laminar flows between parallel plates and in tubes wherein the flows are homogeneous in the streamwise direction. The two flows considered in detail are oscillating flows and impulsively started flows. In impulsively started flows the start-up effects on the dispersion can be quite prolonged and very significantly reduce the streamwise spread of contaminant over that which is observed in the fully developed flow. In oscillatory flows optimal streamwise contaminant spread results from a value of kappa that depends upon kinematic viscosity v and frequency w. The streamwise cloud-variance growth rate is explored over the full range of the two parameters y sq = w(a sq)/kappa and lambda sq = w(a sq)/v sq for all time; a global maximum results when y is approximately equal to 2 pi and lambda is approximately equal to 2 (Moore-IVI)
W85-01518

SOURCES OF NITRATE IN GROUND WATER IN A SEWERED HOUSING DEVELOPMENT, CENTRAL LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
W. J. Flipse, Jr., B. G. Katz, J. B. Lindner, and R. Markel.
Ground Water, Vol. 22, No. 4, p 418-426, July-August, 1984. 3 Fig, 5 Tab, 31 Ref.

Descriptors: *Nitrates, *Water pollution sources, *Long Island, *New York, *Groundwater pollution, Fertilizers, Animal wastes, Ammonium, Organic nitrogen, Wastewater pollution.

Nitrate concentrations in ground water on Long Island, New York, have increased markedly in the last 30 years. A significant amount of this increase has been attributed to lawn and garden fertilizers in addition to cesspool and septic-tank discharges. The increase in nitrate concentration is of particular concern in the central and eastern part of the island, where ground water is the sole source of drinking water. Ground-water samples were collected from 14 wells screened near the water table in the sewered Twelve Pines housing development constructed in Medford, Suffolk County, in 1970. Samples were collected during 1972-79 and analyzed for total ammonium, organic nitrogen, and nitrate. Statistical analyses indicate that concentrations of nitrate-nitrogen in water from 10 of the wells increased significantly during 1972-79; those in water from the other four wells did not. Nitrogen loads were estimated to be 2,300 kg/yr from fertilizers, less than 80 kg/yr from irrigation water, 200 kg/yr from animals, and less than 670 kg/yr from precipitation. Leakage from sewers was considered negligible. Nitrage-nitrogen isotope ratios also suggest that the greatest source of nitrogen is from cultivation sources (either mineralized soil nitrogen or fertilizers) rather than human or animal wastes. (Author's abstract)
W85-01529

MODELING OF TRACE ORGANICS BIOTRANSFORMATION IN THE SUBSURFACE,
Houston Univ., TX. Dept. of Civil Engineering.
E. J. Bouwer, and P. L. McCarty.
Ground Water, Vol. 22, No. 4, p 433-440, July-August, 1984. 3 Fig, 2 Tab, 25 Ref. EPA grant EPA-R-808034010, NSF grant CME-7905707.

Descriptors: *Biotransformation, *Organic compounds, *Groundwater pollution, Fate of pollutants, Bacteria, Biofilms, Halogenated organic compounds, Trace compounds, Mathematical models.

Biofilm processes are potentially important for transformations of organic micropollutants in ground water. Some theoretical hypotheses and empirical observations suggest that a concentration threshold exists for some compounds below which the concentration cannot be reduced by bacterial action. However, in the presence of one compound

latively high concentration, termed the pri-
ubstrate, another compound present at trace
trations, termed the secondary substrate,
biotransformed as well. These concepts
valuated through laboratory column studies
everal halogenated organic compounds of
ance in ground water. A biofilm model can
fully describe utilization of trace substrates,
plication to modeling the subsurface is dis-
A simplified batch model with first-order
s may be adequate for describing subsurface
ial processes when low active organism and
nt concentrations exist over a large scale.
r's abstract)
1531

LIZED GROUND-WATER FLOW AND
ICAL TRANSPORT MODEL (S-PATHS),
e-Northwest, Richland, WA. Geosciences
ch and Engineering Dept.
berlander, and R. W. Nelson.
d Water, Vol. 22, No. 4, p 441-449, July-
, 1984. 4 Fig, 3 Tab, 5 Ref, 1 Append.

ptors: *Groundwater movement, *Solute
rt, *S-PATHS, Mathematical models, Path
utants, Groundwater pollution, Computers.

mber of studies on the actual and potential
mental consequences of contaminated
water is growing. One means of studying
consequences is through an idealized flow
nsport model, S-PATHS, which allows the
gist to determine the salient features of
inant migration with a minimum of data.
ansport of contaminants by ground water
any waste disposal sites can be geometrical-
lized as flow between a line and a circle.
w system adjacent to the disposal site can
esented as a contaminant line source, and a
radient pumping well as a circular sink. To
waste disposal sites on a larger scale the
geometry is reversed and the disposal site is
nted as a circular source, and a river or
convenient line of evaluation is represented
e sink. This idealization allow S-PATHS to
e the flow and transport process directly by
e partial differential expression. S-PATHS
ers transmissivity, effective porosity, sorp-
urce strength, source concentration, decay,
ometric gradient, circle size, and distance to
e. Coding for the model is not lengthy and
run on a large-capacity, hand-held calcula-
uthor's abstract)
1532

RAIN: IONIC CORRELATIONS IN THE
ERN UNITED STATES, 1980-1981,
sota Univ., Minneapolis. Dept. of Ecology
havioral Biology.
ham, F. B. Martin, and J. T. Litzau.
e, Vol. 225, No. 4660, p 407-409, July, 1984.
17 Ref. NSF grant DEB 7922142.

ptors: *Acid rain, *Sulfates, *Nitrates, *Am-
n, Water pollution sources, Ions, Hydrogen
ncentration, Air pollution, Agriculture, Sea

gen ions in precipitation are correlated
more closely with sulfate than with nitrate,
s ammonium ions are correlated more
with nitrate than with sulfate. Target load-
14 to 16 kilograms of wet sulfate deposition
ctare per year, instead of 20 as suggested
o, are probably necessary to produce aver-
H values of 4.6 to 4.7, the approximate
ary levels for damage to aquatic ecosystems.
r analysis reveals that there are three linked
of ions related to air pollution, agriculture,
a spray. (Author's abstract)
1540

ERSION SIMULATION IN TWO-DIMEN-
AL TIDAL FLOW,
Univ., Iowa City. Inst. of Hydraulic Re-
Holly, Jr., and J. M. Usseglio-Polatera.
l of Hydraulic Engineering, Vol. 110, No. 7,
926, July, 1984. 9 Fig, 1 Tab, 24 Ref, 1
d.

Descriptors: *Tidal flow, *Dispersion, *Simulation, Bay of Saint-Brieuc, France, Mathematical models, Path of pollutants, Advection.

An accurate numerical method for the mathematical modeling of contaminant dispersion in two-dimensional tidal currents is developed and applied. The method avoids the excessive numerical damping oscillations associated with most finite difference and finite element schemes for advection by using a characteristics approach with high order Hermite bicubic interpolation. The split-operator algorithm, incorporating a Crank-Nicolson operator for diffusion, provides a relatively simple and economic method for accurate simulation of pollutant dispersion on a fixed, Eulerian mesh. A special procedure for Lagrangian calculation of the dispersion of concentration fields which are small compared to the mesh size simulates the early stages of growth of point source plumes. These various procedures are described in detail, and their performance is demonstrated by application to schematic test cases and to the Bay of Saint-Brieuc, France. (Author's abstract)
W85-01558

5C. Effects Of Pollution

APPLICATION OF A CONVENTIONAL FISHERY MODEL FOR ASSESSMENT OF ENTRAINMENT AND IMPINGEMENT IMPACT,
Michigan Univ., Ann Arbor. School of Natural Resources.
For primary bibliographic entry see Field 6G.
W85-01118

TOXICITY OF MERCURIC CHLORIDE AND METHYLMERCURIC CHLORIDE TO FUNDULUS HETEROCLITUS EMBRYOS IN RELATION TO EXPOSURE CONDITIONS,
Texas A and M Univ., College Station. Dept. of Biology.
J. R. Sharp, and J. M. Neff.
Environmental Biology of Fishes, Vol. 7, No. 3, p 277-284, 1982. 4 Tab, 31 Ref. NSF grant OCE75-04890.

Descriptors: *Killfish, *Mercuric chloride, *Methylmercuric chloride, *Toxicity, Fish eggs, Embryonic growth stage, Fish, Water pollution effects.

Embryos in specific stage of the estuarine teleost, Fundulus heteroclitus, were exposed to mercuric chloride (MC) and methylmercuric chloride (MMC) under several distinct treatment conditions. Four-eight cell stage eggs (0-day old) were exposed for 4 days (continuous), 2 days and one day to each mercury compound. One-day old (mid-blastula), 2-day old (mid-neurula) and 5-day old (beating heart) embryos were exposed 4 days to MC and MMC. Mortality for the four days immediately following the initiation of exposure was the embryonic response measured. Under most exposure conditions to the 4-8 cell eggs, progressive and significant reductions in survival were observed at all concentrations above 40 and 30 micro g Hg(++)/L as MC and MMC, respectively. Reducing the duration of exposure to 1 day most significantly increased the survival potential of the 4-8 cell eggs. For all exposure treatments to the 4-8 cell eggs, significant differences in survival, between eggs exposed to MC and MMC, were determined at 40, 60 and 80 micro g Hg(++)/L, indicating the presence of compound-dependent response differences. In all cases demonstrating response differences between MC and MMC exposed embryos, survival was significantly lower following exposure to MMC. Survival of embryos was progressively increased when the initiation of continuous exposure (4 days) was delayed, 1, 2 and 5 days after fertilization. As a result, compound-dependent response differences were progressively shifted to higher Hg(++) concentrations. For both MC and MMC, survival of 1-day old embryos exposed for 4 days was greater than that of 0-day old eggs exposed for 1 day. Of the embryonic stages examined, it appears that the earlier cleavage stages are the most sensitive to mercury intoxication. (Author's abstract)
W85-01119

UPTAKE AND ACCUMULATION OF ZINC IN JUVENILE RAINBOW TROUT, SALMO GAIRDNERI,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
S. M. Lovegrove, and B. Eddy.
Environmental Biology of Fishes, Vol. 7, No. 3, p 285-289, 1982. 1 Fig, 2 Tab, 27 Ref.

Descriptors: *Zinc sulfate, *Toxicity, *Trout, Tissue analysis, Animal tissues, Hardness, Saline water, Freshwater, Drinking rate, Water pollution effects.

Rainbow trout are far more tolerant of zinc ions in dilute sea water than in freshwater; they are very susceptible to the toxic effects of Zn ions in soft freshwater. The 72 h median lethal concentration was found to be 2.00 mg/L in freshwater (hardness 7.50 mg/L as calcium). An insignificant increase in Zn concentration of internal tissues occurred in fish exposed to 1.52 mg/L in freshwater for 72 h. However, there was a significant uptake of Zn by gills and the body surface. Fish exposed to 10 mg/L Zn for 72 h in two-thirds sea water showed significant zinc uptake by liver, rectum and muscle, when compared to control fish. Mean drinking rate in freshwater decreased from 1.43 to as low as 0.26 ml/kg/h when zinc sulfate was added. Trout adapted to two-thirds sea water had a mean drinking rate of about 7 ml/kg/h; when Zn was added to the water there was no decrease from this rate which is probably due to the protective action of the salinity and hardness. The reduced drinking in freshwater trout may be related to an avoidance reaction to Zn. In unfed freshwater trout drinking is probably not a significant route for Zn accumulation, while in sea water fish this is probably the case since the osmotic reasons for the drinking rate is very much greater. (Collier-IVI)
W85-01120

AVOIDANCE RESPONSES OF ESTUARINE FISH EXPOSED TO HEATED-DECHLORINATED POWER PLANT EFFLUENTS,
Johns Hopkins Univ., Shady Side, MD. Aquatic Ecology Section.
L. W. Hall, Jr., D. T. Burton, W. C. Graves, and S. L. Margrey.
Environmental Science and Technology, Vol. 18, No. 7, p 561-566, July, 1984. 2 Fig, 5 Tab, 30 Ref.

Descriptors: *Powerplants, *Effluent streams, *Thermal pollution, *Dechlorination, *Avoidance responses, Bass, Menhaden, Water pollution effects, Sulfur dioxide.

Avoidance responses of striped bass (Morone saxatilis) and Atlantic menhaden (Brevoortia tyrannus) exposed to simultaneous dechlorinated waters (using SO2 to dechlorinate total residual chlorine (TRC) concentrations of 0.00, 0.05, 0.10, and 0.15 mg/L TRC) and elevated temperatures (0, 2, 4 and 6 degrees C) were evaluated at acclimation temperatures of 15, 20, 25, and 30 degrees C. Both species showed minimal avoidance to dechlorinated estuarine water (no delta T) at all acclimation temperatures. Elevated temperature (delta T) or a combination of delta T and dechlorination were the most important factors influencing avoidance of the test species. Acclimation temperature was an important factor influencing the avoidance behavior of both species exposed to heated-dechlorinated power plant conditions. Greatest avoidance of all test conditions generally occurred at an acclimation temperature of 30 degrees C. Both species avoided 34 degrees C when acclimated to 30 degrees C regardless of the dechlorinated condition. (Author's abstract)
W85-01127

QUANTIFICATION OF VOLATILE SULFUR COMPOUNDS RELATED TO THE CORROSION OF CONCRETE SEWERS,
Hamburg Univ. (Germany, F.R.). Inst. fuer Organische Chemie und Biochemie.
M. Rinken, M. Aydin, S. Sievers, and W. A. Konig.
Fresenius's Zeitschrift fur Analytische Chemie, Vol. 318, No. 1, p 27-29, 1984. 1 Fig, 17 Ref.

Descriptors: *Sewer systems, *Corrosion control, *Concrete, *Sulfur compounds, Thiobacillus, Hamburg, Germany, Gas chromatography, Oxygenation, Sulfuric acid.

Considerable corrosion of concrete sewers in the Hamburg (Germany) sewage system occurred after only a few years of service; the corrosion occurred exclusively above the wastewater surface. Concentrations of volatile sulfur compounds related to the formation of the substrate for sulfuric acid producing thiobacilli were determined using a gas-chromatographic procedure with a sulfur specific detector at several locations in the sewage system. The concentrations of volatile sulfur were correlated with the degree of concrete corrosion in sewage systems. In sewers without any corrosion, the concentration of volatile sulfur compounds was below the detection limit which was in the range of 30 ppb for all compunds of interest. To avoid corrosion in concrete sewers, the occurrence of volatile sulfur compounds should be prevented; this can be achieved by introducing oxygen into the system. Oxygenation also decreases the population of thiobacilli on the sewer walls. (Collier-IVI)
W85-01128

DECISION ANALYSIS FOR TOXIC WASTE RELEASES,
Indiana Univ. at Bloomington. School of Public and Environmental Affairs.
D. F. Parkhurst.
Journal of Environmental Management, Vol. 18, No. 2, p 105-130, March, 1984. 7 Fig, 8 Tab, 28 Ref, 3 Append.

Descriptors: *Decision making, *Toxic waste, *Hazardous materials, *Contamination, *Polychlorinated biphenyls, *Bloomington, *Indiana, *Salt Creek, Hazardous waste sites, Risks, Risk analysis, Water pollution sources, Environmental effects, Public health, Water pollution effects.

Dealing with releases of hazardous wastes into the environment requires many decisions: should we clean up Dump A, Dump B, or both. To what extent. Do we know enough to begin, or should we carry out additional research first. What kind of research. Given the many problem sites that exist, and finite resources to deal with them, it is important to make these decisions wisely. The methods of formal decision analysis deal precisely with these kinds of problems, and ought to be useful for federal, state, and industrial decision-makers with responsibility for hazardous waste sites. In particular, decision analysis allows one to break a complex decision process into simpler parts. For each part, one estimates probabilities of component events, and assigns preferences to each possible result. The parts are then reassembled to find the overall optimal strategy. This paper describes the application of decision analysis methods to hazardous waste releases, and uses them to analyze possible solutions to a polychlorinated biphenyl (PCB) contamination problem near Bloomington, Indiana. A partial risk analysis indicates that one additional case of cancer might result from consumption of PCB-contaminated fish from Salt Creek in Monroe and Lawrence Counties. Of potential solutions considered, an advertising campaign to alert the public about the hazards of eating these fish appears from the decision analysis to be the best. (Author's abstract)
W85-01157

TOXICITY AND WATER QUALITY: A BIOASSAY INTERPRETATION,
Ontario Ministry of the Environment, Toronto.
S. L. Wong.
Journal of Environmental Science and Health, Vol. A19, No. 3, p 377-386, April, 1984. 2 Fig, 12 Ref.

Descriptors: *Toxicity, *Bioassay, *Triton, *Algae, Algal growth, Copper, Productivity.

Many natural waters contain sufficient quantities of trace organic contaminants to prohibit algal growth in bioassays. Triton X-100 is capable of moderating the toxic effects and revitalizing growth of algal cells in natural water medium. By compensating for the growth activating effect of Triton and by equating the growth inhibitions to equivalent Cu(++) stresses, the toxicity of natural water can be determined and its impact on productivity can be evaluated. At present, the evaluation of toxicity in the aquatic environment still relies heavily on the interpretation of the concentrations of chemicals in the water medium. However, after numerous studies revealed that chemical speciation, chelation, antagonistic and synergistic reactions and chemical transformation were additional significant factors controlling biological responses rather than chemical concentration alone, many researchers are again recognizing the importance and usefulness of algal assays to assess toxicity in natural waters. (Author's abstract)
W85-01162

GROWTH OF BACTERIA AND THE FUNGUS PHAEOSPHAERIA TYPHARUM (DESM.) HOLM (EUMYCOTA:ASCOMYCOTINA) IN SALT-MARSH MICROCOSMS IN THE PRESENCE AND ABSENCE OF MERCURY,
Georgia Univ., Athens. Inst. of Ecology.
R. E. Hicks, and S. Y. Newell.
Journal of Experimental Marine Biology and Ecology, Vol. 78, No. 1-2, p 143-155, June, 1984. 5 Fig, 45 Ref.

Descriptors: *Mercury, *Salt marshes, *Bacteria, *Fungi, *Phaeosphaeria, *Toxicity, Heavy metals, Spartina, Biomass, Glucosamine, Mercuric chloride, Carbon dioxide, Muramic acid, Respiration, Water pollution effects.

Marine microcosms were used to test the effect of mercury on the growth and respiration of microbes associated with dying Spartina alterniflora Loisel, leaves. All microcosms, except controls, received a bacterial inoculum and one-half also received an inoculum of Phaeosphaeria typharum (Desm.) Holm, a salt-marsh fungus. Experimental microcosms received 0.5 mg of mercuric chloride (0.74 mg Hg/l). Leaves from microcosms representing each mercury treatment (2) and community type (2) were sampled weekly for 21 days. Muramic acid and glucosamine concentrations, bacterial and fungal direct-counts, and carbon dioxide production were measured. Concentrations of muramic acid and glucosamine and direct-counts were converted to microbial biomasses (mg/g leaf). The addition of mercury did not produce a significant difference ($P > 0.05$) in any measured parameter for any mercury treatment or community type, although there were indications that the mercury addition might have caused microbial biomasses to increase and bacterial respiration to decrease. Glucosamine analysis could be used to differentiate the two communities ($P < 0.01$). Microbial community type and age could be distinguished by carbon dioxide production ($P < 0.01$). Bacterial biomasses calculated from direct-counts and muramic acid concentrations gave similar values ($Y = 0.93X - 1.39$, $r = 0.90$, $P < 0.01$). The direct-count method yielded high values for fungal biomass relative to the glucosamine method ($Y = 2.51X + 0.93$, $r = 0.88$, $P < 0.01$). Microbial growth and respiration on dying S. alterniflora leaves appear to be rather insensitive to the mercury levels recorded for contaminated salt marshes in Georgia. (Author's abstract)
W85-01163

DISTRIBUTION OF BENTHIC INVERTEBRATES ALONG A DISTURBED SECTION OF THE LA TROBE RIVER, VICTORIA: AN ANALYSIS BASED ON NUMERICAL CLASSIFICATION,
National Museum of Victoria, Melbourne (Australia).
For primary bibliographic entry see Field 2 .
W85-01165

RESPONSES OF CERTAIN FRESHWATER PLANKTONIC ALGAE TO FLUORIDE,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
W. E. Hekman, K. Budd, G. R. Palmer, and J. D. MacArthur.
Journal of Phycology, Vol. 20, No. 2, p 243-249, June, 1984. 2 Fig, 5 Tab, 25 Ref.

Descriptors: *Algae, *Fluorides, *Photosynthesis, *Respiration, Water pollution effects, Sodium fluoride, Growth rates, Enolase.

The effects of dissolved fluoride supplied as NaF at up to 150 p.p.m. F(-) (7.9 mM) on growth, photosynthesis, dark respiration, enolase activity and fluoride uptake were determined for six phytoplankters: Synechococcus leopoliensis (Racib.) Komarek (Cyanophyta), Oscillatoria limnetica Lemmermann (Cyanophyta). Ankistrodesmus braunii Brun (Chlorophyta), Scenedesmus quadricauda (Turp.) Breb. (Chlorophyta), Cyclotella meneghiniana Kutzing (Bacillariophyta) and Stephanodiscus minutus Grun. ex Cleve et Moll (Bacillariophyta) Growth (determined by absorbance at 660 nm or by cell-numbers) was unaffected by fluoride at up to 50 p.p.m. (2.6 mM) in all algae except S. leopoliensis, in which growth ceased transiently followed by resumption of growth at reduced rate These effects showed a threshold at ca. 25 p.p.m. (1.3 mM) F(-) and increased with increasing F(-) concentration above this threshold. Photosynthetic O2 evolution in the chlorophytes was unaffected by F(-) at up to 50 p.p.m. whereas in S. leopoliensis F(-) above ca. 25 p.p.m. caused a concentration-dependent inhibition of photosynthesis which was most pronounced at saturating irradiance. Dark O2 uptake was unaffected at up to 50 p.p.m. in chlorophytes but was stimulated in S. leopoliensis. Enolase in clarified cell-extracts of all six algae was inhibited by F(-), with Ki values ranging from 27 to 319 micro M. Fluorine (measured by proton-induced gamma-ray emission) could not be detected in chlorophytes exposed during growth to up to 50 p.p.m. F(-), but was detected in S. leopoliensis, O. limnetica and C. meneghiniana. Fluorine associated with cells of these algae increased as the external F(-) concentration increased. (Author's abstract)
W85-01176

ENVIRONMENTAL CONSTRAINTS OF SLUDGE APPLICATION,
Cook Coll., New Brunswick, NJ.
For primary bibliographic entry see Field 5E.
W85-01185

IMPLICATIONS OF TREATING WATER CONTAINING POLYNUCLEAR AROMATIC HYDROCARBONS WITH CHLORINE; A GAS CHROMATOGRAPHIC-MASS SPECTROMETRIC STUDY,
Minnesota Univ.-Duluth. Dept. of Chemistry
For primary bibliographic entry see Field 5B.
W85-01207

ORGANIC N-CHLORAMINES: CHEMISTRY AND TOXICOLOGY,
Old Dominion Univ., Norfolk, VA. Dept. of Chemical Sciences.
For primary bibliographic entry see Field 5F.
W85-01210

TOXICOLOGY OF ORGANIC DRINKING WATER CONTAMINANTS: TRICHLOROMETHANE, BROMODICHLOROMETHANE, DIBROMOCHLOROMETHANE AND TRIBROMOMETHANE,
Medical Coll. of Virginia, Richmond. Dept. of Pharmacology.
A. E. Munson, L. E. Sain, V. M. Sanders, B. M. Kauffmann, and K. L. White.
Environmental Health Perspectives, Vol. 46, p 117-126, December, 1982. 12 Tab, 12 Ref.

Descriptors: *Trihalomethanes, *Drinking water, *Trichloromethane, *Bromodichloromethane, *Dibromochloromethane, *Tribromomethane, *Toxicology, Pollutants, Halomethanes, Chlorinated hydrocarbons, Brominated hydrocarbons, Water pollution effects.

This study evaluated the subchronic toxicity of selected halomethanes which are drinking water contaminants. The compounds studied were trichloromethane, bromodichloromethane, dibromochloromethane and tribromomethane. Subch-

-day gavage studies were performed in
n the use of doses encompassing one-tenth
0 for the compounds. A 90-day gavage
one of the compounds, trichloromethane,
done. Parameters observed included body
n weights, histopathology, hematology,
chemistries, and hepatic microsomal
ctivities. Toxicity to the humoral immune
as assessed by measuring the number of
gM antibody-forming cells and the serum
level to sheep erythrocytes. Cell-mediat-
nity was evaluated by measuring the de-
e hypersensitivity response and popliteal
ode proliferation response to sheep red
lls. The functional activity of the reticu-
elial system, as measured by the vascular
rate and tissue uptake of Cr-51 sheep red
ls was also determined. The major effects
lomethanes were increased liver weights,
s of SGPT and SGOT, decreased spleen
and a decrease in the number of splenic
body-forming cells. The humoral immune
peared to be an indicator of halomethane
There is evidence that subchronic 14-day
may be of greater value than long-term
determining the toxicity of these com-
Author's abstract)
11

**ORAL TOXICITY OF TRIHALO-
NE CONTAMINANTS OF DRINKING
IN MICE,**
Coll. of Virginia, Richmond. Dept. of
ology.
ster, and J. F. Borzelleca.
nental Health Perspectives, Vol. 46, p
December, 1982. 3 Fig, 7 Tab, 16 Ref.
nt R804701010.

ors: *Animal behavior, *Toxicology, *Be-
toxicity, *Trihalomethanes, *Drinking
Mice, *Pollutants, Dichlorobromometh-
promochloromethane, Tribromomethane,
omethane, Neurotoxicity, Chlorinated hy-
ns, Brominated hydrocarbons, Water pol-
ects.

vioral toxicity of trihalomethanes, which
nonly found in finished drinking water,
ed in mice using an oral route of adminis-
nd long term, daily, low dose exposures.
omethane (TCM), dichlorobromomethane
, dibromochloromethane (DBCM) and
methane (TBM) were the contaminants
Two dose groups treated at 300 and 3000
estimated average human daily intake of
ated drinking water were exposed for 14
lays. The ED50 for acute effects on a
st of motor performance was about 500
or all four trihalomethanes. The 14-day
s had no effect on swimming behavior
90-day treatments had no effect on bar
a test of motor coordination, and a meas-
xploratory behavior. None of the com-
produced effects on passive-avoidance
following 100 mg/kg/day for 30 days.
BCM and TBM elicited clear effects at
and 400 mg/kg/day on operant behavior
ministered for 60 days. DBCM elicited
ects at 400 mg/kg/day. These effects on
behavior were seen following the first
tolerance tended to develop. Thus, there
vidence from these studies for a progres-
rotoxicity from trihalomethanes in adult
behavioral teratology study was also con-
ith TCM; no clear evidence for behavior-
in the offspring were observed. The most
measure for the effects of TCM was a
rsion paradigm in which saccharin aver-
re produced after a single oral dose of 30
Collier-IVI)
12

**ONTROL CANCER MORTALITY
AND CHLORINATION OF DRINKING
IN LOUISIANA,**
Univ., New Orleans, LA. School of Medi-
ttlieb, and J. K. Carr.
nental Health Perspectives, Vol. 46, p
December, 1982. 1 Fig, 10 Tab, 8 Ref.

Descriptors: *Epidemiology, *Drinking water, *Chlorination, *Cancer mortality, *Louisiana, Public health, Water pollution effects, Risks, Water treatment.

Several Louisiana parishes (counties) using the Mississippi River for their source of public drinking water have the highest mortality rates (1950-69) in the United States for several cancers. Therefore, a case-control mortality study on cancer of the liver, brain, pancreas, bladder, kidney, prostate, rectum, colon, esophagus, stomach, non-Hodgkin's lymphoma, multiple myeloma, leukemia, Hodgkin's disease, lung, breast and malignant melanoma, from 1960 to 1975 in South Louisiana parishes grouped for similarities in industrial characteristics, having approximately equal exposure of the population to surface and groundwater, was conducted. Noncancer deaths were randomly selected as controls and matched to the case death on age, race, sex, and year and parish group of death. Water source at death was assigned based on the residence at death and described as surface or ground and chlorinated or nonchlorinated. A significantly increased risk for surface, chlorinated water use was noted for rectal cancer. No risk could be demonstrated for colon cancer. The risk noted for bladder cancer by other investigators is not substantiated. Brain cancer risk appears to be associated with chlorinated groundwater, but this may be industrial confounding. Breast cancer demonstrated a slight, but significant, risk associated with surface chlorinated water. This risk, however, might be due to confounding of rural life style, early childbearing and large families with nonchlorinated water found in these settings. Chlorination risk for kidney cancer was not significant. No risk was observed in association with surface water for other cancers of the gastrointestinal or urinary tract. Multiple myeloma was significantly associated with a risk from ground water. (Author's abstract)
W85-01213

DRINKING WATER TREATMENT AND RISK OF CANCER DEATH IN WISCONSIN,
Wisconsin Univ.-Madison.
M. S. Kanarek, and T. B. Young.
Environmental Health Perspectives, Vol. 46, p 179-186, December, 1982. 1 Fig, 6 Tab, 12 Ref. EPA contract C2769 NAEX.

Descriptors: *Drinking water, *Chlorination, *Water treatment, *Cancer mortality, *Wisconsin, Public health, Epidemiology, Trihalomethanes, Water pollution effects, Risks.

A case control study of drinking water treatment practices and female cancer mortality was conducted in Wisconsin. Cancer deaths for 1972-1977 from 28 Wisconsin counties and noncancer deaths matched to cancer deaths on age, year of death and county of residence, were compared for characteristics of drinking water supplied to their places of residence. Using logistic regression, estimates of relative risk associated with chlorinated water were examined allowing for the influence of indicators of water organics and the potential confounders of occupation, marital status and urbanicity. Only colon cancer appeared to be related significantly to chlorination in all models explored. A dose-response relationship was found between crude indicators of trihalomethane level (chlorination x organic contamination) and colon cancer death. The odds ratio for chlorinated surface water for colon cancer was 2.81 ($p < 0.01$); approximately half this risk was found for chlorinated ground water. Consequently, a case control study of colon cancer and drinking water quality utilizing newly diagnosed patients is being conducted in Wisconsin. (Author's abstract)
W85-01214

EPIDEMIOLOGICAL EVIDENCE OF CARCINOGENICITY OF CHLORINATED ORGANICS IN DRINKING WATER,
National Cancer Inst., Bethesda, MD. Environmental Epidemiology Branch.
K. P. Cantor.
Environmental Health Perspectives, Vol. 46, p 187-195, December, 1982. 9 Fig, 1 Tab, 20 Ref.

Descriptors: *Epidemiology, *Carcinogenicity, *Cancer mortality, *Toxicity, *Chlorinated hydrocarbons, *Drinking water, Public health, Water treatment, Risks, Chlorination, Water pollution effects.

Concern has recently been voiced over possible chronic toxicity associated with chlorination of public drinking water supplies in the United States. This paper reviews the available evidence and the studies underway to further evaluate hypothesized associations between cancer risk and byproducts of chlorination. Preliminary data from measures of halogenated volatiles and personal exposure histories from respondents in a large epidemiologic study of bladder cancer are present. These data support the use in epidemiologic studies of categorial measures of exposure and suggest that results from completed case-control studies, based on death certificates, may have underestimated the true risk of chlorination by-products. The current generation of studies which use a case-control interview design offer many advantages over earlier efforts to evaluate this issue. (Auther's abstract)
W85-01215

MUTAGENIC ACTIVITY ASSOCIATED WITH BY-PRODUCTS OF DRINKING WATER DISINFECTION BY CHLORINE, CHLORINE DIOXIDE, OZONE AND UV-IRRADIATION,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands).
B. C. J. Zoeteman, J. Hrubec, E. de Greef, and H. J. Kool.
Environmental Health Perspectives, Vol. 46, p 197-205, December, 1982. 6 Fig, 5 Tab, 24 Ref.

Descriptors: *Chlorination, *Chlorine dioxide, *Ozone, *Ultraviolet radiation, *Disinfection, *Drinking water, *Cancer mortality, *Mutagenicity, *Netherlands, *Epidemiology, Public health, Water pollution effects, Ames test, Salmonella, Trihalomethanes, Water treatment.

A retrospective epidemiological study in The Netherlands showed a statistical association between chlorination by-products in drinking water and cancer of the esophagus and stomach for males. A pilot-plant study with alternative disinfectants was carried out with stored water of the Rivers Rhine and Meuse. It was demonstrated that the increase of direct acting mutagens after treatment with chlorine dioxide is similar to the effect of chlorination. Ozonation of Rhine water reduced the mutagenic activity for Salmonella typhimurium TA 98 both with and without metabolic activation. UV alone hardly affects the mutagenicity of the stored river water for S. typh. TA 98. In all studies, practically no mutagenic activity for S. typh. TA 100 was found. Although remarkable changes in the concentration of individual organic compounds are reported, the identity of the mutagens detected is yet unclear. Compounds of possible interest due to their removal by ozonation are 1,3,3-trimethyloxindole, dicyclopentadiene and several alkylquinolines. Compounds which might be responsible for the increased mutagenicity after chlorination are two brominated acetonitriles and tri(2-chlorethyl) phosphate. Furthermore, the concentration procedure with adsorption on XAD resin and the subsequent elution step may have affected the results. It is proposed to focus further research more on the less volatile by-products of disinfection than on the trihalomethanes. (Author's abstract)
W85-01216

PRESENCE, INTRODUCTION AND REMOVAL OF MUTAGENIC ACTIVITY DURING THE PREPARATION OF DRINKING WATER IN THE NETHERLANDS,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands). Chemical Biological Div.
For primary bibliographic entry see Field 5F.
W85-01217

USE OF BIOLOGICAL ASSAY SYSTEMS TO ASSESS THE RELATIVE CARCINOGENIC

HAZARDS OF DISINFECTION BY-PRODUCTS,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5F.
W85-01218

PROBLEM OF ACID PRECIPITATION IN SWITZERLAND (LE PROBLEME DES PRECIPITATIONS ACIDES EN SUISSE),
Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. du Genie de l'Environnement.
I. Tripet, and P. Wiederkehr.
Wasser, Energie, Luft, Vol. 75, No. 7/8, p 144-147, January, 1983. 6 Fig, 8 Ref.

Descriptors: *Switzerland, *Acid rain, Precipitation chemistry, Water pollution effects, Hydrogen ion concentration, Lake acidification, Air pollution, Water pollution control, Spatial distribution.

For the first time, a compilation of precipitation analyses in Switzerland has been established for the period from 1957 to 1982. The evolution and regional distribution of the pH levels, as well as the changes of the chemical composition of precipitation have been investigated; these results show a low pH level of around 4.3. Whenever possible, the consequences of acid precipitation on surface waters, soil, vegetation and on the corrosion of building materials were deduced. The acidification of mountain lakes in southern Switzerland and damage to forests indicate serious dangers for the environment. Therefore, measures have to be undertaken urgently in order to reduce the sulfur content of fuels and the nitrogen of the exhaust fumes produced by industry and traffic. (Author's abstract)
W85-01266

TOXICITY, UPTAKE, AND ELIMINATION OF THE HERBICIDES ALACHLOR AND DINOSEB IN FRESHWATER FISH,
Environmental Protection Agency, Washington, DC. Office of Pesticides and Toxic Substances.
D. J. Call, L. T. Brooke, R. J. Kent, S. H. Poirier, and M. L. Knuth.
Journal of Environmental Quality, Vol. 13, No. 3, p 493-498, July-September, 1984. 2 Fig, 3 Tab, 34 Ref. EPA grants R-806196-01 and R-880020-01-0.

Descriptors: *Fish, *Toxicity, *Herbicides, *Alachlor, *Dinoseb, Biological magnification, Water pollution effects, Pesticide toxicity, Metabolism, Minnows, Trout.

Fathead minnows 30 d of age were exposed to technical grade alachlor and dinoseb in flow-through tests to determine acute toxicity. Median lethal concentrations for alachlor were 9.9, 6.6, 5.0 and 3.0 mg/L at 24, 48, 96, and 192 hr, respectively. Values for dinoseb were 0.8, 0.7, 0.7, and 0.5 mg/L, respectively. Early life stages of the fathead minnow were exposed to lower concentrations of each compound for a total of 64 d. The no effect concentration was estimated to lie between 0.52 and 1.10 mg/L for alachlor and between 14.5 and 48.5 microg/L for dinoseb. Neither herbicide was appreciably accumulated in fish tissue. Whole body bioconcentration factors for parent alachlor and dinoseb were 6.0 and 1.4, respectively. Rainbow trout injected with radiolabeled herbicides eliminated > 83% of the radioactivity within 24 hr as a combination of parent compound and metabolites. Accumulation of alachlor and dinoseb residues and the toxicity of alachlor do not appear to present great environmental risks to fish. The toxicity of dinoseb may pose some risk. (Baker-IVI)
W85-01296

DESCRIPTION OF THE MULTI-ANNUAL EUTROPHICATION PROCESS OF SHALLOW LAKES BY A DISCRETE TIME WATERSHED DEVELOPMENT MODEL,
Magyar Tudomanyos Akademia, Budapest. Szamitastechnikai es Automatizalasi Kutato Intezete.
L. Telegdi, and L. David.
Ecological Modelling, Vol. 16, No. 2/3/4, p 241-250, August, 1982. 4 Tab, 5 Ref.

Descriptors: *Lakes, *Eutrophication, *Model studies, *Lake Balaton, *Hungary, Shallow water, Watershed management, Socioeconomic development, Nutrient loading Mathematical models.

A discrete time model is presented for the description of the multi-annual eutrophication process of shallow lakes based on watershed development. The formulation of the model is based on the fact that there is a close connection between the eutrophication of the lake and the socio-economic development of the watershed. According to the formulation of the model, the eutrophication index of a certain waterbody (basin) of the lake in any specific year depends on the topometrical (geometrical) and the previous year's eutrophication index of the same waterbody, and on the topometrical and the same year's eutrophication index of the previous waterbody. A further dependence is also noted on the topometrical (topographical) and socioeconomic development index of the watershed adjacent to the given waterbody. Model options are selected for Lake Balaton in Hungary. The specified model is able to describe the relationship between eutrophication and watershed development on a multiannual and multiregional basis. Watershed development indicating nutrient loading is considered as a multicriteria utility function. The long term eutrophication process of shallow lakes like Lake Balaton can be characterized by the model. Furthermore, the model is able to simulate eutrophication under various lake protection policies, strategies, investments, projects, and other activities to measure and compare their effectiveness. (Baker-IVI)
W85-01305

ECOLOGICAL EVALUATION OF A PERMANENT DIVERSION OF A SMALL RIVER INTO THE SEWER OUTLET OF A LARGE CITY (BILAN ECOLOGIQUE DU DETOURNEMENT PERMANENT D'UN PETIT FLEUVE COTIER DANS L'EMISSAIRE D'EAUX USEES D'UNE GRANDE VILLE),
Endoume Marine Station and Oceanography Centre, Marseille (France).
G. Bellan, and M. Bourcier.
Marine Environmental Research, Vol. 12, No. 2, p 83-111, 1984. 3 Fig, 7 Tab, 19 Ref.

Descriptors: *Marseilles, *France, *Benthos, *Water pollution effects, Wastewater pollution, Effluents, Species diversity, Diversion, Substrates.

The benthic communities established on soft substrate off the outlet of the main sewer of the city of Marseilles were investigated in June 1980 and January 1981; this was about a year and a half after the permanent diversion of a polluted river into the sewer. Although the quantity of pollutants does not seem to have been appreciably modified within these communities, we note, in comparison with the former state: a decrease in the number of species and individuals of roughly 50 to 25% according to the stations (except for the one nearest the outlet); a perceptible decrease of the diversity and similarity indices; an increase in the dominance of muddy substratum species. All of these observations demonstrate degradation of the communities. (Author's abstract)
W85-01311

HISTOLOGICAL ALTERATIONS OBSERVED IN IDOTEA BALTHICA BASTERI AUDOUIN 1827 (CRUSTACEA, ISOPODA) EXPOSED TO THE CHRONIC EFFECT OF NON-IONIC DETERGENTS,
R. A. Kaim-Malka, and C. Donadey.
Marine Environmental Research, Vol. 12, No. 2, p 143-160, 1984. 12 Fig, 1 Tab, 19 Ref.

Descriptors: *Detergents, *Water pollution effects, *Isopods, Crustaceans, Organic compounds, Industrial wastes, Non-ionic detergents, Toxicity.

Following extended exposure to eight non-ionic compounds, the crustacean isopod Idotea balthica basteri was studied by light microscopy and histoautoradiography. The most significant observations concern the alimentary canal, the gonads and the molting gland. The nervous system and gill pleopods showed no evidence of structural modification. However, the detergents do have some effect on these organs as morphological alter
of gill pleopods occur. The nervous syste
tained a good deal of detergent because it is p
equipped for elimination. Histological observ
of the alimentary canal reveal epithelial ce
exceptional size with hypertrophied nuclei, ev
ally developing into a tumor. Gonads seem a
be affected. The molting gland also showed i
tant histological alterations. Detergent e
occur on the intimate structure of organs,
consequently disturb their function. Becau
these interrelationships, it is clear that even
area affected is localized, the effect is not limi
an organ or a function, but affects the
individual and the entire population. (Baker
W85-01312

STORM RUNOFF AND WATER QUALITY THREE EPHEMERAL WASHES IN PRICE RIVER BASIN, UTAH,
Unitex Corp., Salt Lake City, UT.
A. Lin, W. L. Jackson, and K. D. Knoop.
Journal of Soil and Water Conservation, Vo
No. 3, p 211-214, May-June, 1984. 3 Fig, 5 Ta
Ref. Bureau of Land Management Co
YA553-CT1-1064.

Descriptors: *Price River Basin, *Utah, *S
runoff, *Salinity, *Water quality, Erosion co
Sediment transport, Colorado River, Wate
management, Dissolved solids, Runoff control

Eighteen late summer runoff events were
tored in 1981 on three small watersheds i
Price River Basin, Utah. Surface runoff contri
significant quantities of sediment and salt t
Colorado River system. Total dissolved s
total solids ratios and the correlation between
age storm total dissolved solids and surface
loss potential, as indexed by the Universal
Loss Equation parameters supports the hypot
that surface erosion of Mancos shale hillslopes
important salt-contributing process. Watershe
tivities, such as vegetation management, co
furrows, or small retention structures that re
erosion of highly erosive Mancos shale hills
and channels or that retain runoff on these
can help reduce salinity in the Colorado R
Less actively eroding shale features are more
to be leached of soluble salts at the soil surfac
are less important sources of salinity in su
runoff. Salinity in these areas would be less
ageable through surface runoff and erosion co
practices. (Baker-IVI)
W85-01325

RELATIONSHIPS BETWEEN PHYSIOL CAL STRESS AND TRACE TOXIC STANCES IN THE BAY MUSSEL, MYTI EDULIS, FROM SAN FRANCISCO BAY, C FORNIA,
California State Dept. of Fish and Game, M
rey. Marine Pollution Studies Lab.
M. Martin, G. Ichikawa, J. Goetzl, M. de los
Reyes, and M. D. Stephenson.
Marine Environmental Research, Vol. 11, No.
91-110, 1984. 1 Fig, 4 Tab, 47 Ref.

Descriptors: *Scope for growth, *Water poll
effects, *Mussels, *San Francisco Bay, *Califo
Stress, Toxicity, Chromium, Copper, Merc
Silver, Aluminum, Zinc, Chlordanes, Dieldrin.

Resident populations of Mytilus edulis from
males and San Francisco Bay, California,
measured for scope of growth, a physiolo
integration of the energy consumed by indivi
animals (feeding rate and assimilation efficie
less the energy lost in metabolic processes (ox
consumption and ammonia excretion). Scope
growth of mussels was significantly correlate
< 0.05) with feeding rates. There was a signif
decline in the scope for growth between
Golden Gate, at the bay's entrance and Redw
City in south San Francisco Bay. The scope
growth in resident M. edulis was significantly
atively correlated ($p < 0.05$) with increased
ronmental concentrations (from transplanted
californianus body burden data) of the follo
trace elements and higher molecular weight ch

ed organic compounds: Cr, Cu, Hg ($p < 0.01$) Ag, Al, Zn, total clordanes, and dieldrin. pe for growth was significantly correlated ($p < 0.05$) with body condition index (dry body ght/shell length). (Author's abstract)
5-01350

JTE TOXICITY OF HEAVY METALS TO O SPECIES OF MARINE NEMATODES,
vcastle upon Tyne Univ. (England). Dept. of logy.
Howell.
ine Environmental Research, Vol. 11, No. 3, p 161, 1984. 2 Fig, 1 Tab, 28 Ref.

criptors: *Nematodes, *Heavy metals, *Toxici- Marine animals, Estuarine environment, per, Lead, Cadmium, Mercury, Water pollu- effects, Seawater.

acute toxicity of seawater solutions of copper, , lead, cadmium and mercury to two species of -living marine nematodes was studied. Enoplus ris (Bastian) is a euryhaline species inhabitating rtidal estuarine mud. The closely related Eno- communis (Bastian) is stenohaline and may be id as a commensal in the byssus threads of seed sels. Specimens of both species were collected n two sites on the Northeast coast of England ving different levels of pollution by heavy als. Both species were more susceptible to per, lead and mercury than to zinc and cadmi- but the order of toxicity of the metals changed exposure concentration. The euryhaline spe- survived better than the strictly marine species there is a suggestion that animals from a pol- d site were more tolerant of elevated levels of vy metals. (Author's abstract)
5-01351

TAL HYDROCARBONS, POLYCYCLIC AR- ATIC HYDROCARBONS AND SYNTHETIC GANIC COMPOUNDS IN THE HARD ELL CLAM, MERCENARIA MERCENARIA, RCHASED AT COMMERCIAL SEAFOOD ORES,
ode Island Univ., Narragansett. Graduate ool of Oceanography.
. Pruell, E. J. Hoffman, and J. G. Quinn.
ine Environmental Research, Vol. 11, No. 3, p 181, 1984. 4 Fig, 5 Tab, 43 Ref.

criptors: *Clams, *Rhode Island, *Hydrocar- s, *Organic compounds, *Aromatic com- nds, Foods, Water pollution effects, Polycyclic natic hydrocarbons, Chromatography, Benzo- zoles, Public health.

analytical method for the determination of vcyclic aromatic hydrocarbons (PAHs) and stituted benzotriazoles in clams was developed g a combination of silica gel and Sephadex omatography to isolate these compounds from e concentrations of polyolefinic hydrocarbons. concentrations of total hydrocarbons, PAHs substituted benzotriazoles were measured in d shell clams (Mercenaria mercenaria) pur- sed from Rhode Island seafood stores. The ls of total hydrocarbons, PAHs and substituted zotriazoles in these clams were generally ner than the concentrations found in clams col- ed from a lower Narragansett Bay control loca- . The significance of these findings on the lth of consumers is unknown at this time be- se human health standards or alert levels for e compounds in seafoods have not been estab- ed. However, this study illustrates that con- inants entering Narragansett Bay from a varie- of sources may eventually make their way to mmercial outlets. (Author's abstract)
5-01352

FECTS OF LONG-TERM EXPOSURE TO VER OR COPPER ON GROWTH, BIOAC- MULATION AND HISTOPATHOLOGY IN E BLUE MUSSEL MYTILUS EDULIS,
ional Marine Fisheries Service, Milford, CT. ford Lab.
Calabrese, J. R. MacInnes, D. A. Nelson, R. A. ig, and P. P. Yevich.
Marine Environmental Research, Vol. 11, No. 4, p 253-274, 1984. 8 Fig, 6 Tab, 34 Ref.

Descriptors: *Mussels, *Silver, *Copper, *Growth, *Bioaccumulation, *Toxicity, Histopathology, Heavy metals, Water pollution effects, Juvenile growth stage.

Mussels raised in the laboratory were continuously exposed to 0, 1, 5 and 10 micro g/l of either silver (nitrate) or copper (chloride) and sampled at 12, 18 and 21 months. Mussels exposed to silver accumulated significant amounts of silver only at the highest test concentration after 12 months, but at 18 and 21 months significant levels were accumulated at all three test concentrations. Mussels exposed to copper accumulated significant amounts of copper at 5 and 10 micro g/l Cu after all three sampling periods, but not at 1 micro g/l. Silver-exposed animals also accumulated significantly greater amounts of copper than control animals. Field-collected juvenile mussels and adult mussels were exposed for 12 months to 0, 5, 25 and 50 micro g/l silver only and subsequently sampled for metal-accumulation analyses and growth measurements. Juvenile mussels accumulated significant amounts of silver at all test concentrations, with the exception of mussels exposed to 5 micro g/l Ag for 6 months. Copper accumulation in the silver-exposed juveniles was significant only at 50 micro g/l Ag after 6 months, but at all test concentrations after 12 months. Adult mussels exposed to silver accumulated significant levels of both silver and copper, but at somewhat lower levels than juveniles. Silver had no effect on growth in laboratory reared mussels at the highest concentration of 10 micro g/l tested, whereas copper at 10 micro g/l did appear to affect growth as early as 4 months after the start of experimental exposure. Field-collected juvenile mussels did show inhibition in growth after 6 months' exposure to 25 and 50 micro g/l Ag, with some growth occurring after 12 months. Adults also showed inhibition in growth after 6 months but not at 12 months. Histopathological examination of mussels exposed to either 5 or 10 micro g/l of copper for 18 months showed changes in the digestive diverticula, gastrointestinal tract, reproductive tract and muscle tissues. Mussels exposed to silver for 21 months showed yellowish to black particulate deposition in the basement membrane and connective tissue of the various organs and tissues. (Moore-IVI)
W85-01355

ABNORMAL REPRODUCTION OF THE SAND CRAB EMERITA ANALOGA IN THE VICINITY OF A NUCLEAR GENERATING STATION IN SOUTHERN CALIFORNIA,
California Univ., Santa Barbara. Dept. of Biological Sciences.
P. R. Siegel, and A. M. Wenner.
Marine Biology, Vol. 80, No. 3, p 341-345, June, 1984. 2 Fig, 1 Tab, 33 Ref.

Descriptors: *Emerita, *Reproduction, *Nuclear powerplants, *California, Water pollution effects, Agricultural runoff, Crustaceans, Thermal pollution, Metals, Turbidity.

Female sand crabs (Emerita analoga) were sampled from 12 beaches along a 350 km stretch of Southern California coastline during the reproductive season in July, 1982. The percentage of mature females with egg masses and the condition of those egg masses were examined at each site. The proportion of mature females with egg masses varied only slightly between beaches. However, at sites within about 20 km of the San Onofre Nuclear Generating Station, a high percentage of females carried egg masses consisting of empty egg shells. A transplant experiment was conducted. Females with empty egg masses were taken from the 6.5 km N study site, where only 5% of the mature females carried normal egg masses, and transferred to running unfiltered seawater in Santa Barbara. After 2 wk, about a third of the transplanted females carried normal egg masses, while at the same time the proportion of mature females with normal egg masses remained at 5% on the beach of origin. Heated water discharged from the nuclear generating station is probably not the cause of the abnormal reproduction of sand crabs along the nearby coast. More likely causes are: (1) runoff of agricultural pesticides from a creek 3 km north of the nuclear generating plant; (2) release of metals from corroding cooling pipes, and/or (3) increased turbidity of the nearshore waters. (Author's abstract)
W85-01365

EFFECTS OF PETROLEUM HYDROCARBONS ON THE CYTOCHROME P450 CONTENT OF THE MOLLUSC BIVALVE MYTILUS GALLOPROVINCIALIS,
Endoume Marine Station and Oceanography Centre, Marseille (France).
M. Gilewicz, J. R. Guillaume, D. Carles, M. Leveau, and J. C. Bertrand.
Marine Biology, Vol. 80, No. 2, p 155-159, June, 1984. 2 Fig, 4 Tab, 21 Ref.

Descriptors: *Mussels, *Hydrocarbons, *Cytochromes, *Bay of Fos, *France, Water pollution effects, Hepatopancreas, Aromatic compounds, Marine environment, Bioindicators.

Marine animals accumulate a wide variety of petroleum hydrocarbons in their tissues and some animals are able to produce polar metabolites from these highly hydrophobic molecules. They usually employ hydroxylation of the organic compound; the enzyme system is a cytochrome P450-dependent mixed-function oxidase. Cytochrome P450, identified by the characteristic 450 nm spectral peak of its carbon monoxide complex, was detected in the hepatopancreatic microsomes of Mytilus galloprovincialis, collected from Ponteau (Bay of Fos, France) in 1982 and 1983. When mussels were exposed to a variety of petroleum hydrocarbons in the laboratory, the cytochrome P450 content increased. Aromatic hydrocarbons are more effective than alkanes in inducing a high level of cytochrome P450. Tnis hemoprotein may be of use in hydrocarbon pollutant detection. (Moore-IVI)
W85-01367

SENSITIVITY OF TOAD LARVAE TO 2,4-D AND ENDOSULFAN PESTICIDES,
Poona Univ. (India). Dept. of Zoology.
H. K. Vardia, P. S. Rao, and V. S. Durve.
Archiv fur Hydrobiologie, Vol. 100, No. 3, p 395-400, 1984. 1 Fig, 2 Tab, 23 Ref.

Descriptors: *Pesticide toxicity, *Toads, *Larval growth stage, *2,4-D, *Endosulfan, Pesticide residues, Toxicity, Herbicides, Water pollution effects.

Toad larvae are an important fish food organism and may have a role in the biomagnification of agrochemicals in an aquatic food web. The crop protecting agents endosulfan and weedicide 2,4-D were tested for possible effects on toad larvae while in use in water bodies or reaching them through other means. Toad larvae are very sensitive to these pesticides. The 96 h LC50 ranges from 0.12-0.13 mg/l for endosulfan and 7.29 to 8.81 mg/l for 2,4-D. The LT 50 varies between 12.5-201.5 and 10.5-123 hours respectively for a given range of concentrations. Incipient lethal levels were 0.105 and 6.1 mg/l in case of endosulfan and 2,4-D. The toad larvae appear more sensitive when compared to many other organisms especially fishes, crustaceans and insect larvae. The sensitivity of toad larvae may be quite different in natural conditions compared with the laboratory. (Moore-IVI)
W85-01369

PROPOSAL ON AN ECOLOGICAL BASIS FOR THE CLASSIFICATION OF RECENT UNDERWATER SOILS IN RIVERS (EIN VORSCHLAG ZUR KLASSIFIZIERUNG REZENTER UNTERWASSERBODEN VON FLUSSEN AUF OKOLOGISCHER GRUNDLAGE),
Technische Univ., Munich (Germany, F.R.). Lehrstuhl fuer Bodenkunde.
W. R. Fischer.
Archiv fur Hydrobiologie, Vol. 100, No. 3, p 371-384, June, 1984. 5 Fig, 1 Tab, 12 Ref.

Descriptors: *Eutrophication, *Aquatic soils, *River sediments, Humic substances, Gyttja, Sulfides, Soil classification, Oxidization.

During the man-made eutrophication of rivers, reduced zones in bottom sediments became more and more important for the ecological properties of a site. Together with the accumulation of humic substances, this leads to the formation of an 'underwater soil'. For the classification system proposed in this paper, the degree of reduction is assumed to be the most significant factor. Therefore the soil type 'Gyttja' was subdivided into several subtypes by the thickness of its oxidized horizon, this horizon being characterized by the absence of sulfides (H2S or FeS/FeS2).
W85-01370

TEMPORAL CHANGES IN THE COMPOSITION AND ABUNDANCE OF THE MACRO-INVERTEBRATE COMMUNITIES OF THE RIVER HULL,
Hull Univ. (England). Dept. of Zoology.
For primary bibliographic entry see Field 6G.
W85-01371

RELATIONSHIPS BETWEEN WATER QUALITY AND PHOSPHORUS CONCENTRATIONS FOR PUGET SOUND REGION LAKES,
Geological Survey, Reston, VA.
R. J. Gilliom.
Water Resources Bulletin, Vol. 20, No. 3, p 435-442, June, 1984. 3 Fig, 1 Tab, 34 Ref.

Descriptors: *Phosphorus, *Water quality, *Eutrophication, *Lakes, Limiting nutrients, Chlorophyll, Transparency, Prediction, Water quality control.

Many of the lakes in the Puget Sound region are threatened by eutrophication related water quality problems associated with increased nutrient loading from urban and agricultural land uses in their watersheds. The most cost effective approach to managing eutrophication is usually to control the supply of nutrients to a lake. Regression relationships were developed between summer mean total phosphorus (P) concentrations in near-surface water and both chlorophyll a concentrations and Secchi disc transparency for use in the management of Puget Sound region lakes. Total P concentrations in the lakes studied ranged from 7 to 66 micro g/L. The relationship between total P and chlorophyll a, based on data from 69 lakes, explained 57% of the variance in chlorophyll a. Predicted chlorophyll a concentrations and 95% confidence intervals ranged from 1 (+ 3, 0.5) micro g/L for 7 micro g/L P to about 16 (+ 35, - 10) micro g/L for 66 micro g/L P. The relationship between total P and Secchi disc, based on data from 71 lakes, explained 53% of the variance in Secchi disc. Predicted Secchi disc transparencies and 95% confidence intervals ranged from 5.5 (+ 5.5, - 3.0 m) for 7 micro g/L P to 1.4 (+ 1.5, - 0.7 m) for 66 micro g/L P. Often the greatest uncertainty in prediction the response of a lake to management actions for reducing P levels or to development actions which increase P levels is in what the resultant P level will be. The most appropriate approach to expressing this uncertainty may be to make best and worst case estimates of P levels in additon to the most likely outcome and to use this range of estimates to evaluate potential changes in chlorophyll concentrations and transparency. (Moore-IVI)
W85-01379

DIFFERENTIAL ACCUMULATION OF SELENIUM AMONG AXIAL MUSCLE, REPRODUCTIVE AND LIVER TISSUES OF FOUR WARM-WATER FISH SPECIES,
Maryland Univ., Cambridge. Center for Environmental and Estuarine Studies.
D. R. Sager, and C. R. Cofield.
Water Resources Bulletin, Vol. 20, No. 3, p 359-363, June, 1984. 2 Fig, 2 Tab, 14 Ref.

Descriptors: *Selenium, *Bioaccumulation, *Cooling water reservoirs, *Fish, Bluegill, Catfish, Bass, Trace elements, Powerplants, Coal, Fly ash, Liver, Muscle, Reproductive system.

The release of trace elements from fossil-fueled electric power plants, by way of coal pile runoff, fly ash and fly ash settling pond effluents, is associated with the increase in waterborne concentrations of trace elements. Selenium, one element found in high concentrations in coal, has been implicated in fishery population declines in cooling reservoirs. Bluegill (Lepomis macrochirus), largemouth bass (Micropterus salmoides), white catfish (Ictalurus catus), and channel catfish (Ictalurus punctatus), collected from an electric power plant cooling reservoir and a municipal water supply reservoir near Roxboro, North Carolina, were analyzed for selenium concentrations in axial muscle, reproductive and liver tissues. Fishes from the municipal water reservoir had lower selenium concentrations (< 0.2-2.1 micro g/g - wet weight) than found in the cooling reservoir fishes (1.6-70.0 micro g/g - wet weight) but similar distributions of concentrations among the tissues was evident. Selenium was differentially accumulated, with higher concentrations in liver tissues (0.7-70.0 micro g/g - wet weight), followed by female reproductive tissues (0.7-25.0 micro g/g - wet weight), axial muscle tissues (< 0.2-23.0 micro g/g - wet weight) and male reproductive tissues (0.2-7.2 micro g/g - wet weight). (Moore-IVI)
W85-01385

LONG TERM MONITORING OF THE MACROBENTHOS OF THE UPPER CLYDE ESTUARY,
Clyde River Purification Board, East Kilbride (Scotland).
For primary bibliographic entry see Field 2L.
W85-01412

CORRELATION BETWEEN SELENIUM ACCUMULATION IN SUNFISH AND CHANGES IN CONDITION FACTOR AND ORGAN WEIGHT,
Texas Univ. at Austin. Dept. of Pharmacology.
E. M. B. Sorensen, and T. L. Bauer.
Environmental Pollution (Series A), Vol. 34, No. 4, p 357-366, 1984. 5 Fig, 1 Tab, 25 Ref.

Descriptors: *Toxicity, *Selenium, *Sunfish, *Martin Lake, *Texas, Water pollution effects, Industrial wastes, Ash water, Hepatopancreas, Growth.

From May 1978 through May 1981, wastes from ash water holding ponds from an electrical generating station were allegedly discharged into the main basin of Martin Lake, a 20.2 sq km reservoir in east Texas. To monitor the biological impact of chronic, low-level selenium exposure, redear sunfish (Lepomis microlophus) were collected from five locations in Martin Lake. Redear sunfish were also sampled from one uncontaminated lake 8 km upstream in the same drainage system. Fish collected from Martin Lake locations accumulated the highest levels of selenium in various organs and had significantly reduced condition factors and hepatopancreas weight to body weight ratios. Linear regression analyses of these data indicated that the Martin Lake fish which accumulated the highest levels of selenium in the hepatopancreas had the lowest condition factors and the smallest hepatopancreas weight to body weight ratios. Such biological changes could result from selenium-induced toxic effects such as anorexia, poor feed-to-gain conversion ratios, and stunting. Although the mechanism of action of toxic levels of selenium has not yet been elucidated, these data provided evidence for direct effects of selenium on growth and on relative hepatopancreas weight. (Moore-IVI)
W85-01444

ACUTE TOXICITY OF A SYNTHETIC OIL, ANILINE AND PHENOL TO LABORATORY AND NATURAL POPULATIONS OF CHIRONOMID (DIPTERA) LARVAE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5A.
W85-01445

HEAVY METALS IN TISSUES OF WATERFOWL FROM THE CHESAPEAKE BAY, USA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Scien
R. T. Di Giulio, and P. F. Scanlon.
Environmental Protection (Series A), Vol. 35, 1, p 29-48, 1984. 6 Tab, 46 Ref.

Descriptors: *Heavy metals, *Ducks, *Chesape Bay, Waterfowl, Food habits, Cadmium, Le Copper, Zinc, Lead shot, Macrophytes, Water p lution effects.

The decline of submerged macrophytes in Ch peake Bay has apparently resulted in a change the food habits for wildfowl. A major purpose this study was to elucidate relationships betw food habits and tissue accumulations of hea metals in Chesapeake Bay waterfowl. Concent tions of cadmium, lead, copper and zinc w measured in 774 livers, 266 kidneys and 271 ul bones from 15 species of ducks obtained from Chesapeake Bay region. Copper and zinc w examined principally due to their capacities ameliorate cadmium toxicity. Liver and kidn concentrations of cadmium were highest amo two carnivorous seaduck species, Clangula hyem lis and Melanitta deglandi. Lead concentrations tissues were generally highest in largely herbiv rous species which are at greater risk of ingesti lead shot. No relationships were apparent betwe food habits and tissue concentrations of copper a zinc. Tissue concentrations of cadmium and le were generally below those associated with acu toxicosis, but a significant proportion of the duc may have been at risk of experiencing sublet effects. (Moore-IVI)
W85-01448

COMPARISON OF FUNGI FROM POLLUTE WATER,
National Univ. of Singapore. Dept. of Botan
T. K. Tan, and G. Lim.
Environmental Protection (Series A), Vol. 35, N 1, p 57-65, 1984. 1 Fig, 3 Tab, 13 Ref.

Descriptors: *Fungi, *Water pollution effec *Singapore Island, Species diversity, Yeas Rivers, Industrial wastes, Sediments, Aquat fungi, Organic compounds.

Two sites on a river located in the western part Singapore Island were chosen for a study of t effects of water pollution on mycoflora. Site I located within a recreation parkland, where deca ing aquatic plants form the main type of sedimen Site II is located about 6 km downstream, after th river has received effluents from chemical an detergent manufacturing plants, construction an engineering works, timber-logging factories an repair workshops. The dissolved oxygen conten 4-h permanganate demand and BOD of the riv water showed both sites to be organically enriche but each to a different extent. Fungi were isolate from water, sediment and debris collected fro both sites. The site not polluted by industri wastes yielded twenty-seven species from twent genera while the severely polluted site yielde twelve species from nine genera. Severe pollutio at Site II also appeared to have an adverse effe on the number of individuals. The percentage fr quencies of yeasts at Site II were generally highe than those at Site I. Site II also showed the pre ence of yeast-like fungi absent from Site I. (Moor IVI)
W85-01449

AGE AND GROWTH OF BARBUS GRYPU HECKEL FROM A POLLUTED RIVER,
Biological Research Center, Baghdad (Iraq).
A. N. Khalaf, M. Shafi, A. K. M. Sirajul Islam, A R. Al-Jafery, and S. E. Sadek.
Environmental Protection (Series A), Vol. 35, No 1, p 83-95, 1984. 2 Fig, 6 Tab, 17 Ref.

Descriptors: *Diyala, *Iraq, *Water pollution ef fects, *Barbus, Growth, Age, Fish, Wastewate pollution, Industrial wastes.

The present study was undertaken to determine th age, growth and condition of Barbus grypus from the polluted waters of the river Diyala at Ruste

h, Bagdad, Iraq. The river receives untreated
oorly treated sewage and industrial wastes,
ding heavy metals. A total of 340 specimens
grypus was collected by monthly sampling
May 1981 to April 1982. The oldest fish was
ars old and 370 mm in length and 627.4 g in
ht. The length and weight of the fish in each
group were much lower in comparison with
hs and weights of the species for similar age
os in other Iraqi waters. A nearly isometric
onship was observed between the lengths and
hts of the fish. K-values in relation to lengths
nonths were higher than the values observed
her Iraqi waters. Fork length-scale radius
ed an isometric relationship. The growth pat-
could not be described by the von Bertalanfly
th equation. On a Walford plot, the mean
s for ages run more or less parallel to the 45
e line, showing an unusual growth pattern.
comparatively poor growth was possibly due
e effect of pollution. (Moore-IVI)
-01451

**ECT OF PHOSPHORUS ADDITIONS IN
LOSURES ON THE PHYTOPLANKTON
ZOOPLANKTON OF AN ACID LAKE,**
Virginia Univ., Morgantown. Dept. of Biol-

Costa, A. Janicki, G. Shellito, and G. Wilcox.
OS, Vol. 40, No. 2, p 283-294, February, 1983.
, 9 Tab, 36 Ref.

riptors: *Acid lakes, *Phosphorus, *Phyto-
kton, *Zooplankton, *Cheat Lake, *West Vir-
. Fertilizers, Chlorophyll, Crustaceans, Ro-
, Water pollution effects.

g enclosure experiment was conducted during
ember and October, 1978, in acid Cheat Lake,
Virginia to determine the effects of phospho-
ertilization on the zooplankton assemblage. In
ion to control bags, treatments included zoo-
kton enrichment, phosphorus addition (100
g/l), and the combination of phosphorus and
lankton enrichment. Each treatment was rep-
ted by two bags. Chlorophyll concentrations
ased greatly within 8 d of fertilization. The
oplankton also increased greatly. By 28 d the
number of zooplankton also increased greatly.
28 d the total number of zooplankton had
ased by three orders of magnitude in the bags
h had been fertilized compared to the con-
Bosmina longirostris was the dominant orga-
but shared dominance with Diaphanosoma
tenbergianum in the fertilized bags. Also in
bags a very large population of Keratella
learis developed. The main result of fertiliza-
was a large increase in zooplankton popula-
and the addition of a second dominant herbi-
(Author's abstract)
-01454

**TE TOXICITY OF EDB AND ALDICARB
YOUNG OF TWO ESTUARINE FISH SPE-
S,**
or Branch Inst., Fort Pierce, FL. Center for
ne Biotechnology.
andau, and J. W. Tucker, Jr.
tin of Environmental Contamination and
cology, Vol. 33, No. 2, p 127-132, August,
1 Fig, 2 Tab, 16 Ref.

riptors: *Fish, *Toxicity, *Ethylene dibro-
, *Aldecarb, Insecticides, Nematicides, Pesti-
toxicity, Water pollution effects, Snook, Min-
, Immature growth stage.

nile snook and sheepshead minnows were ex-
d to aldicarb at concentrations of 0.04, 0.2, 1.0,
nd 10.0 mg/liter. EDB assay with minnows
conducted with concentrations of 0.1, 1.0,
25.0, and 500 mg/liter. EDB proved less toxic
aldicarb. A peculiar side effect with EDB was
ference with osmoregulation, resulting in
ling of some of the minnows. A 6-hr LC-50 of
mg/liter was noted for the snook embryo/
bioassay test. At 0.25 and 0.50 mg/liter the
seemed to have a granulated yolk and larvae
more contorted at death. While the short
LC-50 values of EDB reported here are
er high, those for aldicarb were considerably lower than would have been predicted based on reports of its effects on freshwater fish. (Baker-IVI)
W85-01455

EFFECTS OF DYESTUFF EFFLUENTS ON NIGERIA MACRO-BENTHIC INVERTEBRATES HIPPOPERA NIGERIAE,
Federal Univ. of Technology, Bauchi (Nigeria). Dept. of Biological Sciences.
P. T. E. Ozoh.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 2, p 210-214, August, 1984. 1 Fig, 2 Tab, 16 Ref.

Descriptors: *Water pollution effects, *Worms, *Dye industry wastes, *River Kaduna, *Nigeria, Industrial wastes, Environmental effects, Hippopera, Toxicity.

The River Kaduna in Nigeria is highly polluted by dyestuff. The dyestuff discharges are highly alkaline and soapy to the touch. The effect of various concentrations of dyestuff pollutants (100, 90, 80, 60, 50, 30, 10, 5, and 0%) added to beakers containing adult Hippopera nigeriae worms was studied. High concentrations of dyestuff effluents were highly toxic. Intermediate concentrations of 60 and 50% gave high mortalities. At the 10% concentration, 2 worms out of 20 died within 251 minutes and 413 minutes and at 5% concentration only 2 worms died within 451 minutes. Immature worms below 5 cm were very susceptible to rapid death, regardless of the exposure concentrations. The osmoregulatory properties of the epithelia were destroyed as a result of thinning and this destruction might lead to leaching of the metabolites resulting in flaccidity of the body. In the low concentrations death was biphasic as a result of toxicosis and anoxamia. Whether the blood diffusion distance between the worms and the pollutant reduced the toxic effect is not known. Thinning of the epithelia might be due to the corrosive nature of the dyestuff. Rapid disintegration of the worms after death might be as a result of osmoregulatory dysfunction. (Baker-IVI)
W85-01457

TOXICITY OF CHROMIUM TO THE MARINE PLANKTONIC COPEPOD ACARTIA CLAUSI, GIESBRECHT,
Athens Univ. (Greece). Zoological Lab. and Museum.
M. Moraitou-Apostolopoulou, and G. Verriopoulos.
Hydrobiologia, Vol. 96, No. 2, p 121-127, October, 1982. 1 Fig, 3 Tab, 29 Ref.

Descriptors: *Chromium, *Toxicity, *Copepods, Water temperature, Feeding, Respiration, Generation.

The toxicity of chromium to the marine planktonic copepod Acartia clausi, Giesbrecht was studied. The LC50 48 h values (concentration of chromium lethal to 50% of the test animals) vary with the experimental temperature, the form of chromium compound tested and the annual generation to which the Acartia specimens belong. The elevation of temperature resulted in a considerable increase of Acartia's sensitivity to chromium, Cr(6+) in the form of Na2CrO4 was more toxic to A. clausi than in the form of CrO3. Cr(3+) in the form of Cr(NO3)3 9 H2O precipitated to the bottom and was not toxic to Acartia. Acartia specimens belonging to the summer generation were more sensitive to chromium than those belonging to the winter or autumn generation. The exposure of Acartia to sublethal concentrations of chromium resulted in a reduction of its longevity proportional to the chromium concentrations used. Furthermore, when A. clausi was exposed to sublethal chromium concentrations it showed a decrease of feeding capacity and increase of respiratory rates, which became more pronounced with increasing chromium concentrations. (Author's abstract)
W85-01469

INFLUENCE OF HIGHWAY CONSTRUCTION ON THE MACROINVERTEBRATES AND EPILITHIC ALGAE OF A HIGH MOUNTAIN STREAM,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
L. D. Cline, R. A. Short, and J. V. Ward.
Hydrobiologia, Vol. 96, No. 2, p 149-159, October, 1982. 9 Fig, 5 Tab, 29 Ref.

Descriptors: *Highway construction, *Invertebrates, *Algae, *Mountain streams, Suspended solids, Species diversity, Snowmelt, Construction, Water pollution effects, Organic matter, Detritus, Hydrological regime, Epilithon.

The response of a high elevation Rocky Mountain stream to highway construction activities was investigated over a three-year period during the ice-free season. Suspended solids and the proportion of fine sediment in the substrate increased at impacted sites, but rapidly returned to levels similar to reference sites following cessation of construction activities. During snowmelt runoff when suspended solids levels increased, there was little or no sedimentation of find particles, even in depositional areas. At impacted sites algal species diversity and the organic content of the epilithon were reduced, and the detrital component was increased. The epilithon recovered less rapidly than suspended solids or substrate. The macroinvertebrate community was altered by construction activities at some locations but not others, and was generally less severely affected than anticipated. However, where an alteration occurred, reduction density, abundance, and diversity were apparent, and the taxonomic composition was modified. The severity of the response was a function of the flow regime and the timing and duration of the impact at a given site. The hydrologic regime and high gradient of the study stream appeared to ameliorate to some extent the potentially adverse effects of short-term perturbations engendered by highway construction activities. (Author's abstract)
W85-01470

EFFECTS OF SEDIMENT RELEASES FROM A RESERVOIR ON STREAM MACROINVERTEBRATES,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
L. J. Gray, and J. V. Ward.
Hydrobiologia, Vol. 96, No. 2, p 177-184, October, 1982. 6 Fig, 1 Tab, 31 Ref.

Descriptors: *Guernsey Reservoir, *Wyoming, *Invertebrates, *Sediments, *Reservoir operation, Suspended solids, Particulates, Midges, Mayflies, Oligochaetes, Reservoir silting, Flushing, Benthic fauna.

One method of increasing the useful life of reservoirs is flushing of profundal sediments. Releases of reservoir sediments are expected to adversely affect macroinvertebrates by altering substrates, increasing suspended solids, and introducing potential toxins. Effects of sediment release from Guernsey Reservoir on macroinvertebrates of the North Platte River, Wyoming, were investigated during summer 1981. Because flows from an upstream reservoir are used to flush sediments from Guernsey Reservoir, discharge and most water quality parameters vary little from those before the flushing (silt run). Suspended solids concentrations during sediment release increased from < 20 mg/l to > 300 mg/l. Because fine particulates remained in suspension, mean particle size of substrates was unaltered. Densities of chironomids decreased 90% + during sediment release but recovered to initial levels in 3 weeks after the release ended. Densities of mayflies and oligochaetes increased. Changes in benthic populations were highly correlated with increases in suspended solids. In the North Platte River, sediment releases had short-term effects on benthic populations and subsequent selection for organisms with rapid life cycles. (Moore-IVI)
W85-01471

PERIPHYTON GROWTH AND DIATOM COMMUNITY STRUCTURE IN A COOLING WATER POND,

Jyvaeskylae Univ. (Finland). Dept. of Biology.
P. V. Eloranta.
Hydrobiologia, Vol. 96, No. 3, p 253-265, October, 1982. 9 Fig, 8 Tab, 36 Ref.

Descriptors: *Periphyton, *Diatoms, *Cooling water ponds, *Finland, Powerplants, Effluents, Water temperature, Seasonal variation, Solar radiation, Species diversity.

Periphyton (Aufwuchs) accumulation was measured on artificial substrates in a pond in central Finland which receives warm cooling-water effluent from a power plant. The growth of periphyton was generally more rapid on the substrates during the first two weeks of colonization near the inflow of the warm water effluent than in the middle of the pond. The maximum accumulation of periphyton was in spring and autumn (dry weight maximum at warm effluent was in spring 3.5 mg DW/sq cm, 2.65 mg AFDW/sq cm, chlorophyll a maximum 3.96 micro g/sq cm was found in autumn at pond-middle station). During mid-winter months the growth was strongly limited by solar radiation, but the growth was also slow at both stations in the summer months, when the power plant was out of operation. The periphyton accumulation rate was fastest near the water surface and decreased rapidly with increasing depth. A total of 167 diatom species were found in periphyton samples. However, most species were rare; many of the dominants were common to both plankton and periphyton. Species similarity analyses (Jaccard's similarity) between 10 different diatom communities (including periphyton from 9 different types of substrates and phytoplankton) indicated low similarity index values although differences between communities were not significant. (Author's abstract)
W85-01474

STEP-WISE DISCRIMINANT ANALYSIS OF THE EFFECTS OF LONG TERM COAL MINE DRAINAGE AND COAL DREDGING ON PHYTOPLANKTON OF THE GUYANDOTTE RIVER,
Marshall Univ., Huntington, WV. Dept. of Biological Sciences.
T. E. Weaks.
Hydrobiologia, Vol. 97, No. 2, p 97-103, November, 1982. 2 Fig, 4 Tab, 25 Ref.

Descriptors: *Phytoplankton, *Mine drainage, *Coal mining, *Dredging, *Guyandotte River, *West Virginia, Mud River, Diatoms, Species diversity, Conductivity, Hydrogen ion concentration, Water pollution effects.

Phytoplankton was sampled from the lower 60 miles portion of the Guyandotte River where three active coal dredging operations presently exist and five more permits are pending. Comparisons were made with phytoplankton from a similar stretch of the Mud River, a stream of minimal mine drainage and no coal dredges along its entire course. Diatoms were the predominant planktonic algae on both streams. The number of all phytoplankton species was 24% higher for the Mud River than for the Guyandotte River. Equitability and species diversity indices plus the distribution of mine water indicator algae show that the Guyandotte River is heavily polluted with domestic wastes and mine drainage. No correlation could be established for turbidity, specific conductance, or pH and locations of dredging operations, when the data were analyzed for differences among sampling stations. Step-wise discriminant analysis was used to compare the two streams and the biological, physical, and chemical variables. Based on coefficients for canonical variables, conductivity and pH are the two most influential variables in separating the two streams. Analysis of variance indicates that the canonical means of the stations on the Guyandotte River are significantly different from the Mud River stations. (Author's abstract)
W85-01480

BROOK TROUT (SALVELINUS FONTINALIS) POPULATION STRUCTURE IN ACIDIFIED LAC TANTARE, QUEBEC,
Laval Univ., Quebec. Dept. de Biologie.
J.-J. Frenett, and J. J. Dodson.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 6, p 865-877, June, 1984. 8 Fig, 4 Tab, 46 Ref.

Descriptors: *Trout, *Water pollution effects, *Lac Tantare, *Quebec, *Acid lakes, Acidification, Spawning, Toxicity, Mortality, Hydrogen ion concentration, Aluminum, Fish populations, Recruitment.

A large number of Quebec lakes are presently undergoing acidification due to acid rain. The population structure and distribution of brook trout were studied in acidified Lac Tantare, Quebec to determine the effects of acid stress. Trout greater than 21 cm (FL) represented only 16.2 and 10% of the population sampled in 1979 and 1980, respectively. There was higher survival among individuals > 25 cm, mortality occurring primarily among fish of 13-25 cm. The marked decline in numbers of fish occurring at 21 cm coincided with the size at which 50% of the female trout population reached sexual maturity, suggesting that post-spawning mortality contributes to the high mortality observed among these fish. Smaller fish of age-classes 1 to 5 suffer higher mortality than do the larger individuals of these age-classes, implicating mortality agents other than those related to spawning. The most probable cause of mortality is size-related differential exposure to toxic stress whereby small brook trout (< 25 cm) are found in the areas (brooks) exhibiting the most potentially toxic combination of pH and aluminum, thus enhancing the exposure of the most susceptible part of the population to toxic stress. Large brook trout (> or = 25 cm) are found in the 'safest' lake areas (springs), thus diminishing the exposure of the least susceptible part of the population to toxic stress and enhancing survival. Female trout exhibit delayed sexual maturity relative to other Quebec populations, attaining 50% maturity at age 3 and a length of 21-24 cm. The major part of the population's reproductive effort is provided by those fish representing only 15% of the population in 1979 and 1980. During the October spawning season, 20% of potential spawners exhibited retarded oogenesis. These reductions in reproductive effort and changes in spawning site selection provide evidence in support of the hypothesis that recruitment failure may be occurring in the Tantare brook trout population. (Moore-IVI)
W85-01489

STRUCTURAL, FUNCTIONAL, AND RECOVERY RESPONSES OF STREAM INVERTEBRATES TO FLY ASH EFFLUENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
W. L. Specht, D. S. Cherry, R. A. Lechleitner, and J. Cairns, Jr.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 6, p 884-896, June, 1984. 6 Fig, 2 Tab, 46 Ref.

Descriptors: *Fly ash, *Invertebrates, *Effluents, *Settling basins, Mayflies, Stoneflies, Caddisflies, Coleoptera, Water pollution effects, Heavy metals, Hydrogen ion concentration, Particulates, Toxicity, Arsenic, Selenium.

Small fly ash settling ponds (e.g. 2-yr life time) should not be used after they are ca 87-90% full when effluents are released into lotic systems. When a pond was > 90% full, mayflies (Stenonema, Heptagenia, Paraleptophlebia), stoneflies (Acroneuria), and caddisflies (Cheumatopsyche) were significantly (alpha = 0.05) reduced in density, number of taxa, and diversity in the stream receiving system. Highly resistant coleopterans (e.g. Psephenus herricki) became the dominant species. Two to 10 mo were required for the insect community to recover after cessation of ash effluent. Potential lethal effects of fly ash may result from ash particles, heavy metal, and other elements (especially As and Se), and alkaline pH increases above 9.0. Which fraction of fly ash is most limiting to each insect group or species needs far more examination. Ash particle concentrations (total suspended solids, < or = 4000 mg/L) were not acutely toxic in 96-h laboratory bioassays to sensitive mayflies (Stenonema pudicum) or resistant coleopterans (P. herricki), nor were heavy metals (Cd, Cu, Zn) at concentrations similar to tho found in the fly ash effluent, although data a lacking to evaluate long-term (e.g. > or = 28 effects. Alkaline pH exposures need more researc since the 96-h LC50 of 9.5 for S. pudicum w similar to pH values observed in the receivi stream during summer low-flow, high-temperatu conditions when the ash pond was > 95% fu (Author's abstract)
W85-01491

METAL TOXICITY TO ALGAE: A HIGHLY P DEPENDENT PHENOMENON,
Department of Fisheries and Oceans, Winnipe (Manitoba). Freshwater Inst.
H. G. Peterson, F. P. Healey, and R. Wagemann.
Canadian Journal of Fisheries and Aquatic Sc ences, Vol. 41, No. 6, p 974-979, June, 1984. 5 Fi 26 Ref.

Descriptors: *Scenedesmus, *Phytotoxicit *Metals, *Hydrogen ion concentration, Cadmiu Copper, Phosphorus, Chlorophyta, Water poll tion effects, Heavy metals.

The inhibitory effect of Cd and of Cu on P uptak by the green alga Scenedesmus quadricauda is highly pH dependent process. A simple inorgan medium was used to minimize the effects of var bles other than pH so that changes in toxici should reflect changes related only to H(+) co centration. The toxicity of Cd to P uptake i creases strongly (almost 200-fold) with increasi pH over the range 5.5-8.5. Hydrated Cd(2+ dominates the dissolved Cd pool over this p range. The logarithm of the Cd concentrati causing 50% inhibition of P uptake is linear related to pH. Total Cu toxicity increases 76-fo from pH 5.0 to 6.5, where hydrated Cu(2+) is t dominant dissolved Cu species, and then remai relatively constant at higher pH, where unchang inorganic Cu complexes are dominant. The log rithm of the Cu(2+) concentration causing 50 inhibition of P uptake was also linearly related pH, but total Cu was not. This variation in met toxicity with pH is explained as a competiti between H(+) and free metal cations for cellul binding sites. Possibly this is a general phenom non for metals that form a significant amount free cations relative to the total metal pool. (A thor's abstract)
W85-01494

BEHAVIORAL THERMOREGULATION O LARGEMOUTH BASS, MICROPTERUS SA MOIDES, AND BLUEGILL, LEPOMIS MA CROCHIRUS, IN A NUCLEAR REACTO COOLING RESERVOIR,
State Univ. of New York at Buffalo. Dept. Biological Sciences.
C. J. Block, J. R. Spotila, E. A. Standora, and J. W. Gibbons.
Environmental Biology of Fishes, Vol. 11, No. 1, 41-52, June, 1984. 3 Fig, 3 Tab, 51 Ref. DO constracts E-11-1-2502 and E-381-1-819.

Descriptors: *Bluegill, *Bass, *Fish behavio *Heated water, Cooling water, Water temperatur Behavioral thermoregulation, Nuclear reactor Thermal pollution, Spatial distribution.

Behavioral responses which allow largemout bass, Micropterus salmoides, and bluegill, Lepom macrochirus, to survive under unusually high tem perature conditions were examined. Distribution fish was ascertained by angling. Body temperature of 4 fish were obtained using radio transmitter Temperatures of other fish were measured aft fish were captured by angling. Both species wer restricted in range by lethal water temperature and therefore inhabited a greater portion of a the mally altered reservoir in winter than in summe Under unheated conditions (during reactor shu down), bass occupied shallow areas with an abu dance of submerged logs and stumps, a deep are with springs, and a cover where the effluent can entered the reservoir. Commencement of reacto operation resulted in an increase in water tempera ture to more than 50 degrees C in summer. Ba and bluegill retreated to three refuges and r

ed there until the reactor shut down and the voir cooled. In the refuges, bass experienced a variety of temperatures, but adults generally led temperatures above 31 degrees C. Large bass (> 40 cm) occupied particular positions refuge cove, medium size bass (15-40 cm) in the open water, and small bass (< 15 cm) pied shallow water near shore where tempera- were 32-34 degrees C. Bluegill stayed in from 32-37 degrees C. (Author's abstract) 01495

WTH RESPONSES OF FISH TO CHANG- ENVIRONMENTAL CONDITIONS IN A TH CAROLINA COOLING RESERVOIR,
Conservation Service, Ottawa, IL.
primary bibliographic entry see Field 6G. 01496

MENTATION RATES AND HEAVY AL POLLUTION OF SEDIMENTS IN THE INLAND SEA; PART 2. HIROSHIMA
rnment Industrial Research Inst., Tosu n).
oshika, and T. Shiozawa.
al of the Oceanographical Society of Japan, 40, No. 2, p 115-123, April, 1984. 5 Fig, 3 12 Ref.

riptors: *Sedimentation, *Heavy metals, *Hir- a Bay, *Seto Inland Sea, *Japan, Fate of tants, Copper, Zinc, Lead radioisotopes, His- Sediment load.

nentation rates in ten sediment cores from shima Bay in the Seto Inland Sea of Japan determined with the Pb-210 technique, and y metals were analyzed. The sedimentation vary from 0.18 to 0.33 g/sq cm/yr. The st sedimentation rates were observed in the ern part of the bay at the mouth of Ota River, lower sedimentation rates not more than 0.20 cm/yr were observed at stations close to w waterways, or where water depth was ow. The contents of copper and zinc in ent cores began to increase around 1930 as a of increased human activity, and have re- d almost unchanged since 1970 possibly be- of regulation of pollutant discharge. The al background values of copper and zinc in diment of this bay range from 16 to 27 mg/kg 70 to 105 mg/kg, respectively. The total nts of anthropogenic copper and zinc deposit- the sediments since about 1930 are estimated 0.5-2.7 ton/sq km and 2.2-14.5 ton/sq km, ctively. At the present-day, the anthropogen- ds of copper and zinc to the sediments of the e bay are 26 ton/yr and 183 ton/yr, and these s constitute 39% and 48% of the total sedi- ary loads at the present-day, respectively. hor's abstract) 01497

NKTON COMMUNITY OF AN ACID CKWATER SOUTH CAROLINA POWER NT IMPOUNDMENT,
lina Power and Light Co., New Hill, NC.
s Energy and Environmental Center.
primary bibliographic entry see Field 6G. 01498

SICO-CHEMICAL, BACTERIOLOGICAL BIOLOGICAL STUDY OF THE SEYMAZ DE PHYSICO-CHIMIQUE, BACTERIO- IQUE ET BIOLOGIQUE DE LA SEYMAZ),
oart S.p.A., Milan (Italy).
evaclier, and M. Dethier.
ives des Sciences, Geneve, Vol. 37, No. 1, p 1984. 6 Fig, 2 Tab, 9 Ref.

riptors: *Seymaz, *Switzerland, *Caniliza- *Water pollution effects, Fertilizers, Land Water quality, Physicochemical properties, eria, Dissolved oxygen, Vegetation, Decom- ion.

Seymaz, a river which is a part of the Arve , is the only stream of some importance entirely within the Canton of Geneva. The Seymaz is subdivided into two distinct segments. The canalized segment, with concrete banks and bed, extends from the source (Touviere, formerly the Grands Marais) to downstream of the Ladame bridge has a weak slope and drains a vast plain formerly swampy and now dedicated to agriculture. The segment with few modifications extends to the mouth of the Arve, with natural banks and bed, and drains an area which is partly rural and partly industrial, with a high population concentration. In spite of improvements since a study conducted in 1969, the analyses conducted in 1981-1982 indicated the the state of the Seymaz remains very poor, in particular in the section which is canalized. Ensolation and the fertilizers of agricultural origin contribute notably to the proliferation of vegetation, the decomposition of which results in an oxygen deficit. (Moore-IVI)
W85-01555

TRENDS IN PH, CALCIUM, AND SULFATE OF RIVERS IN ATLANTIC CANADA,
Department of the Environment, Moncton (New Brunswick). Water Quality Branch.
T. A. Clair, and P. H. Whitfield.
Limnology and Oceanography, Vol. 28, No. 1, p 160-163, January, 1983. 2 Fig, 2 Tab, 10 Ref.

Descriptors: *Acid rain, *Rivers, *Canada, Sulfate, Nitrate, Acidity, Alkalinity, Calcium, Hydrogen ion concentration, Water analysis, Time series, Computer models.

Acid precipitation is affecting the chemistry of rivers in Atlantic Canada. Long term records for pH, calcium, and sulfate from 11 rivers were fitted using time series methods of Box and Jenkins (Box, G. E., and G. M. Jenkins, 1976. Time Series Analysis Forecasting and Control. Holden-Day.) with BMDQ2T, an experimental version of a time series program in the BMDP series of statistical computer programs. Six parameters were considered initially: pH, calcium, sulfate, alkalinity, nitrate, and discharge. Nitrate, alkalinity, and discharge were later eliminated. Decreases in pH over time were found, but the results for calcium and sulfate were not consistent with the predicted model. The conceptual models used to understand the effects of acid precipitation on water chemistry did not adequately explain the observed changes. (Baker-IVI)
W85-01589

ACID PRECIPITATION: ITS ROLE IN THE ALKALIZATION OF A LAKE IN MICHIGAN,
Michigan Univ., Ann Arbor. Div. of Biological Sciences.
P. Kilham.
Limnology and Oceanography, Vol. 27, No. 5, p 856-867, September, 1982. 3 Tab, 57 Ref. NSF grant G-OCE78-27016.

Descriptors: *Acid rain, *Alkalization, *Weber Lake, *Michigan, Water pollution lakes, Seepage lakes, Nitrates, Sulfates, Weathering, Chemical reactions.

Weber Lake is a soft water seepage lake in a nonsensitive region of northern lower Michigan that has doubled in alkalinity over the past 30 years. An acid-base budget for Weber Lake and its watershed was constructed from the difference between bulk precipitation input and lake water output. Strict application of the first law of thermodynamics and the principle of electroneutrality permits the calculation of the acid base budget from the input output budget. The acid base budget indicates that alkalinity production resulting from nitrate uptake and sulfate reduction is sufficient to completely neutralize the hydrogen ions entering the system from acid precipitation. The acid-base budget shows that the alkalinity of Weber Lake has doubled primarily as a result of increased rates of weathering in the watershed. Weathering rates have increased as an indirect result of acid precipitation. (Baker-IVI)
W85-01592

AVOIDANCE OF COPPER AND NICKEL BY RAINBOW TROUT AS MONITORED BY A COMPUTER-BASED DATA ACQUISITION SYSTEM,
Corvallis Environmental Research Lab., OR.
J. D. Giattina, R. R. Garton, and D. G. Stevens.
Transactions of American Fisheries Society, Vol. 111, No. 4, p 491-504, July, 1982. 4 Fig, 3 Tab, 38 Ref.

Descriptors: *Avoidance response, *Trout, *Copper, *Nickel, *Automation, *Fish behavior, Behavior, Water pollution effects, Water quality standards, Sublethal effects, Distribution patterns.

Possible behavioral effects should be considered when water-quality criteria are established; the preference or avoidance responses of fish would be of obvious importance given the effects these behaviors have on fish distributions. The avoidance response of rainbow trout Salmo gairdneri to copper and nickel solutions under several exposure regimes was evaluated with a computer-based data acquisition system interfaced with an exposure chamber. The best estimates of the avoidance thresholds for these metals were 6.4 micro g/liter total copper and 23.9 micro g/liter total nickel (95% confidence limits were 2.6-15.5 and 10.2-54.3 micro g/liter, respectively). Rainbow trout initially avoided low copper concentrations, but were attracted to higher ones (330-390 micro g/liter) during shallow-gradient tests. Under similar test conditions, fish were attracted to low nickel concentrations (about 6 micro g/liter), but avoided higher levels (> 19 micro g/liter). The 24-hour average concentration of these two metals presently considered adequate for the protection of freshwater aquatic life fell within the 95% confidence limits for threshold avoidance concentrations reported here. This suggests that environmental impacts predicted on the basis of toxicity tests alone do not reflect potentially important behavioral changes caused by subchronic concentrations of copper annd nickel. (Collier-IVI)
W85-01624

EFFECTS OF POLLUTANTS ON MARINE ECOSYSTEMS,
Oslo Univ. (Norway). Inst. of Marine Biology.
J. S. Gray.
Netherlands Journal of Sea Research, Vol. 16, p 424-443, December, 1982. 7 Fig, 6 Tab, 52 Ref.

Descriptors: *Water pollution effects, *Ecosystems, *Marine environment, Plankton, Copepods, Diatoms, Fish, Trophic level, Heavy metals, Organic compounds, Distribution patterns, Oil spills.

Effects of continuous gross pollution lead to dominance by small-sized individuals that have life-history characteristics allowing rapid recolonization of disturbed habitats. Acute short-term pollution, such as oil accidents, can recover to normal conditions in 3 to 10 years depending largely on exposure. Moderate pollution in planktonic systems is thought to lead to dominance by microflagellates, small copepods, ctenophores and medusae whereas in unpolluted systems diatoms, large copepods and fish dominate. Close analysis of data on which such hypotheses are based suggests that there are few strong trophic links in planktonic systems. The species that dominate under moderate pollution are tolerant species with life-history characteristics that allow them to increase. In the absence of potentially competitively superior diatoms, microflagellates increase, and lacking large copepods, small copepods increase. Unstructured systems will not show food chain accumulation of heavy metals nor organochlorines, as is demonstrated with data on cesium, mercury and DDT levels. A hypothesis is suggested that structured food web systems exist only where the predator or herbivore can completely control prey or plant density. In planktonic and soft-sediment systems this structure will be restricted to small patches in space or time and over large areas or long time scales unstructured systems will be the rule. The lognormal distribution is suggested as a model for the distribution of individuals among species for such unstructured systems. Pollution has the effect of simplifying the system and giving it structure with defined groups of species dominating. Thus

pollution can structure communities over large areas. (Baker-IVI)
W85-01626

EFFECTS OF AMMONIUM EFFLUENTS ON PLANKTONIC PRIMARY PRODUCTION AND DECOMPOSITION IN A COASTAL BRACKISH WATER ENVIRONMENT, I. NUTRIENT BALANCE OF THE WATER BODY AND EFFLUENT TESTS,
Helsinki Water District (Finland).
T. Tamminen.
Netherlands Journal of Sea Research, Vol. 16, p 455-464, December, 1982. 3 Fig, 1 Tab, 13 Ref.

Descriptors: *Water pollution effects, *Industrial wastes, *Ammonium, *Archipelago Sea, Gulf of Finland, Baltic Sea, Bacteria, Algae, Temperature effects, Oxygen, Nutrients, Eutrophication, Primary productivity.

A case study is offered on effects of ammonium effluent discharged at the coast of the Archipelago Sea near the entrance of the Gulf of Finland, Baltic Sea. Whether ammonium discharge altered the nutrient balance of the area was investigated along with examining the direct effects of effluents on natural algal and bacterial communities. Samples were taken of the inner archipelago loaded with ammonium-rich industry effluents and some stations towards the open sea. Acute effects of effluent on natural algal and bacterial communities were tested by measurements of primary productivity and heterotrophic activity. Effluent tests were also conducted with a test alga. Nutrient ratios and AGP tests indicated that nitrogen was the principal limiting nutrient for algal growth even in the ammonium-loaded regions. The discharge caused a considerable eutrophication in the area. Effluent concentrations from 0.01 to 1% stimulated primary productivity of natural algal communities up to 230% of the control, whereas 10% concentrations were toxic. Test algae tolerated also 10% of effluent in some cases, and showed stimulations up to 960% of the control. No stimulation of heterotrophic activity was usually detected in effluent tests, and the threshold of toxicity was considerably lower than with algae. The effect of effluents on heterotrophic bacteria of the water body is therefore likely to be mediated through autotrophic production. (Baker-IVI)
W85-01627

UNDERWATER EXPERIMENTS ON THE EFFECTS OF SEWAGE SLUDGE ON A MARINE ECOSYSTEM,
Marine Lab., Aberdeen (Scotland).
A. Eleftheriou, D. C. Moore, D. J. Basford, and M. R. Robertson.
Netherlands Journal of Sea Research, Vol. 16, p 465-473, December, 1982. 5 Fig, 2 Tab, 17 Ref.

Descriptors: *Sludge disposal, *Wastewater, *Water pollution effects, *Marine environment, Ecosystems, Macrofauna, Sediments.

A clean area was experimentally contaminated by the addition of sewage sludge in order to obtain a better insight into the sequential changes which follow the addition of organic wastes as well as to investigate the ecosystem's tolerance level. The effects were monitored over several months. The addition of a large amount of sludge (100 l/sq m/a) resulted in a sparse Capitella dominated fauna of low density and high biomass. The lower amount (50 l/sq m/a) allowed the presence of a normal fauna but of an enhanced abundance and biomass. Though recovery was good there was evidence that the addition of large amounts of sludge had lasting toxic effects. The addition of 100 l of sewage causes changes in the environment and in the fauna fimilar to those observed in the polluted zone of sludge dumping grounds. Because of the heterogenous nature of sewage sludge, further experiments must be carried out in order to distinguish between the effects resulting from organic pollution and the possible toxic effects of heavy metals and industrial wastes. (Baker-IVI)
W85-01628

CHANGES IN THE SUBLITTORAL HARD BOTTOM BENTHOS AFTER A LARGE REDUCTION IN PULP MILL WASTE TO IDDEFJORD, NORWAY, SWEDEN,
Oslo Univ. (Norway). Inst. of Marine Biology.
H. Christie, and N. W. Green.
Netherlands Journal of Sea Research, Vol. 16, p 474-482, December, 1982. 4 Fig, 1 Tab, 21 Ref.

Descriptors: *Benthos, *Pulp wastes, *Iddefjord, *Water pollution control, *Norway, *Sweden, Pulp and paper industry, Industrial wastes, Population dynamics, Pollution load, Fjords.

Changes in a rocky wall community were monitored in response to a reduction in pollution load. Tests were also made of stereophotography as a sampling technique. The study site was the Iddefjord, situated on the border between Norway and Sweden. It is a narrow fjord with two shallow sills near the mouth which hinder water renewal. The fjord is polluted primarily by effluents from a pulp mill. Reduction in pollution load has lead to a more diverse community on the sublittoral rocky bottom at two sites at 7 and 17 m depth from 1978 to 1980. The changes were confirmed by fixed-site stereophotography. The sites were initially dominated by a single species, Polydoraciliata, which was then partially replaced by several other species, particularly Mytilus edulis and Ciona intestinalis. It is suggested that improved water quality indirectly affected predation and natural succession. (Baker-IVI)
W85-01629

5D. Waste Treatment Processes

REMOVAL OF FINE OILY HAZES FROM WASTEWATER USING DEEP FIBROUS BED COALESCER,
Kuwait Univ., Safat. Dept. of Chemical Engineering.
M. A. Fahim, and A. M. Akbar.
Journal of Environmental Science and Health, Vol. A19, No. 3, p 299-319, April, 1984. 7 Fig, 1 Tab, 4 Ref. Kuwait University grant EC007.

Descriptors: *Kerosine, *Oily water, *Wastewater treatment, *Fibrous beds, *Coalescence, Water pollution treatment, Separation techniques, Gravity seperators.

A Knitmesh packing composed of glass wool and stainless steel was studied for removing fine hazes of kerosine (20 - 25 microns) at different phase ratios (phi) up to 1000 ppm in the wastewater stream. In the bed, the mechanism of droplet removal is through coalescence of the droplets to such sizes which can be removed by gravity separators. A parametric study was conducted to investigate the effect of operating conditions such as flow rate (u), bed height (L), and oil loading on the pressure drop and bed efficiency. A flow rate of 36 cu m/sq m/hr will produce a water stream containing less than 20 ppm and coalesced drops not less than 0.4 mm in diameter, which can easily be separated by gravity. Energy savings could be achieved with this bed since it requires low pressure drops in operation; the pressure drop is predicted as delta P sub 2 = 2.69 x L(0.65) x u(1.04) x phi(0.34). The selection of bed height for a given wastewater flow rate and oil loading could be carried out using graphs that were developed. (Collier-IVI)
W85-01160

OXYGEN UPTAKE RATES ASSOCIATED WITH BIOLOGICAL TREATMENT OF PENTACHLOROPHENOL WASTEWATER,
Moore, Gardner and Associates, Inc., Baton Rouge, LA.
M. Madden, and M. Tittlebaum.
Journal of Environmental Science and Health, Vol. A19, No. 3, p 321-335, April, 1984. 5 Fig, 3 Tab, 7 Ref. State of Louisiana Board of Regents contract 81-LBR/031-814.

Descriptors: *Pentachlorophenol, *Biological wastewater treatment, *Oxygen uptake, *Chemical oxygen demand, Activated sludge process, Wastewater treatment, Respirometers.

The biodegradability of pentachlorophe wastewater (PCPWW) obtained from an op ational wood-preserving plant was determi with the use of an electrotytic respirometer. T average PCP concentration in untreated PCPW was measured at 245 mg/L as its sodium salt chemical oxygen demand ranged from appro mately 1800 to 25,000 mg/L. Electrolytic res rometer flasks were set up containing varying v umes of PCPWW; the remaining volumes w filled with mixed liquor obtained from a domes wastewater treatment plant. Oxygen uptake ra (OUR) for the 1, 15, 20, and 30% PCPWW fla were found to be 62, 56, 64, and 64 mg O2/ho respectively (as computed from hours 48-64). T 1, 20, and 30% by volume flasks were operat near or at capacity of the respirometer to prod oxygen. No pronounced toxicity effects occur at a 5% PCPWW by volume level. Based o gradual introduction of the PCPWW, over COD reductions of 71.4 percent were realized i bench scale (32 L) activated sludge treatm system. (Collier-IVI)
W85-01161

HYPERFILTRATION OF SURFACTAN CONTAINING SOLUTIONS FROM THE PLA ING INDUSTRY,
Essen Univ. (Gesamthochschule) (Germany, F.R Inst. fuer Technische Chemie.
E. Staude, W. Assenmacher. and H. Hoffmann.
Desalination, Vol. 49, No. 3, p 321-333, Marc 1984. 8 Fig, 3 Tab, 15 Ref.

Descriptors: *Metal-finishing wastes, *Surfactar *Hyperfiltration, Detergents, Filtration, Chro um, Membranes, Membrane processes, Elect lytes, Industrial wastes.

Plating rinse water contains detergents which m change the performance of membranes when t wastes are handled by hyperfiltration. The hyp filtration of chromic plating rinse water, whi contains a special type of surfactant, was examin using different annealed CA membranes in a clos loop apparatus; rinse water containing Cr(VI) 0.00136 molarity was supplied by a plating firm low concentrations the surfactant influences t volume flow more than the rejection. An effect the electrolytes can be neglected at low concentr tion. Increasing surfactant concentration as well rising electrolyte concentration cause a remarkab drop of both volume flow and electrolyte rej tion. This was measured with tetraethylammoniu perfluoroctanolsulfonate, a commonly used surfa tant for chromic plating. There is a breakthrou concentration of 0.02 g surfactant/L, correspon ing to 0.0000335 M in the feed, at which t performance of the membrane is transformed. Th depends on the electrolyte concentration; breakthrough is observed when electrolytes a absent. The influence of electrolyte on critic micelle concentration in the concentration pola ization layer or on adsorption of the surfactant the membrane is provoked by the concentration the former. (Collier-IVI)
W85-01223

TREATMENT OF HIGHLY FOULING WAST WATERS WITH TUBULAR MEMBRANE SY TEMS,
Nitto Electric Co. Ltd., Osaka (Japan).
S. Takadono, H. Iwahori, T. Yabushita, Y. Imamura, and H. Ishizuka.
Desalination, Vol. 49, No. 3, p 347-355, Marc 1984. 6 Fig, 2 Tab, 9 Ref.

Descriptors: *Wastewater treatment, *Membra processes, Reverse osmosis, Ultrafiltration, Filtr tion, Sponge ball cleaning.

Membrane fouling by suspended solids is a seve problem in reverse osmosis or ultrafiltration highly fouling feed streams. Tubular membra systems are inherently fouling resistant and can automatically mechanically cleaned at regular i tervals by a sponge ball cleaning device. The u of this type of system to process a number highly fouling feed streams difficult to treat membrane processes is described. High membra

ixes can be maintained with these systems. The onomics of treating highly polluted wastewaters th this type of process are highly competitive th techniques such as evaporation or hauling to vaste site. (Baker-IVI)
85-01225

LUIDIC VORTEX DEVICE FOR WATER REATMENT PROCESSES,
niversidad Nacional Autonoma de Mexico, exico City. Inst. de Ingenieria.
Levi.
urnal of Hydraulic Research, Vol. 21, No. 1, p 31, 1983. 15 Fig, 5 Ref.

escriptors: *Water treatment, *Fluidic vortices, ortices, Flow, Mixing, Clarification, Aeration, ntinuous flow reactor.

e fluidic vortex device transforms a rectilinear w into a rotating flow without using impellers other mechanical implements. The workings of device are explained along with experiments formed in order to determine its fitness as water ter, aerator and clarifier. This continuous flow ctor is strictly fluidic in nature, with no me- nical impulsion needed to produce the rotary tion. The device is adaptable to different work- conditions in that the vortex intensity can ily be modified, for example, by varying the uid depth within the vessel or the distance of the zle from the floor. Its main advantages over ivalent impeller driven devices includes: the y source of energy needed is a pump forcing the d into the vessel; the risk of producing a forced tex that, when fully developed, makes the ing ineffective, is eliminated; if baffling is ded, baffles can be located anywhere inside the k, because there is no chance of obstructing a peller- or paddle-motion; the entire apparatus be constructed of readily available non-metal- materials which lowers costs and precludes dation and corrosion processes; and no special ntenance needed except for periodic cleaning. w the device can be fitted to perform continu- mixing, aeration and clarification processes is cribed. (Baker-IVI)
5-01228

NIMIZING WASTEWATER WITH BOTTOM H RECIRCULATION SYSTEMS,
M. Rode, and N. C. Mohn.
ver Engineering, Vol. 88, No. 6, p 50-53, June, 4. 4 Fig, 5 Tab, 3 Ref.

escriptors: *Bottom ash, *Wastewater reduction, circulation, Water use, Dewatering, stewater treatment, Powerplants.

latest EPA regulations on wastewater emis- s, often combined with site restrictions on er use, have led to the incorporation of water rculating systems into the bottom ash removal ems of coal fired steam generators. There are methods for conveying boiler bottom ash: raulically to either dewatering tanks or a pond, nechanically, incorporating continuous removal n integral dewatering. Systems of either type be equipped for water recirculation, but there substantial differences in capital expenditures operating costs between the two methods. h of these systems is described and compared a typical 600-MW coal fired utility unit and a 000 lb/hr steam industrial unit. (Baker-IVI)
5-01232

FECT OF LOADING RATE AND SOIL ENDMENTS ON INORGANIC NITROGEN D PHOSPHORUS LEACHED FROM A STEWATER SOIL ABSORPTION SYSTEM,
th Carolina State Univ. at Raleigh. Dept. of Science.
. Uebler.
rnal of Environmental Quality, Vol. 13, No. 3, 5-479, July-September, 1984. 5 Fig, 2 Tab, 14

escriptors: *Leaching, *Land disposal, stewater treatment, *Soil amendments, *Nitro- *Phosphorus, Groundwater pollution, Lime, Cement, Wastewater treatment, Soil smearing, Load distribution.

The absorptive capacity of undisturbed soil can be severely reduced during digging of trenches for ground absorption sewage disposal systems by soil smearing at the trench-soil interface. The effects of wastewater loading rate and soil amendments proposed to help overcome the detrimental effect of soil smearing on wastewater treatment by a soil absorption system were evaluated. Three loading rates (7.5, 11.3, and 15.0 L/sq m/day) were tested and two soil amendments, cement and lime, were compared with a control. Three absorption trenches, 3.0 m in length, were dug for each loading rate-soil amendment combination. Soil water samples were obtained monthly for 12 months from ceramic cups placed 15 and 30 cm below the trenches. Concentrations of ammonia-nitrogen, nitrate-nitrogen, and soluble P varied significantly with the time of sampling. Transformation of ammonia-ntrogen to nitrate-nitrogen was enhanced by the soil amendments, indicating that the aeration status of the soil near the trenches was improved by the amendments. The effect of the amendments was most noticeable in the spring recovery period as aeration status was increasing from winter minimums. Higher nitrate-nitrogen levels for the cement as compared with the lime in spring suggest that cement may be a more effective amendment than lime. The lowest loading rate had significantly higher concentrations of nitrate-nitrogen during the spring months. Soluble P levels increased linearly from 0.1 to 0.9 mg/L over the first operating year of the system. (Baker-IVI)
W85-01295

SEPARATION OF AROMATIC SUBSTANCES FROM AQUEOUS SOLUTIONS USING A REVERSE OSMOSIS TECHNIQUE WITH THIN, DENSE CELLULOSE ACETATE MEMBRANES,
Osaka Univ. (Japan). Dept. of Chemical Engineering.
S. Tone, K. Shinohara, Y. Igarashi, and T. Otake.
Journal of Membrane Science, Vol. 19, No. 2, p 195-208, May, 1984. 8 Fig, 2 Tab, 13 Ref.

Descriptors: *Reverse osmosis, *Membrane processes, Cellulose acetate membranes, Permeability, Phenol, Aniline, Hydroquinone, p-Chlorophenol, Organic compounds, Aromatic compounds.

Investigations were made of the water flux rate and rejection characteristics of aromatic substances in aqueous solutions using a thin, dense cellulose acetate membrane in reverse osmosis experiments. The aromatic substances used included phenol, aniline, hydroquinone and p-chlorophenol. The water flux and the solute rejection were significantly dependent on variations of water content of the membrane. The solutes phenol, aniline and p-chlorophenol became enriched in the permeate in the case of a swollen membrane with high water content. The model relationship describing the transport mechanism was depicted adequately by considering the effect of the pressure-dependent term on the chemical potential of the components and the viscous flow contribution to the diffusion in the membrane. Based on this, relationships between water flux and solute rejection were derived. Negative solute rejection can be successfully explained in terms of the component permeability coefficient, partial molar volume, operating pressure and osmotic pressure differences. The water permeability coefficient was estimated from the measured water flux and was correlated well with the water content based on a free volume model. The solute permeability coefficient estimated from measured solute rejection was in good correlation with that obtained from partition and diffusion coefficient measurements. The data of solute rejection in reverse osmosis runs can be predicted by the proposed solute rejection theory using the correlation of permeability coefficients of water and solute with varying water content in the membrane. (Baker-IVI)
W85-01313

ORIGIN OF THE HEAVY METALS IN SEWAGE SLUDGE AND IN COMPOST FROM THE MURA WASTE AND WASTEWATER WORKS IN BIEL (HERKUNFT DER SCHWERMETALLE IM KLARSCHLAMM UND IM KOMPOST DES KEHRICHT- UND ABWASSERWERKS MURA IN BIEL),
Bundesamt fuer Umweltschutz, Bern (Switzerland).
J. Scharer.
Wasser, Energie, Luft, Vol. 74, No. 10, p 261-263, 1982. 1 Fig, 3 Tab.

Descriptors: *Heavy metals, *Wastewater, *Biel, *Switzerland, Sludge, Waste disposal, Domestic wastes, Industrial wastes, Runoff, Wastewater treatment.

The waste and wastewater works of Biel was found to be the origin of heavy metals, which can bring about problems in agricultural use of sewage sludge and in waste composting. The metal balance in the wastewater system and in wastes has been determined. The local critical points above average for metal introduction and the share from households, industry, and street, roof and area runoff of the collected metal burden was determined. Industry is not always the most important heavy metal source (for example for zinc, 40%). In wastes, there is an above average portion of coarse metals (13%). The contribution of factories and public sources will be determined in order to improve the load proportion. Effective metal removal may be necessary for other sources. (Author's abstract)
W85-01360

LAMELLAR FLOWPACK CLARIFIERS FOR SEDIMENTATION (SCHRAGKLARER FUR DIE SEDIMENTATION),
Gebrueder Sulzer A.G., Winterthur (Switzerland).
Wasser- und Abwassertechnik.
J. Tylmann.
Wasser, Energie, Luft, Vol. 74, No. 10, p 263-266, 1982. 6 Fig, 7 Ref.

Descriptors: *Clarifiers, *Sedimentation, *Lamellar flowpack clarifiers, Water treatment, Wastewater treatment.

Sedimentation of substances present in water is one of the most important process stages in water and wastewater treatment technology. In addition to the conventional sludge contact process OPUR, Sulzer has developed a high-performance sedimentation process using lamellar flowpacks. Two operational plants of different designs are described. (Author's abstract)
W85-01361

QUARTER CENTURY OF INDUSTRIAL WATER USE AND A DECADE OF DISCHARGE CONTROLS,
Wisconsin Dept. of Natural Resources, Madison.
E. L. David.
Water Resources Bulletin, Vol. 20, No. 3, p 409-416, June, 1984. 3 Fig, 2 Tab, 13 Ref.

Descriptors: *Clean Water Act, *Industrial wastewater, *Pulp and paper industry, Wastewater treatment, Water demand, Effluents, Water reuse, Water use, Biochemical oxygen demand,.

Trends in industrial water intake, discharge, recycling, and gross water use were examined to determine whether or not the 1972 Clean Water Act (CWA) has had an impact on industrial effluent discharge. The levels of discharge, both generally and per unit of product, have been falling for as long as these data have been gathered. Trends in gross water use and recycling ratios suggest that during the 25 years of record production processes were gradually modified so that less total water was discharged and less was used per unit of output. Untreated discharge as a percent of all discharge fell fairly steadily across all industries until 1973 and continued to fall in 1978 in the major BOD-discharging industries. By 1978, 75% of the pulp and paper effluent and 40% of the food processing effluent was treated. The consistent increase in treated discharge in the pulp and paper mills, with their large component of BOD-related process discharge, was not matched by parallel

trends in the steel, petroleum, and chemicals industries with their relatively smaller amounts (and percents) of process discharge. This suggests that the CWA may have been responsible in part for the change in the former. For the century as a whole, pulp and paper mills discharged less water, and more discharge was treated, in 1978 than in 1973; these trends were especially dramatic among firms in the Northeast where controls were likely to have been most stringent. The drop in discharge levels and the increasing amounts of treatment may have had a significant effect on the amount of BOD discharged to surface and ground water. Industrial water use has changed over the 25 years of record; the CWA and the environmental ethic which spawned it may have played an important part in the shifts. (Moore-IVI)
W85-01382

EFFECT OF SALINITY ON REAERATION COEFFICIENT OF RECEIVING WATERS,
National Cheng Kung Univ., Tainan (Taiwan).
For primary bibliographic entry see Field 2L.
W85-01398

STANDARDS FOR WATERS AND INDUSTRIAL EFFLUENTS,
Haiste International Ltd., Leeds (England).
R. K. Chalmers.
Water Science and Technology, Vol. 16, No. 5-7, p 219-244, 1984. 6 Tab, 25 Ref.

Descriptors: *Water quality standards, *Industrial wastes, *Effluents, Costs, Technology transfer, Wastewater treatment.

Experience in 25 countries shows, not surprisingly, that the trend everywhere is towards tightening legislative control on waste discharges to the environment. What is comparatively recent, however, is the rate of change in the standards required under these laws. This stems partly from the elevation of environmental protection to a political issue within the last quarter century, a new awareness among environmental pressure groups enhanced by instant communications world-wide, an international knowledge of what is - or should be - technically attainable in effluents from various manufacturing processes, and technology transfer and sometimes funding encouraged by the international agencies like those of the United Nations. After a brief consideration of the derivation of standards 21 cases are noted in which the actual application of standards has been questionable. In view of the significant effect of effluent standards upon manufacturing costs it is important that standards are both rational and necessary. Approaches to the minimizing of industrial effluent discharges benefit both the discharger and the receiving environment. (Author's abstract)
W85-01404

EFFLUENT STANDARDS FOR RECLAIMING INDUSTRIAL RIVERS,
Yorkshire Water Authority (England).
H. B. Tench.
Water Science and Technology, Vol. 16, No. 5-7, p 245-258, 1984. 2 Tab, 9 Ref.

Descriptors: *Water quality standards, *Rivers, *Industrial wastes, *Yorkshire, *England, Effluents, Biological oxygen demand, Suspended solids, Fisheries.

Wastewater from the high concentration of population and heavy industry can cause overload of relatively small rivers. Uniform emission standards for the discharges are inappropriate even in these areas as variations in river flows would make a uniform standard too relaxed or too stringent, according to circumstances, at different points. Provisional river water quality standards for commonly occurring toxic compounds are recommended which should enable self-sustaining coarse fisheries to be established in industrial rivers. Standards are also suggested which would improve the visual amenity of industrial rivers. These include a mean BOD no greater than 7 mg/l and a suspended solids of about 25 mg/l maximum expressed as a median to avoid the difficulties of interpretation of means. The toxic substances standards are expressed either as means or 95 percentiles for compounds which have a long or short time of effect respectively at their median lethal threshold concentration. These standards when tested against the river water qualities observed at various sampling points on Yorkshire (England) rivers give a broad indication of the presence or absence of fish, but they are not fully reliable in that some apparently satisfactory river reaches do not supprt a satisfactory fish population. A possible reason for this is that the intermittent discharges form storm sewage overflows are inadequately allowed for in the standards. (Moore-IVI)
W85-01405

CADMIUM BALANCE AND RESTORATION STRATEGY FOR A RIVER BASIN,
Ruhrverband, Essen (Germany, F.R.).
K. R. Imhoff, P. Koppe, and D. R. Albrecht.
Water Science and Technology, Vol. 16, No. 5-7, p 315-325, 1984. 6 Fig, 3 Tab, 8 Ref.

Descriptors: *Cadmium, *Water pollution control, *West Germany, Industrial wastes, Wastewater treatment, Pretreatment, Wastewater disposal, Heavy metals.

As the standards of the European Commission for river water and drinking water are to be converted into national regulations in the near future, it was necessary to investigate the cadmium concentration in the Ruhr catchment area. Further incentives were the West German regulation for sewage sludge disposal on farmland as well as the necessity of identifying unlawful industrial wastewater discharges causing occasionally unstable effluent quality of some municipal treatment plants in the Ruhr catchment area. A cadmium balance calculated for the Ruhr river basin indicated the dominating impact of industrial wastewater discharge while the cadmium load from other sources is comparatively small. For the 20 treatment which had 80% of the inflow cadmium load, balances were performed by comparing the cadmium load at the inflow with the known emissions into the sewerage system. Six treatment plants where the differences exceeded 60 kg/a or 50% of the initially know load were investigated further. These investigations included secret analyses over 24 hours in the municipal sewerage system upstream and downstream of particular factories; samples were also taken on weekends and holdays. Analyses in the pretreatment plant effluents did not always give a true picture, as in some cases a bypass was used to discharge hazardous wastewater into the interceptor. By consulting industries in the river basin and by improving pretreatment in existing plants, the discharged cadmium load was reduced. (Moore-IVI)
W85-01409

OPERATIONAL RIVER WATER QUALITY MANAGEMENT,
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W85-01414

APPLICATION OF MODELS IN DEVELOPING CONTROL STRATEGIES FOR ACTIVATED SLUDGE WASTE WATER TREATMENT PLANTS,
Rintekno Oy, Espoo (Finland).
A. Holmberg, and J. Forsstrom.
Water Science and Technology, Vol. 16, No. 5-7, p 587-594, 1984. 3 Fig, 4 Ref.

Descriptors: *Activated sludge process, *Model studies, Simulation, Wastewater treatment, Mathematical models, Suspended solids, Algorithms.

The dynamic behavior of the activated sludge process is very complex and difficult to predict because of the sludge recycle. The use of mathematical models and simulation techniques for developing efficient control strategies for activated sludge plants was examined. The process can be influenced at two stages: planning and dimensioning; and by improving operational efficiency by introducing suitable control strategies. The v
bles which can be controlled when operating
activated sludge process and the sludge pump
and air blowing. The control algorithm devel
was tested using model simulations: the eff
BOD7 concentration was improved compare
the uncontrolled case, and the daily fluctuatio
the recycle sludge were also considerably sm
when using the controller. The prerequisite
using the algorithm offered is that devices
measuring the suspended solids concentratio
available. The lack of such sensors generally f
the main obstacle for implementation of co
algorithms at activated sludge plants. The pr
appears not to be sensitive to the recycle flow
Waste flow control with the objective to kee
sludge concentration constant was promi
(Baker-IVI)
W85-01431

**NITRIFICATION DYNAMICS IN THE OX
TION DITCH WASTEWATER TREATM
PROCESS,**
Imperial Coll. of Science and Technology, Lo
(England). Dept. of Civil Engineering.
S. Cook.
Water Science and Technology, Vol. 16, No.
p 595-611, 1984. 8 Fig, 2 Tab, 12 Ref.

Descriptors: *Nitrification, *Oxidation ditch, *
logical wastewater treatment, Stochastic pro
Model studies, Recursive parameter estima
Extended Kalman Filter, Wastewater treatm

An approach to the identification of dynamic,
chastic wastewater treatment process models
developed, and is applied to the development
model of nitrification in a Carrousel Oxid
Ditch wastewater treatment plant. The metho
gy involves the testing of model structure hyp
eses through recursive parameter estimation
operational data and the Extended Kalman F
The final model performs well in both non-ac
ive and adaptive operation with the data se
which it was identified. Performance on an alt
tive data set is reported as being worse but ac
able. The use of rigid, stochastic differential e
tions to represent biological processes
wastewater treatment plant is called into ques
(Moore-IVI)
W85-01432

**ACTIVATED SLUDGE PROCESS CONT
USING DISSOLVED OXYGEN MEASU
MENTS,**
Florence Univ. (Italy). Ist. di Informatica e S
mistica.
S. Marsili-Libelli.
Water Science and Technology, Vol. 16, No.
p 613-620, 1984. 5 Tab, 13 Ref.

Descriptors: *Activated sludge process, *Pro
control, *Dissolved oxygen, Biological wastew
treatment, Oxygen uptake rate, Biomass, Micr
activity.

In the activated sludge process, as in most bio
cal and biotechnical processes, very few quan
are directly measureable and this has present
major obstacle in the implementation of co
schemes. A combined estimation/control sch
was conceived to handle unmeasurable pro
quantities, such as viable mass in the aerobic
tor. The control scheme makes use of a rea
measureable quantity, dissolved oxygen. The
between dissolved oxygen and the rest of the p
ess variables is represented by the oxygen up
rate (OUR), a key process quantity which re
oxygen utilization to microbial activities, thus
viding the necessary coupling with biomass
namics. The OUR is used to mechanize a nonli
state observer for the process variables. Event
this cascaded double observer is coupled to a
tal PID controller, thus forming an overall ou
controller based solely on dissolved oxygen m
urements. The scheme provides stable and accu
set-point regulation of the process biomass. A
sitivity analysis showed that the most sens

meter of the whole setting is the oxygen trans-
ate coefficient. (Moore-IVI)
-01433

**)WTH OF ENTEROMORPHA LINZA IN
'AGE EFFLUENT AND SEWAGE EFFLU-
-SEAWATER MIXTURES,**
ese Univ. of Hong Kong, Shatin. Dept. of
ogy.
. Chan, P. K. Wong, and S. L. Ng.
robiologia, Vol. 97, No. 1, p 9-13, November,
. 2 Fig, 2 Tab, 17 Ref.

riptors: *Enteromorpha, *Wastewater treat-
, *Seawater, *Water reuse, *Hong Kong, Sa-
, Nitrogen, Phosphorus, Limiting nutrients,
ier, Effluents, Algae, Protein.

romorpha linza (L.) J. Ag. was grown in full
gth sewage effluent, various combinations of
ge effluent and seawater, and in natural sea-
r. It was found that full strength sewage efflu-
vith a salinity of 14% supported best growth
ie alga. After a 12 day cultivation period,
th of E. linza in full strength sewage effluent
5% sewage effluent-seawater mixture showed
ld and 2-fold increase in fresh weight over
grown in natural seawater, respectively.
ke of PO4(3-)-P, NH3-N and NO3(-)-N by
of E. linza was extremely efficient in all tested
a. Data obtained from the experiments indicat-
at inorganic nitrogen rather than phosphorus
the limiting nutrient factor for growth of E.
in full strength sewage effluent and in other
ge effluent-seawater mixtures. NH3-N at con-
ations above 4.5 ppm was found to inhibit
e of NO3(-)-N in the same culture medium by
lgal cells. The fact that sewage grown E. linza
ined comparatively much higher protein con-
30.2% dry weight) than that grown in natural
ater (12.5% dry weight) leads to the conclu-
that sewage grown E. linza could serve as an
omically feasible feed for livestock in Hong
where the sewage is characterized by having
nity of approximately 14%. It is proposed that
nulticellular green alga is a suitable species to
the dual function of wastewater purification
gh the production of algal protein from
ge effluent having high salinities. (Author's
act)
-01475

**SURFACE INJECTION OF TREATED
AGE INTO A SALINE-WATER AQUIFER
ST. PETERSBURG, FLORIDA - WATER-
LITY CHANGES AND POTENTIAL FOR
OVERY OF INJECTED SEWAGE,**
ogical Survey, Tampa, FL.
Hickey, and G. G. Ehrlich.
nd Water, Vol. 22, No. 4, p 397-405, July-
st, 1984. 5 Fig, 7 Tab, 12 Ref.

riptors: *St. Petersburg, *Florida, *Subsur-
injection, *Wastewater disposal, Injection
, Water quality, Subsurface storage, Chloride,
r reuse, Dissolved oxygen, Denitrification,
ria.

city of St. Petersburg is testing subsurface
ion of treated sewage into the Floridian aqui-
a means of eliminating discharge of sewage
face waters and as a means of storing treated
ge for future nonpotable reuse. The injection
at the test site at the start of injection con-
d saline water with chloride concentrations
ng from 14,000 to 20,000 milligrams per liter
l). Treated sewage with a mean chloride con-
ation of 170 mg/l was injected through a
e well for 12 months at a mean rate of 4.7 x 10
e 5th cu ft/day. The volume of water injected
g the year was 1.7 x 10 to the 8th cu ft.
lved oxygen was contained in the sewage
to injection. Water removed from the injec-
zone during injection was essentially free of
en. Probable growth of denitrifying bacteria
thus, microbial denitrification, was suggested
cterial counts in water from two observation
that were close to the injection well. The
ne fraction of treated sewage in water from
located 35 ft and 733 ft from the injection
and open to the upper part of the injection zone stabilized at about 0.9 and 0.75, respectively. Chloride concentrations stabilized at about 1,900 mg/l in water from the well that was 35 ft from the injection well and stabilized at about 4,000 mg/l in water from the well that was 733 ft from the injection well. These and other data suggest that very little near injection-quality treated sewage would be recoverable from storage in the injection zone. (Author's abstract)
W85-01526

CONTROL SOLIDS IN COOLING WATER TO CUT MAKEUP REQUIREMENTS,
Rexnord, Inc., Milwaukee, WI.
R. Osantowski, and J. Kane.
Power, Vol. 128, No. 7, p 35-36, July, 1984. 1 Fig, 3 Tab.

Descriptors: *Wastewater treatment, *Reverse osmosis, *Electrodialysis, Cooling water, Recirculated water, Pilot plants, Water conservation, Total dissolved solids, Membrane processes.

A pilot program is described which demonstrated effectiveness of reverse osmosis and electrodialysis in increasing the cycles of concentration of recirculating water systems. Both systems were able to produce product water of higher quality than the makeup water currently used which comes from the Colorado River. Capital cost of a full scale treatment system with 75% product water recovery is estimated at $3.6 million. Annual operating cost would be about $822,000. The pilot study extended over nine months, and was conducted on two cooling towers, each producing 330 MW. The pilot scale blowdown treatment trains call for the collection of water for the two treatment processes from a return channel on the hot side of each cooling tower and pumping of the water into a 100 gal tank located outside the first of two vans. After chemicals are added to aid in floc formation, the waste is pumped to a 12000 gal clarifier. The clarified water passes through a pressure filter containing two layers of progressively smaller media. Pretreated water is split into two streams and pumped into the second van for removal of dissolved solids from the stream. The pilot study determined that a full size system could be operated at a minimum total dissolved solids rejection of 97% with 75% product water recovery. Cleaning of the membranes would be required once every three to four weeks. The major membrane foulants were inorganic chemicals; some organic fouling was also identified. (Baker-IVI)
W85-01538

WASTE APPLICATION TO LAND: THE LAND-USE ISSUE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
W. E. Cox.
Journal of Water Resources Planning and Management, Vol. 110, No. 3, p 270-284, July, 1984. 55 Ref.

Descriptors: *Land disposal, *Land use, *Legal aspects, Waste disposal, Institutional constraints, Zoning, Legislation, Lawsuits, Political constraints, Environmental effects.

Projects for disposal of wastes by application to land must be implemented within a complex framework of institutional constraints, with land-use controls a significant component. Controls imposed by local government are the most direct form of constraint and include zoning ordinances and local environment controls. Local governmental controls are especially significant where publicly owned land application projects are proposed outside the political boundaries of the owner since such location is likely to generate controversy. The applicability of local controls to extraterritorial projects varies under existing state enabling legislation and judicial determinations. A second relevant land-use constraint is the private lawsuit based on property rights. Landowners have the legal right to be free from unreasonable interference with the use and enjoyment of property. The rights of landowners adjacent to a land application facility therefore act as a constraint on offsite impacts and have some potential to provide a basis for legal prohibition of such facilities. Therefore land use controls, both publicly and privately enforced, are a determinant of the feasibility of land application proposals. (Author's abstract)
W85-01564

ADSORPTION IN WASTEWATER TREATMENT,
Warsaw Univ. (Poland). Inst. of Environmental Protection Engineering.
W. Adamski.
Effluent and Water Treatment Journal, Vol. 24, No. 6, p 225-229, June, 1984. 3 Fig, 1 Tab, 11 Ref.

Descriptors: *Wastewater treatment, *Adsorption, *Model studies, Granular activated carbon, Chemical reactions, Flow rate, Permeability coefficient, Ficks law.

Models identifying the most important phenomena that occur in the adsorption process on granular activated carbon beds are derived and verified. It is important that a precise definition of the mechanisms governing these phenomena includes the parameters describing the adsorbate, the absorbent, as well as the kinetics and dynamics of the process. Adsorption effects and diffusivity of adsorbate particles in the GAC bed are related to concentration gradient and hydraulics of flow. The models presented obey Fick's law, include a number of empirical formulae describing mass transfer in the bed, and are based on the hypothesis of a diffusion layer adjacent to the carbon surface. The dynamics of the adsorption process includes flow rate, mass transfer coefficient hydraulic diffusion coefficient (D-h) and coefficient of molecular diffusion (D-m). Adsorption effects and, also, diffusivity of adsobate particles are related to the concentration gradient which acts in the layer adjacent to the carbon grain surface and to the hydro-dynamic parameters of the process. It is suggested to adopt the root of the Dm/Dh ratio as a generalized criterion for estimating the sorption activity of GAC beds, which includes the percentage of efficient collisions between adsorbate particles and adsorbent surface. (Baker-IVI)
W85-01582

FACTORS AFFECTING THE EFFICIENCY OF CLINOPTILOLITE FOR REMOVING AMMONIA FROM WATER,
National Fishery Research Lab., La Crosse, WI.
L. L. Marking, and T. D. Bills.
Progressive Fish Culturist, Vol. 44, No. 4, p 187-189, October, 1982. 1 Tab, 17 Ref.

Descriptors: *Ammonia, *Fish farming, *Clinoptilolite, *Water pollution control, *Ion exchange, Resin, Zeolites, Nitrogen removal, Denitrification, Water temperature, Hardness, Hydrogen ion concentration.

Sublethal concentrations of ammonia in fish culture systems may inhibit growth or increase the susceptibility of fish to other stress conditions. Ion exchange methods appear to have the greatest potential for nitrogen removal from fish culture systems. Clinoptilolite, a natural zeolite and ion exchange resin, is efficient for removing ammonia from water. Ammonia removal efficiency was unaffected by variations in temperature, but decreased in hard waters, in waters of low and high pH, and with size of granule. Efficiency was optimum in water of 44 mg/L or less total hardness, near neutral pH, and for granules of 20 x 30 mesh size. Adsorptive capacity ranged from 3.42 to 9.12 mg of ammonia per gram of clinoptilolite. (Collier-IVI)
W85-01583

HYBRID WASTEWATER TREATMENT SYSTEM USING ANAEROBIC MICROORGANISMS AND REED (PHRAGMITES COMMUNIS),
National Space Technology Labs., NSTL Station, MS.
B. C. Wolverton.
Economic Botany, Vol. 36, No. 4, p 373-380, 1982. 3 Fig, 2 Tab, 36 Ref.

Descriptors: *Secondary wastewater treatment, *Anaerobic digestion, *Reeds, Aquatic plants, Wastewater treatment, Organic compounds, Sulfides, Costs.

A small hybrid wastewater treatment system consisting of a sludge collecting tank and digesting chamber which may contain a simple septic tank, a covered anaerobic lagoon or a high surface area anaerobic digester, in series with an anaerobic filter-reed treatment cell containing attached microbial filters and vascular aquatic plants was evaluated and compared with a similar plant-free system. Rocks or vinyl core media can be used for the bottom microbial filter with pea gravel or related material used on top to support the vascular aquatic plants. Wastewater from the anaerobic settling tank flows into the bottom of the filter cell then upward to near the top during the treatment process. The lower anaerobic portion of the filter continues the conversion of complex organics which started in the settling tank. The major gaseous end products of the anerobic digestion are carbon dioxide and methane. Complex organics are broken down into simpler compounds which can be assimilated by the reeds. Odorous volatile sulfides produced during anaerobic digestion are either removed by the plants or converted to nonvolatile sulfates by aerobic microogansims near the surface of the filter cell, thus clarifying the final effluent and completing the treatment process. This system promises to be cost effective in both installation and operation and more versatile than present systems. It can be installed in modules with additional units added in series when needed for expansion or advanced wastewater treatment. (Baker-IVI)
W85-01604

PERFORMANCE OF AN ANAEROBIC FILTER FOR PURIFICATION AND METHANE PRODUCTION FROM WASTE WATER OF A SUGAR REFINERY,
Zurich Univ. (Switzerland). Inst. of Plant Biology.
W. Tesch, K. Schneider, and R. Bachofen.
Process Biochemistry, Vol. 18, No. 1, p 34 and 36-37, January/February, 1983. 3 Fig, 2 Tab, 10 Ref.

Descriptors: *Anaerobic digestion, *Methane production, *Wastewater treatment, *Sugar refineries, *Food processing industry, *Food-processing wastes, Biological treatment, Biodegradation, Industrial plants, Substrates, Chemical oxygen demand.

For dilute wastewater with a relatively low content of suspended solids, such as that from food industries, degradation in anaerobic filters has advantages over degradation in a completely mixed reactor. Waste water from a Swiss sugar refinery plant (COD 6000 - 13 000 mg/l O2) was successfully treated in the laboratory with an anaerobic filter. Different support materials for the anaerobic filters were tested in batch type glass vessels. These were filled with complete culture medium and supplemented with Raschig glass rings and Leca porous clay particles of 2-5 and 10-20 mm diameter, respectively. The glass rings had no significant effect on the kinetics of growth as measured as methane formation. The presence of the clay particles greatly stimulated the methane production rate and reduced the lag phase until gas production started. The anaerobic filter was run with clay particles of 2-5 mm diameter at different hydraulic retention times. With a hydraulic retention time of 27 h, a COD removal of 75% or better was obtained with a maximum methane formation rate of 3.6 cu m/day. The treatment of the waste water by the anaerobic filter seems feasible for COD removal and methane production. (Collier-IVI)
W85-01605

GRANULAR ACTIVATED CARBON REGIONAL REACTIVATION PROJECT AT MANCHESTER, NEW HAMPSHIRE,
Manchester Water Works, NH.
R. Beaurivage.
Journal of the New England Water Works Association, Vol. 98, No. 2, p 112-137, June, 1984. 9 Fig, 5 Tab.

Descriptors: *Activated carbon, *Reactivation, *Manchester, *New Hampshire, Recycling, Wastewater treatment facilities, Waste recovery, Costs, Feasibility.

A study was made of costs and feasibility of using the Manchester fluid-bed furnace as a regional reactivation facility. The 40 MGD water treatment facility at Manchester uses one million pounds of granular activated carbon to remove taste and odor compounds and treat any organic upsurge from either the current Lake Massabesic supply or the future Merimak River supply. The most cost effective method of restoring the adsorptive effectiveness of the carbon is on-site reactivation. Various tables are shown presenting data on reactivation costs at the Manchester water works, granular activated carbon volumetric losses during the reactivation cycle; and test filter percent removals for total organic carbon, trihalomethanes and THMFP. A process flow diagram is offered of the GAC reactivation system. The approximate yearly reactivation requirement is listed for the twenty New England water utilities expected to make use of this reactivation system at Manchester. (Baker-IVI)
W85-01620

5E. Ultimate Disposal Of Wastes

ENVIRONMENTAL CONSTRAINTS OF SLUDGE APPLICATION,
Cook Coll., New Brunswick, NJ.
A. J. Higgins.
Transactions of the ASAE, Vol. 27, No. 2, p 407-414 and 418, March-April, 1984. 12 Fig, 3 Tab, 28 Ref.

Descriptors: *New Jersey, *Mercer County, *Sludge, *Digested sludge, *Land Disposal, Groundwater pollution, Nitrates, Heavy metals, Coliform, Zinc, Copper, Soil contamination.

Aerobically digested liquid sewage sludge was applied to Sassafras sandy loam soils, characteristic of the eastern coastal plain, for three consecutive years in Mercer County, New Jersey. Sludge was applied at rates of 0, 22.4, and 44.8 Mg of dry solids/ha in June of each year. Groundwater, soils, and crops were monitored for four years to establish the effects of high rates of sludge application. The results indicate that application of 22.4 Mg of dry solids/ha of sludge is the upper limit to ensure protection of the groundwater quality. Annual application of sludge for three years at 44.8 Mg of dry solids/ha resulted in gross contamination of the groundwater by nitrate-nitrogen and other salts. However, no contamination of the groundwater by heavy metals at either loading rate was detected. Fecal coliform levels were low throughout the duration of the study. Zinc and copper accumulated in the A soil horizon. However, no accumulation occurred in the B horizon. (Author's abstract)
W85-01185

SUBSURFACE DRAINAGE WATER QUALITY FROM LAND APPLICATION OF SWINE LAGOON EFFLUENT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. O. Evans, P. W. Westerman, and M. R. Overcash.
Transactions of the ASAE, Vol. 27, No. 2, p 473-480, March-April, 1984. 7 Fig, 6 Tab, 42 Ref.

Descriptors: *Land application, *Animal wastes, *Subsurface drainage, *Water quality, Path of pollutants, Nutrients, Nitrogen, Sprinkler irrigation, Surface runoff, Nitrates.

Livestock waste is often applied to land in excess of the nutrient needs of the crops. Water quality was monitored for a subsurface drainage (lateral flow) from small experimental plots receiving N from sprinkler-irrigated swine-lagoon effluent. Subsurface flow volumes and nutrient concentrations were observed for 20 months at the end of a 6-yr treatment period. Irrigation applied at the higher rate was about one-half of the normal precipitation and thus represented a signifi amount of moisture input. Nutrient transpor subsurface drainage resulted. Subsurface drain developed when infiltrated water contacted a permeable clay layer and moved laterally ab the clay rather than vertically to groundwa Surface runoff was generally less than 1 % (a was less than 3 %) while subsurface drainage nearly 25 % of the annual water input. F weighted NO3-N concentrations in subsur drainage were 6, 18 and 27 mg/L for N applica rates of 325, 650, and 1300 kg N/ha/y. This re sented N applications of 1:2:4 times the gener recommended application rate for coastal ber dagrass. The N applications at both the med and the high rates resulted in subsurface drain NO3-N concentrations which could contami water supplies based on the 10 mg/L drink water standard. (Collier-IVI)
W85-01196

HEAVY METALS EXTRACTABLE FROM CALCAREOUS SOIL TREATED WI SEWAGE SLUDGE,
King Saud Univ., Riyadh (Saudi Arabia). Dep Soil Science.
A. S. Mashhady.
Environmental Pollution (Series B), Vol. 8, No p 51-62, 1984. 1 Fig, 6 Tab, 23 Ref.

Descriptors: *Sludge disposal, *Land disp *Heavy metals, *Saudi Arabia, Copper, Man nese, Iron, Zinc, Calcareous soils.

The plant-available and extractable heavy metal a calcareous soil treated with sewage sludge f the Riyadh sewage treatment plant were inv gated. Glasshouse and incubation experim were carried out. Riyadh sewage sludge is ap ently a good source of elements for plant grow The plant-available and water-, hydrochloric a and DTPA-extractable metals found in slud treated soil were considerably higher than th found in soil alone. Fluctuations in the concen tions of chemically extractable metals with t were observed, indicating that more than one r tion process is operating and leading to more st forms. Cropland use of Riyadh digested sew sludge, on the calcareous soils commonly found Saudi Arabia is unlikely to give rise to the he metal problems associated with disposal on a soils. (Baker-IVI)
W85-01318

IMPACTS ON GROUNDWATER DUE LAND APPLICATION OF SEWAGE SLUD
Rutgers - The State Univ., New Brunswick, Dept. of Biological and Agricultural Engineer
A. J. Higgins.
Water Resources Bulletin, Vol. 20, No. 3, p 4 434, June, 1984. 13 Fig, 2 Tab, 16 Ref.

Descriptors: *Sludge disposal, *Land applicati *Groundwater pollution, Heavy metals, Colifor Water pollution control, Fertilizers, Soil conditi ers, Nutrients.

The effects and constraints on groundwater qua resulting from high application rates of wastew solids as a soil conditioner and fertilizer on Sa fras sandy loam soil were demonstrated. Aerobi ly digested, liquid sewage sludge was applied the soil at rates of 0, 22.4, and 44.8 Mg of solids/ha for three consecutive years between 1 and 1981. Annual application rates of 22.4 Mg dry solids/ha resulted in contamination of groundwater beneath the test plots and immedi ly offsite. Annual application rates of 44.8 mg dry solids/ha grossly contaminated the groundw er beneath the test plots and immediately offs Sludge application up to 44.8 Mg of dry solids did not contribute heavy metals to groundwa samples taken within the test plots nor 30.5 offsite. Total and fecal coliform levels were throughout the study and there appeared to be evidence of human coliform contamination due sludge application. Application of 22.4 Mg of solids/ha of sludge is the upper limit to ens protection of the groundwater quality on the studied. Application rates at or slightly below 2

of dry solids/ha are sufficient for providing
nutrients for the dent corn and rye cropping
m used. (Moore-IVI)
-01381

Water Treatment and Quality Alteration

RY'S LAW CONSTANTS FOR THE TRI-OMETHANES: EFFECTS OF WATER IPOSITION AND TEMPERATURE,
h Australia Engineering and Water Supply
., Salisbury. State Water Labs.
Nicholson, B. P. Maguire, and D. B. Bursill.
ronmental Science and Technology, Vol. 18,
, p 518-521, July, 1984. 2 Fig, 3 Tab, 11 Ref.

riptors: *Trihalomethanes, *Henry's law,
er temperature, *Temperature effects,
mical composition, Air stripping, Aeration,
le water, Chloroform, Bromoform, Dibro-
loromethane, Dichlorobromomethane.

y's law constant, H, for a compound can be
d to its change in concentration when
ed from solution by a stream of gas. Using a
ing vessel, H for each of the trihalomethanes
Ms) - chloroform, bromodichloromethane, di-
ochloromethane, and bromoform - was deter-
d in various waters which included distilled
, natural potable water samples of relatively
dissolved salts and organic matter, and water
ich humic acid had been added. The waters
ined a mixture of all four THMs, each at 200
g/L. The values obtained with distilled
were in excellent agreement with those ob-
for each THM individually in distilled
, indicating that the constant obtained is inde-
nt of the presence of other THMs; i.e., ideal
on behavior applies at these low concentra-
The values obtained were not affected by the
nce of other THMs or by water composition
were in good agreement with published and
cted values. In the range 10-1000 micro g/L
were independent of concentration. The
s obtained in distilled water can thus be used
design of treatment plant aeration facilities
HM removal. The temperature dependence of
s also established; the value of H doubles
ximately for each 10 degree C rise in temper-
(Collier-IVI)
01124

ODUCTION: EVALUATING THE BENE-AND POTENTIAL RISKS OF DISINFECT-S IN DRINKING WATER TREATMENT,
onmental Protection Agency, Washington,
Criteria and Standards Div.
Cotruvo.
onmental Health Perspectives, Vol. 46, p 1-6,
mber, 1982. 1 Fig, 4 Tab.

iptors: *Public health, *Drinking water,
nfection, Water treatment, Oxidation, Oxi-
Chlorine, Chloramine, Chlorine dioxide,
e, Chemical reactions, Degradation products,
lomethanes.

bly the most significant public health meas-
troduced within the last 100 years has been
troduction of chlorine widely as a disinfect-
r drinking water. The possibility that there
e some disbenefits to the addition of these
cals must be considered. It is essential to
fy any disbenefits and to minimize them
maximizing the beneficial side of the ques-
Three types of substances are examined: the
ectants themselves (chlorine, ozone, chlora-
, iodine or chlorine dioxide), the degradation
cts of those substances which are retained in
(chlorites, chlorates, hydrochlorites or io-
, and the chemical reaction products of those
potent chemically active substances with the
materials present in the water. Specific atten-
s directed toward the formation of trihalo-
nes and their control. (Baker-IVI)
01197

WATERBORNE OUTBREAK CONTROL: WHICH DISINFECTANT,
Health Effects Research Lab., Cincinnati, OH.
E. W. Akin, J. C. Hoff, and E. C. Lippy.
Environmental Health Perspectives, Vol. 46, p 7-12, December, 1982. 4 Fig, 4 Tab, 19 Ref.

Descriptors: *Public health, *Diseases, *Waterborne diseases, *Disinfectants, *Water treatment, Chlorination, Ozonation, Chlorine dioxide, Chloramines, Disinfection, Typhoid fever, Cholera, Amebiasis, Shigella, Salmonella, Hepatitis A.

Since the turn of the century, the benefits to public health from the disinfection of drinking water have been broadly recognized. In the United States, it was perhaps the single most important factor in controlling the waterborne disease typhoid fever and was important in limiting the number of cases of other diseases known to be capable of waterborne transmisison, i.e., cholera, amebiasis, shigellosis, salmonellosis, and hepatitis A. Even though modern treatment has eliminated water as a major vehicle of infectious disease transmission, outbreaks still occur; the annual number has been increasing since 1966. Interruption in chlorination or failure to achieve adequate levels of chlorine residual is the most often identified deficiency of the involved water supplies. Numerous studies have demonstrated the ability of chlorine to inactivate bacterial, viral, and protozoal pathogens when applied under proper conditions. However, the finding that chlorinated organics that are potentially carcinogenic are formed has prompted an evaluation of alternative disinfectants. The viable alternatives to chlorine currently under consideration for widespread use are ozone, chlorine dioxide, and chloramines. The effectiveness of each varies with the specific microorganisms and with experimental conditions, but generally ozone is the most potent of the three; chlorine dioxide is about the equivalent of free chlorine in the hypochlorous acid form but much more efficient than the hypochlorite form of free chlorine; and the chloramines are weaker biocides than hypochlorite. (Collier-IVI)
W85-01198

TOXICOLOGICAL EFFECTS OF CHLORINE DIOXODE, CHLORITE AND CHLORATE,
Ohio State Univ., Columbus. Dept. of Pharmacology.
D. Couri, M. S. Abdel-Rahman, and R. J. Bull.
Environmental Health Perspectives, Vol. 46, p 13-17, December, 1982. 25 Ref.

Descriptors: *Toxicity, *Chloride dioxide, *Chlorite, *Chlorate, *Disinfection, Drinking water, Disinfectants, Chlorination.

Review of the available literature obtained from both acute and chronic experiments utilizing rats, mice and chickens treated with ClO2, ClO2(-) and ClO3(-) in drinking water has demonstrated alterations in hematologic parameters in all species tested. The effects were usually dose related and marked changes occurred only at the higher dosages (up to 1000 mg/L). In chronic studies, rats have been given ClO2 at doses of up to 1000 mg/L, and NaClO2 or NaClO3 at up to 100 mg/L, in their drinking water for one year. Treatment groups receiving ClO2, ClO2(-) or ClO3(-) showed alterations in erythrocyte morphology and osmotic fragility; at higher dosages mild hemolytic anemia occurred. An examination of blood glutathione content and RBC enzymes involving glutathione formation showed a dose-related diminution of glutathione in chlorine compound treated groups. The higher oxidative capacity of the chlorine compounds resulting in the decreased erythrocytic glutathione might well be the principal biochemical event leading to the other hematological alterations. More recent data show that ClO2, ClO2(-) and ClO3(-) alter the incorporation of H3-thymidine into the nuclei of various organs of the rat. These data suggest the possibility of increased turnover cells of the gastrointestinal mucosa and inhibited DNA synthesis in several organs. In the latter category, most concern revolves around whether or not the apparent depression of DNA synthesis in the testes is associated with depressed spermatogenesis and reproductive toxicity in the male rat. (Author's abstract)
W85-01199

METABOLISM AND PHARMACOKINETICS OF ALTERNATE DRINKING WATER DISINFECTANTS,
New Jersey Medical School, Newark. Dept. of Pharmacology.
M. S. Abdel-Rahman, D. Couri, and R. J. Bull.
Environmental Health Perspectives, Vol. 46, p 19-23, December, 1982. 5 Tab, 11 Ref.

Descriptors: *Chlorination, *Disinfection, *Chlorine dioxide, *Toxicity, Disinfectants, Trihalomethanes, Chlorites, Chlorates, Chlorides, Isotope studies, Drinking water.

The chlorination of surface waters is known to elevate trihalomethanes; consequently, chlorine dioxide (ClO2) is being considered as an alternative disinfectant. The primary products resulting from ClO2 disinfection of waters are chlorites (ClO2(-)) and chlorates (ClO3(-)). Studies in rats revealed that ClO2 is converted to chloride (Cl(-)), ClO2(-) and ClO3(-). ClO2(-) and ClO3(-) are excreted as Cl(-), ClO2(-) and Cl(-), ClO2(-), ClO3(-), respectively. Radioactivity was rapidly absorbed from the gastrointestinal tract following the administration of Cl-36 labeled ClO2 orally, and the half-life for the elimination of Cl-36 from the rat was 44 hr, corresponding to a rate constant of 0.016/hr. After 72 hr, radioactivity was highest in plasma, followed by kidney, lung, and stomach. Cl-36 in plasma reached a peak at 2 hr and 1 hr after oral administration of labeled ClO2(-) and ClO3(-), respectively. Cl-36 excretion was greatest 24 hr after the administration of labeled ClO3(-), but in the case of labeled ClO2(-), the excretion probably represented saturation of the biotransformation and excretion pathway. A low activity in packed cells compared to plasma was detected in chlorate ingestion, rather than an even distribution in chlorite treatment. Chloroform determinations in rat blood after one year indicated that chloroform was significantly higher than control in the 100 and 1000 mg/L ClO2 groups. However, no significant values were observed in the 1 or 10 mg/L ClO2 and ClO2 metabolites group. ClO2 and its metabolites are eliminated from the body more rapidly than chlorine, and they do not appear to increase trihalomethane concentrations at low dosages. (Author's abstract)
W85-01200

ASSESSMENT OF MATERNAL TOXICITY, EMBRYOTOXICITY AND TERATOGENIC POTENTIAL OF SODIUM CHLORITE IN SPRAGUE-DAWLEY RATS,
Ohio State Univ., Columbus. Dept. of Pharmacology.
D. Couri, C. H. Miller, Jr., R. J. Bull, J. M. Delphia, and E. M. Ammar.
Environmental Health Perspectives, Vol. 46, p 25-29, December, 1982. 6 Tab, 9 Ref.

Descriptors: *Sodium chlorite, *Rats, *Toxicity, *Embryotoxicity, *Teratogenic potential, *Chlorine dioxide, Disinfectants, Embryonic growth stage, Chlorination, Drinking water.

The chlorite ion is formed in water from chlorine dioxide treatment. The maternal toxicity, embryotoxicity, and teratogenic potential of sodium chlorite were investigated in a pregnant rat model. The dam's body weight, food and water consumption were recorded at days 1, 8, 15 and 22 of gestation and the dams were treated on days 8-15 with sodium chlorite, 0.1%, 0.5% or 2% in drinking water or by intraperitoneal (IP) injection of 10, 20, or 50 mg/kg or by gavaging with 200 mg/kg. Delivered fetuses were weighed, measured and examined for soft tissue and skeletal malformations. Sodium chlorite, 20 or 50 mg/kg daily IP or gavaging with 200 mg/kg, caused vaginal and urethral bleeding. Doses of 10, 20 or 50 mg/kg daily IP caused 0, 50 and 100% mortality of dams, respectively. No deaths were caused by sodium chlorite in the drinking water, but the dams' body weight, and water and food consumption de-

creased during all treatments except 0.1% in the drinking water. Blood smears from the dams injected IP or drinking 2% sodium chlorite showed irregular, bizarre and ruptured erythrocytes. Injection of 10 or 20 mg/kg or drinking 2% resulted in decreased litter size and increased stillbirths and resorption sites. Drinking 0.1% or 0.5% sodium chloride did not produce any significant embryotoxicity. Teratogenic effects of sodium chlorite were not observed with any treatment. (Collier-IVI)
W85-01201

TOXICOLOGICAL EFFECTS OF CHLORITE IN THE MOUSE,
Massachusetts Univ., Amherst. Div. of Environmental Health.
G. S. Moore, and E. J. Calabrese.
Environmental Health Perspectives, Vol. 46, p 31-37, December, 1982. 3 Tab, 30 Ref. EPA grant R-805-993-020.

Descriptors: *Chlorite, *Chlorine dioxide, *Mice, *Toxicicty, *Disinfectants, Drinking water, Chlorination, Disinfection.

The use of oxidants such as chlorine dioxide and chlorite as water disinfectants may affect erythrocytes in certain high risk groups including persons with lowered glucose-6-phosphate dehydrogenase (G6PD) activity. Other potential high-risk groups include newborns and fetuses. The potential effect of chlorite on newborns may be exaggerated because newborns drink nearly three times as much liquid per unit of body weight than adults and they are hematologically sensitive to oxidants. When exposed to a maximum level of 100 ppm chlorine dioxide in their drinking water for 30 days, neither A/J or C57L/J mice (the A/J strain has 3 times the G6PD activity of the C57L/J strain) exhibited any hematologic changes. Chlorite exposure under similar conditions produced increases for red blood cells in osmotic fragility, mean corpuscular volume, and G6PD activity for both strains. Chlorite exposure at 100 ppm ClO2(-) in drinking water of pregnant A/J mice resulted in a significant decrease in the weight of pups at weaning and a lower average birth to weaning growth rate; there was no significant difference in litter size. Mice exposed to as much as 100 ppm sodium chlorite (NaClO2) in their drinking water for up to 120 days failed to demonstrate any histopathological changes in kidney structure, body weight changes, or weekly water consumption changes. (Collier-IVI)
W85-01202

HEALTH EFFECTS AMONG NEWBORNS AFTER PRENATAL EXPOSURE TO CLO2-DISINFECTED DRINKING WATER,
Massachusetts Univ., Amherst. Div. of Public Health.
R. W. Tuthill, R. A. Giusti, G. S. Moore, and E. J. Calabrese.
Environmental Health Perspectives, Vol. 46, p 39-45, December, 1982. 2 Fig, 3 Tab, 18 Ref.

Descriptors: *Disinfectants, *Chlorine dioxide, *Chlorates, *Chlorites, *Chicopee, *Holyoke, *Massachusetts, Drinking water, Chlorination, Public health, Epidemiology.

Chemical treatment of drinking water by chlorine dioxide (ClO2) is a likely alternative mode of disinfection. Two common by-products of the ClO2 disinfection of surface water are chlorate and chlorite. These oxidants may have negative health effects on certain high risk groups. Newborns, in particular, would seem to be at increased risk to red cell damage from oxidant stress. Infant morbidity and mortality records for Chicopee, Massachusetts, from the 1940's were compared to those records for Holyoke, MA, a geographically contiguous and socioeconomically similar community, for the same time period. Chicopee used high levels of chlorine dioxide and Holyoke used chlorination for potable water treatment. The highest levels of chlorine dioxide in the Chicopee water supply were added in 1945 with a monthly high of 0.56 ppm and a monthly average of 0.32 ppm. A statistically significant positive association was found between exposure of the mother to ClO2-treated water during pregnancy and prematurity of the newborn as assessed by the attending physician and by a greater weight loss after birth. The rates of jaundice, birth defects and fetal and neonatal mortality did not differ significantly between communities. (Collier-IVI)
W85-01203

SUBCHRONIC TOXICITY OF CHLORINE DIOXIDE AND RELATED COMPOUNDS IN DRINKING WATER IN THE NONHUMAN PRIMATE,
Health Effects Research Lab., Cincinnati, OH.
J. P. Bercz, L. Jones, L. Garner, D. Murray, and D. A. Ludwig.
Environmental Health Perspectives, Vol. 46, p 47-55, December, 1982. 5 Fig, 7 Tab, 20 Ref.

Descriptors: *Sodium chlorate, *Chlorine dioxide, *Chloramine, *Sodium chlorite, *Drinking water, *Toxicity, Disinfectants, Water supply, Monkeys.

Subchronic toxicities of ClO2, NaClO2, NaClO3 and NH2Cl were studied in the African Green monkeys (Cercopithecus aethiops). The chemicals were administered in drinking water during 30-60 days subchronic rising dose protocols. The only unexpected and significant toxic effect was elicited by ClO2; this chemical inhibited thyroid metabolism in the animals at a dose of ca. 9.0 mg/kg/day. A statistically significant decrease of serum thyroxine occurred after the fourth week of exposure to 100 mg/L concentration. The extent of thyroid suppression was dose dependent in each individual monkey, and was reversible after cessation of exposure. NaClO2 and NaClO3 failed to elicit similar effects in doses up to ca. 60 mg/kg/day. Also, NaClO4 or NH2Cl did not cause T-4 suppression in doses of 10 mg/kg/day. The selective thyroid effect of ClO2 was unexplained and it appeared to be paradoxical since ClO2 was rapidly reduced by the oral and gastric secretions to nonoxidizing species (presumably Cl(-)). No evidence of thyroid effects were detected in the serum of human volunteers who ingested approximately 1 mg/L of ClO2 in drinking water as a result of routine use in the community water treatment process. Sodium chlorite induced dose-dependent oxidative stress on hematopoesis, causing decreased hemoglobin and red cell count and increased methemoglobin content. At the same time, serum transaminase (SGPT) levels showed significant subclinical elevation. The hematologic effect of NaClO2 rebounded during exposure indicating compensatory hemopoietic activity taking effect during oxidative stress. Sodium chlorate and chloramine did not induce detectable hematologic changes in the animals. (Author's abstract)
W85-01204

CONTROLLED CLINICAL EVALUATIONS OF CHLORINE DIOXIDE, CHLORITE AND CHLORATE IN MAN,
Ohio State Univ., Columbus. Dept. of Pharmacology.
J. R. Lubbers, S. Chauan, and J. R. Bianchine.
Environmental Health Perspectives, Vol. 46, p 57-62, December, 1982. 3 Tab, 20 Ref.

Descriptors: *Chlorine dioxide, *Chlorite, *Chlorate, *Public health, Disinfectants, Drinking water, Health effects, Human pathology.

To assess the relative safety of chronically administered chlorine water disinfectants in man, a controlled study was undertaken. The clinical evaluation was conducted in the three phases common to investigational drug studies. Phase I, a rising dose tolerance investigation, examined the acute effects of progressively increasing single doses of chlorine disinfectants to normal healthy adult male volunteers. Phase II considered the impact on normal subjects of daily ingestion of the disinfectants at a concentration of 5 mg/L for twelve consecutive weeks. Persons with a low level of glucose-6-phosphate dehydrogenase may be expected to be especially susceptible to oxidative stress; therefore, in Phase III, chlorite at a concentration of 5 mg/L was administered daily for twelve consecutive weeks to a small group of potentially at-risk glu-

cose-6-phosphate dehydrogenase-deficient
jects. Physiological impact was assessed by e
tion of a battery of qualitative and quant
tests. The three phases of this controlled d
blind clinical evaluation of chlorine dioxide
potential metabolites in human male voluntee
jects were completed uneventfully. There we
obvious undesirable clinical sequellae noted b
of the participating subjects or by the obse
medical team. In several cases, statistically s
cant trends in certain biochemical or physiol
parameters were associated with treatment;
ever, none of these trends was judged to
physiological consequence. One cannot rul
the possibility that, over a longer treatment p
these trends might indeed achieve proportio
clinical importance. However, by the absen
detrimental physiological responses within
limits of the study, the relative safety of oral
tion of chlorine dioxide and its metabolites,
rite and chlorate, was demonstrated. (Autho
stract)
W85-01205

**REACTION PRODUCTS OF AQUATIC HU
SUBSTANCES WITH CHLORINE,**
North Carolina Univ. at Chapel Hill. Dep
Environmental Sciences and Engineering.
J. D. Johnson, R. F. Christman, D. L. Norwo
and D. S. Millington.
Environmental Health Perspectives, Vol. 46,
71, December, 1982. 5 Fig, 4 Tab, 5 Ref.
grant R-804430.

Descriptors: *Chlorination, *Humic acids, *T
lomethanes, *Chlorinated hydrocarbons, Suc
acid, Fumaric acid, Maleic acid, Gas chromat
phy, Mass spectroscopy, Fate of pollutants, D
ing water.

A major concern of the chlorination of aq
humic materials is the ubiquitous productio
trihalomethanes. A large number of other chl
ated organic compounds, however, have
shown to be formed by chlorine's reaction
humic substances. In this study, humic ma
was concentrated from a coastal North Car
lake and chlorinated at a chlorine-to-carbon
ratio of 1.5 at pH 12. A high pH was necessar
complete dissolution of the humic material an
production of adequate quantities of oxidation
chlorination products for extraction, separ
and mass spectrometric identification. After
centration in ether, samples were methylated,
rated with a 50-m OV-17 glass capillary colun
a 25 m SP-2100 fused-silica column and ident
A Hewlett-Packard 5710A gas chromatog
interfaced to a VG Micromass 7070F doubl
cusing mass spectrometer was used. Low re
tion, accurate mass measurements were made
a combined EI-CI source. The ability to do
resolution, accurate mass measurements made
sible a rapid scan function necessary for capi
column gas chromatography. Accurate mass m
urements allowed increased confidence in the
tification of compounds, most of which are
available as standards. The products identifie
these studies were chlorinated aliphatic stra
chain acids dominated by di- and trichlorac
acid and the chlorinated dicarboxylic acids: suc
ic, fumaric and maleic acids. Chlorinated
unchlorinated aliphatic mono- and dicarbo
acids and unchlorinated polycarboxylic aron
acids comprise the remaining bulk of the c
pounds identified. (Author's abstract)
W85-01206

**NONVOLATILE ORGANIC COMPOUNDS
TREATED WATERS,**
Water Research Centre, Medmenham (Engla
Medmenham Lab.
C. D. Watts, B. Crathorne, M. Fielding, and S.
Killops.
Environmental Health Perspectives, Vol. 46, p
99, December, 1982. 8 Fig, 3 Tab, 49 Ref.

Descriptors: *Organic compounds, *Chlorina
*Ozonation, *Treated water, Fulvic acids, Hu
acids, Disinfection, Gas chromatography, M

oscopy, Isolation, High performance liquid
atography, Freeze drying, Extraction.

the past decade much information has been
hed on the analysis of organics extracted
reated water. Certain of these organics have
hown to be by-products of the chlorination
ction process and to possess harmful effects
h concentrations. This has resulted in in-
d interest in alternative disinfection process-
rticularly ozonation. The data on organics
en largely obtained by using gas chromatog-
mass spectrometry, which is only capable of
ing, at best, 20% of the organics present in
l water. Research in key areas such as muta-
y testing of water and characterization of
ation and ozonation by-products has em-
ed the need for techniques suitable for analy-
the remaining nonvolatile organics. Several
ds for the isolation of nonvolatile organics
een evaluated and, of these, freeze-drying
ed by methanol extraction appears the most
e. Reverse-phase HPLC was used for sepa-
of the methanol extract, but increased reso-
for separation of the complex mixtures
is desirable. In this context, high resolution
xclusion chromatography shows promise.
terization of separated nonvolatiles is possi-
the application of state-of-the-art mass spec-
ric techniques. Results obtained by these
ques have shown that the nonvolatile organ-
ion of chlorinated drinking water consists of
discrete compounds. Among these, some of
lorinated compounds are almost certainly
ducts of disinfection. Studies of the by-prod-
ozonation of fulvic and humic acids isolated
iver waters have indicated a similar propor-
f nonvolatile organics. Further, ozonation
sult in the release of compounds that are
d in the macromolecules. (Author's abstract)
1208

TION PRODUCTS OF CHLORINE DIOX-

pal Environmental Research Lab., Cincin-
H. Drinking Water Research Div.
Stevens.
nmental Health Perspectives, Vol. 46, p
), December, 1982. 6 Fig, 5 Tab, 39 Ref.

ptors: *Chlorine dioxide, *Trihalomethanes,
inated hydrocarbons, *Water treatment,
g water, Chlorination.

n over the presence of trihalomethanes and
hlorinated by-products in chlorine-disinfect-
king water has led to extensive investiga-
f treatment options for controlling these by-
ts. Among these treatment options is the use
ternative disinfectant such as chlorine diox-
though chlorine dioxide does not react to
e trihalomethanes, considerable evidence
ist that chlorine dioxide, like chlorine, will
e other organic by-products. The literature
es chlorinated and nonchlorinated deriva-
ncluding acids, epoxides, quinones, alde-
disulfides, and sulfonic acids that are prod-
reactions carried out under conditions that
tly different from those experienced during
g water treatment. Evidence is beginning to
, however, that some by-products in these
ies may be produced. Certain specific vola-
ehydes and halogenated derivatives as de-
d by the total organic halogen parameter
ong those by-products that have been meas-
Author's abstract)
209

NIC N-CHLORAMINES: CHEMISTRY
OXICOLOGY,
ominion Univ., Norfolk, VA. Dept. of
al Sciences.
cully, Jr., and M. A. Bempong.
nmental Health Perspectives, Vol. 46, p
, December, 1982. 2 Fig, 1 Tab, 22 Ref.

ptors: *N-Chloramines, *Chlorination,
nated hydrocarbons, *Chemical analysis,
ology, N-chloropiperidine, N-chlorodiethy-
Ames test, Hamsters, Mice, Fate of pollut-

On chlorination in water, amino compounds are converted rapidly and essentially quantitatively to their N-chloro derivatives. Organic N-chloramines have not been identified in chlorinated water; this may be an indication of a low aqueous stability. Spontaneous decomposition and photodecomposition influence the decomposition of solutions of N-chloropiperidine and N-chlorodiethylamine. A new method for their identification in solution was developed which involves reaction of organic N-chloramines with arenesulfinic acid salts; the method gives high yield of stable arenesulfonamides. N-chloropiperidine is mutagenic by Ames assay in Salmonella typhimurium strain TA 100 and does not require metabolic activation as indicated in a total body fluids analysis using C57BL/J6 mice; it is toxic to the mice with an LC50 of approximately 350 mg/kg. N-Chloropiperidine was subjected to a modified in vitro cell transformation assay using diploid fibroblast cells from Syrian hamster fetuses. A maximum number of foci of 4 per dish was observed at a seeding of 5000 cells/60 mm dish. Under similar conditions as a positive control assay, N-methyl-N'-nitro-N-nitrosoguanidine induced foci ranged from 4 to 7 per dish. The fact that N-chloropiperidine is mutagenic and transforms mammalian cells in vitro is not a basis on which to make a health assesment on compounds that have not yet been specifically identified. (Collier-IVI)
W85-01210

MUTAGENIC ACTIVITY ASSOCIATED WITH BY-PRODUCTS OF DRINKING WATER DISINFECTION BY CHLORINE, CHLORINE DIOXIDE, OZONE AND UV-IRRADIATION,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands).
For primary bibliographic entry see Field 5C.
W85-01216

PRESENCE, INTRODUCTION AND REMOVAL OF MUTAGENIC ACTIVITY DURING THE PREPARATION OF DRINKING WATER IN THE NETHERLANDS,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands). Chemical Biological Div.
H. J. Kool, C. F. van Kreijl, E. de Greef, and H. J. van Kranen.
Environmental Health Perspectives, Vol. 46, p 207-214, December, 1982. 9 Fig, 2 Tab, 15 Ref. Netherlands Cancer Society grant RID 80-1.

Descriptors: *Netherlands, *Drinking water, *Mutagenicity, *Water treatment, Mutagens, Ames test, Municipal water, Chlorination, Ozonation, Activated carbon, Water pollution effects.

A survey of the presence of mutagenic activity in drinking water of 18 cities in the Netherlands revealed that in drinking water of 13 cities mutagenic activity could be demonstrated. The activity was detected in the Ames test after concentrating the organic mutagens with a XAD-4/8 procedure. Dose-related responses were observed with concentrates corresponding to 0.5 to 3.0 liters of drinking water. A study of the changes in mutagenic activity during the preparation of drinking water in a few waterworks showed that breakpoint chlorination, transport chlorination and post chlorination increased the mutagenic activity, while ozonation only reduced the activity with metabolic activation. When adsorption on activated carbon powder was used, a certain reduction of mutagenic activity was observed. The use of activated carbon filters, however, removed the activity completely. The majority of organic mutagens present in drinking water concentrates were shown to be nonvolatile and relatively stable and probably consist of compounds with a molecular weight in the order of 200. These mutagens are not identical to the organics identified up till now in drinking water by standard gas chromatography/mass spectrometry analysis. Finally, a group of organic mutagens, which adsorbs only at pH 2-3 on XAD-4/8 (acid fraction), could be demonstrated in Ames-positive drinking waters. (Author's abstract)
W85-01217

USE OF BIOLOGICAL ASSAY SYSTEMS TO ASSESS THE RELATIVE CARCINOGENIC HAZARDS OF DISINFECTION BY-PRODUCTS,
Health Effects Research Lab., Cincinnati, OH.
R. J. Bull, M. Robinson, J. R. Meier, and J. Stober.
Environmental Health Perspectives, Vol. 46, p 215-227, December, 1982. 3 Fig, 7 Tab, 27 Ref.

Descriptors: *Disinfectants, *Carcinogenicity, *Biological assays, *Risks, *Drinking water, *Toxicology, *Byproducts, Miami, Florida, New Orleans, Louisiana, Ottumwa, Iowa, Philadelphia, Pennsylvania, Seattle, Washington, Tumorogenicity, Chlorination, Ozonation, Humic acids, Fulvic acids, Mutagenicity, Water pollution effects, Municipal water, Water treatment.

Concentrated samples of organic material isolated from the finished drinking water supply of 5 U.S. cities were administered in mouse skin tumor initiation/promotion studies. Samples were obtained from Miami (groundwater containing large quantities of natural organic chemicals), New Orleans (surface water source impacted by industrial wastes), Ottumwa (surface water contaminated by agricultural runoff), Philadelphia (surface water impacted by municipal waste), and Seattle (a pristine surface water). Non-statistically significant increased tumor incidence and reduction of mean time to first tumor in 4 of assays and significant results in the assay of the Ottumwa sample demonstrated the presence of tumor initiating activity in at least the Ottumwa sample. In further experiments, water disinfected by chlorination, ozonation or combined chlorine resulted in a significantly greater number of papillomas when compared to nondisinfected water. When water obtained from the Ohio River at different times of the year was assayed, no evidence of increased initiating activity was observed with any disinfectant. Humic and fulvic acids obtained from two surface waters as well as the commercially obtained humic acid were without activity in an Ames test using TA 1535, TA 1537, TA 1538, TA 98 or TA 100 strains of S. typhimurium. Following treatment with a 0.8 molar ratio of chlorine (based on carbon) significant mutagenic activity was observed with all humic and fulvic acid samples. Comparisons of the specific mutagenic activity of the chlorinated products suggests that the commercial material might provide a useful model for studying health hazards associated with disinfection reaction by-products. (Collier-IVI)
W85-01218

WATER SUPPLIES IN RHODE ISLAND PAST TO PRESENT,
Maguire (C.E.), Inc., Portland, ME.
J. L. Keaney.
Journal of the New England Water Works Association, Vol. 98, No. 1, p 23-37, March, 1984.

Descriptors: *Water supply development, *Rhode Island, *History, Planning, Water management, Administration, Water conveyance.

Water systems are described for the communities of Woonsocket, Pawtucket, Providence, East Providence, Westerly, and Newport. In the early settlements in these areas, water for daily needs was carried to houses and shops from clear wells, springs, and brooks by apprentices and young boys. History shows that in 1772, the General Assembly granted charters of incorporation to three water companies in Providence. Each company supplied a section of town west of the Moshassuck River through a wooden network of pipes. Through the mid 1880's towns gradually bought out water companies and took control of their own water supplies. An organization of New England water works managers was established in 1882. Each of the six communities has continued to progress in the development of their individual water systems and the story of each of the six is detailed. Currently there are over 500 public water systems in Rhode Island. (Baker-IVI)
W85-01314

FUTURE OF CROSS-CONNECTION CONTROL,

University of Southern California, Los Angeles. Foundation for Cross-Connection Control and Hydraulic Research.
E. K. Springer.
Journal of the New England Water Works Association, Vol. 98, No. 1, p 38-47, March, 1984.

Descriptors: *Water systems, *Administration, *Cross-connection control, Training, Legal aspects, Public health, Backflow prevention.

In some states the Health Department has in effect asked the local water purveyor to assume the responsibility for the cross-connection control program for both system and internal protection. In other states several of the water agencies have negotiated an arrangement whereby for pro-rata funding from the water agency the County Health Department administers the entire program. Items necessary for a cognizant agency to exist include a properly executed legal document establishing a cross-connection control program for the agency; a set of operating rules established by the agency under the authority of the legal document which calls for backflow prevention devices under certain conditions and that these devices must be tested in situ at least once a year and maintained as necessary; a list of approved backflow prevention assemblies where the approval is based upon both a laboratory and a field evaluation program; a list of certified backflow prevention device testers who are trained and certified to perform any necessary maintenance and the in situ annual test; and an educational program which assists in the local training of the device testers so that they may become certified and explain to the technical and lay people who have to interface with the program just what the program is all about. (Baker-IVI)
W85-01315

INTEGER PROGRAMMING ANALYSIS OF THE REGIONALIZATION OF LARGE WASTEWATER TREATMENT AND COLLECTION SYSTEMS,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
J. P. Leighton, and C. A. Shoemaker.
Water Resources Research, Vol. 20, No. 6, p 671-681, June, 1984. 8 Fig, 2 Tab, 37 Ref.

Descriptors: *Optimization, *Integer programming analysis, *Regionalization, *Wastewater facilities, *Western Suffolk County, *New York, Wastewater treatment, Wastewater collection, Cost analysis, Political aspects, Feasibility.

An optimization procedure is described that can serve to identify attractive regionalization plans for large wastewater treatment and collection systems. Potential expansion of facilities in Western Suffolk County, Long Island, New York is considered. A mixed integer programming approach is utilized. Each system element cost, taken as a function of wastewater flow, is represented by a linear variable cost plus a fixed cost. The objective is to minimize total cost while ensuring that all wastewater flow generated is treated. Political and administrative feasibility and the location of effluent discharge constrain the model. The Long Island problem is too large to be solved with a standard formulation of wastewater network as a mixed integer programming problem. To improve computational efficiency, additional constraints are introduced on the minimum flow in each pipe and on the number of pipes leaving each node. Network configurations obtained for Western Suffolk County show that limiting development plans to 201 regions is not cost effective. Regional solutions indicate a general trade-off between lower costs for coastal discharge and increased groundwater recharge. (Author's abstract)
W85-01340

LAMELLAR FLOWPACK CLARIFIERS FOR SEDIMENTATION (SCHRAGKLARER FUR DIE SEDIMENTATION),
Gebrueder Sulzer A.G., Winterthur (Switzerland). Wasser- und Abwassertechnik.
For primary bibliographic entry see Field 5D.
W85-01361

STABILITY IN WATER OF A NEW CHLORAMINE DISINFECTANT AS A FUNCTION OF PH, TEMPERATURE, AND WATER QUALITY,
Auburn Univ., AL. Dept. of Chemical Engineering.
S. D. Worley, and H. D. Burkett.
Water Resources Bulletin, Vol. 20, No. 3, p 365-368, June, 1984. 2 Fig, 9 Ref.

Descriptors: *Disinfection, *Chloramines, *Calcium hypochlorite, *Stability, Hydrogen ion concentration, Water temperature, Water quality, Agent I.

The stabilities in water and dry storage of two solid-state disinfectants (3-chloro-4,4-dimethyl-2-oxazolidinone, agent I, and calcium hypochlorite) have been compared under a variety of conditions. Variables in the study included pH, temperature, and water quality. Agent I is considerably more stable in dry storage and in water, especially at pH 4.5 and 7.0, than is calcium hypochlorite. This is true for solutions of the two compounds in sterile, distilled, deionized, demand-free water or in a synthetic water containing heavy organic load. Prior work in these laboratories concerning use of agent I as a disinfectant for lake water in a laboratory-scale treatment plant had suggested that agent I has considerable potential for use as an alternative to chlorine gas for water disinfection. The present work suggests that agent I is of sufficient stability to be of use as a solid-state disinfectant for swimming pools and for potable water for remote areas. (Author's abstract)
W85-01374

TENDENCY OF A NEW WATER DISINFECTANT TO PRODUCE TOXIC TRIHALOMETHANES,
Auburn Univ., AL. Dept. of Chemistry.
S. D. Worley, H. D. Burkett, and J. F. Price.
Water Resources Bulletin, Vol. 20, No. 3, p 369-371, June, 1984. 1 Tab, 11 Ref. USAF contract DAMD17-82-C-2257.

Descriptors: *Trihalomethanes, *Disinfection, *Agent I, Chloramines, Calcium hypochlorite, Organic matter, Solar radiation, Toxicity, Water storage.

A new organic N-chloramine disinfectant (3-chloro-4,4-dimethyl-2-oxazolidinone, agent I) has been compared with calcium hypochlorite as to its tendency to react with organic matter in water to produce toxic trihalomethanes. Agent I reacts much less readily with organic demand than does calcium hypochlorite. This study shows that agent I should be safe to use as a disinfectant for water containing appreciable organic load in either sunlight or darkness. On the other hand, calcium hypochlorite may not be a satisfactory disinfectant from the toxicity standpoint for water which contains organic load which must be stored for extended time periods in either sunlight or darkness. (Author's abstract)
W85-01376

RELATIONSHIPS BETWEEN THE POLLUTANTS IN THE SEDIMENTS AND IN THE WATER OF THE DELAWARE AND RARITAN CANAL,
Rutgers - The State Univ., Piscataway, NJ. Coll. of Engineering.
For primary bibliographic entry see Field 5B.
W85-01413

TREATMENT OF FERRUGINOUS GROUNDWATERS FOR RIVER AUGMENTATION IN THE WALLER'S HAVEN, EAST SUSSEX,
D. Barnhoorn, and D. C. Tye.
Journal of the Institution of Water Engineers and Scientists, Vol. 38, No. 3, p 217-230, June, 1984. 3 Fig, 4 Tab, 7 Ref.

Descriptors: *Flow augmentation, *Groundwater, *Water treatment, *Waller's Haven, *England, Water supply development, Iron, Continuous filtration, Dissolved air flotation, Capital costs, Operating costs.

Low-flow river augmentation for water su
Bexhill has been practiced in the Waller's
catchment in East Sussex for about 30 yea
ruginous groundwater is abstracted from th
ings Beds strata at three sites, and is discha
the summer to streams without any prio
ment. An extensive program of water tr
trials was carried out in an attempt to id
process that would be economically viable
reduction in iron content of the groun
before its use for low-flow augmentation. T
processes tested that would be suitable for
ing the iron content were continuous filtrat
dissolved air flotation. A detailed appraisa
relative capital and operating costs of a riv
mentation scheme for iron reduction, and a
providing for the transmission by pipeline
treated groundwater to the water treatment
downstream at Hazards Green, demonstrat
the augmentation scheme would be
(Moore-IVI)
W85-01522

**POTABLE WATER: COST EFFECTIVE T
MENT AND CONTROL,**
C. B. Buckley.
Journal of the Institution of Water Engine
Scientists, Vol. 38, No. 3, p 259-271, June,
Fig, 4 Tab, 10 Ref, 1 Append.

Descriptors: *Water treatment, *Cost a
*Potable water, Water quality control, Op
tion, Monitoring, Chemical treatment, Fil
Backwash, Maintenance, Planning.

An approach is presented for optimizing th
of potable water treatment and quality con
the rationalization of the process through
sequence of abstraction, storage, treatme
subsequent distribution. The setting of pe
ance indicators at all stages of the treatmen
ess is of paramount importance. The additio
treatment chemicals must be precisely cont
and their point of application optimized.
performance, including the backwashing
must be the subject of continuing appra
ensure that operational and quality objecti
optimized. Planning maintenance and cali
schedules are essential if all equipment is
operated and used with the necessary deg
confidence. Treatment chemical and allied
als should be placed on a central purchas
tract. Monitoring can be extremely cost-ef
in terms of treatment and process control,
essential for managing resources and pla
(Moore-IVI)
W85-01525

**COOLING-WATER TREATMENT FOR
TROL OF SCALING, FOULING, CORRO**
S. D. Strauss, and P. R. Puckorius.
Power, Vol. 128, No. 6, p S1-S24, June, 19
Fig, 15 Tab, 31 Ref.

Descriptors: *Cooling water, *Corrosion, *
treatment, *Scaling, *Fouling, Bacteria, F
Dispersants, Sludge, Heat exchangers, Biof
Surfactants, Chemical reactions.

The essence of cooling-water systems cons
plant heat exchange equipment and the wat
passes through it to remove heat from p
fluids. In once-through systems, the cooling
passes through the heat exchange equipmen
once. Such systems are the simplest, and are
extensive use in certain areas. The trend is, h
er, away from such systems as they contar
and use large volumes of water and their pro
are difficult to treat effectively and economi
Both closed and open recirculation systen
defined. Problems of deposit formation are u
divided into two types, fouling and scale. Ca
carbonate is by far the most common scale
in cooling water systems, resulting from the
down of calcium bicarbonate. Scale also
from calcium sulfate, calcium phosphate and
nesium silicate. Preventive measures for ca
scale are discussed. Biological problems ar
ated by both large and microscopic organisms
former is the fouling that results from large

animal organisms, and usually affects steam-densing units. Biological fouling problems asso-ed with desulfovibrio, nitrifying bacteria, and gus are considered. Control methods include use of chemical treatment, thermal backwash screening or other mechanical means. Corro-can be controlled through the use of various bitors. (Baker-IVI)
5-01537

ERACTION BETWEEN HUMIC SUB-NCES AND SOME TRACE METALS IN AGULATION,
rsaw Univ. (Poland). Inst. of Environmental tection Engineering.
Swiderska-Broz.
uent and Water Treatment Journal, Vol. 24, 6, p 218-224, June, 1984. 6 Fig, 4 Tab, 20 Ref.

criptors: *Humic acids, *Heavy metals, *Co-ation, *Water treatment, Chemical reactions, dity, Lead, Nickel, Zinc, Copper, Hydrogen concentration, Ferric sulfate, Alum.

presence of humic substances in natural waters aminated with heavy metal ions is responsible the formation of metal-organic complexes. To olish removal of lead, copper, zinc and nickel by coagulation as a function of pH, experi-ts were made involving model solutions and er samples from the Odra River containing er natural concentrations of these ions or addi-of these ions and also humic acids. Metal-nic complexes were easily formed for lead and per, whereas the efficiency of these reactions zinc and nickel proved minimum. The influ-of organic ligands was greatest at pH 6.0. n and ferric sulfate were used as coagulants were dosed to water after pH adjustment ing from pH 3.0 to 12.0. Removal of colored er obtained by alum coagulation is higher than by ferric sulfate coagulation. Ferric sulfate luces colored chelates and cannot be recom-ded for coagulation, when humic acids are ent. Both processes tend to remove colloidal sparingly soluble fractions of humic acids. +) and Fe(3+) ions are removed together humic acids. (Baker-IVI)
-01581

DAMENTALS OF CHLORINATION,
sachusetts Metropolitan District Commission, hborough. Water Div.
I. Foss.
nal of the New England Water Works Asso-on, Vol. 98, No. 2, p 189-196, June, 1984. 5

criptors: *Chlorination, *History, *Water ment. Drinking water, Disinfection, Safety, rine, Chemical reactions.

rination of public water supplies to prevent rborne disease from spreading was used as an gency measure since about 1850. The first npt to chlorinate a public water supply as al practice was in 1909. Due to the instability e storage of the hypochlorite used, the prac-of chlorination did not grow until about 1912, n the first facilities for feeding gaseous chlo-were developed. Beginning in 1915, the use of ramines as a primary disinfectant grew when it recognized that they provided a more stable ual form and reduced the taste and odors ciated with free chlorine. Both free and com-d chlorine residuals can be determined by vari-methodologies. Chlorine in commerce is a fied gas under pressure shipped in containers ng both a liquid and gaseous phase. Chlorine ainers should be handled carefully during ing and unloading and should be stored in a dry place which is not subject to intense heat ces. When long pipe lines for chlorine must be it must be remembered that chlorine expands % in volume for every degree of temperature ease. After the chlorine solution leaves the gas enser or metering device it can be transported ugh rubber lined steel pipe, Schedule 80 PVC, bber hose to the discharge point. Maintenance lorination equipment is of the utmost impor-e to assure uninterrupted operation, operator safety, and protection of the treatment facility. (Baker-IVI)
W85-01622

5G. Water Quality Control

REGIONAL TENSIONS COMPLICATE SEARCH FOR AN ACID RAIN REMEDY,
R. L. Stanfield.
National Journal, Vol. 16, No. 18 p 860-863, May 5, 1984. 1 Fig.

Descriptors: *Acid rain, *Political aspects, *Economic aspects, Planning, Water pollution prevention, Electric power industry, Coal, Decision making, Sulfur, Air pollution, Utilities, Environmental Protection Agency.

Regional tensions about the source of acid rain and who should pay to control it run high. The Midwest appears to be the source of the acid rain that falls on New England, but alleviating the problem could either be disastrous for the Midwest's economy or expensive for the South and West, which neither contribute to New England's problem nor are now victims themselves of acid rain. Economic tensions occur in part because the high sulfur coal burned by the midwestern utilities is mined in the Midwest. A switch to low sulfur coal, mined mostly in the West, could boost that region's economy at the expense of the Midwest. The cost of reducing sulfur emissions will be huge - as high as $5 billion a year, regardless of who pays. Many politicians are urging for additional research before reaching any conclusions about the appropriate solution. The costs versus the benefits of reducing acid rain are the subject of much debate. Industrial lobbyists, who oppose controls, say they are not sure a problem exists. The American Public Power Association supports controls because it believes a federal response to acid rain is inevitable and it wants to participate in drafting any control program. One approach attracting much attention in the House reflects the concerns of the Midwest. First, the plan would help the polluters pay for reducing emissions by setting up a trust fund supported by a tax on electricity that is generated in the 48 contiguous states. Second, there would be an attempt to preserve the high sulfur coal industry by mandating devices to remove sulfur rather than permitting polluters to switch fuels. House bill (HR 5314) would tackle emission reduction in two phases. Prior to 1990, the 50 biggest sulfur emitters among electric utilities, located in 14 midwestern and southern states, would have to reduce emissions by 6 million tons by installing filtering devices called scrubbers which would allow them to continue to burn high sulfur coal. From 1990-1995 the 48 contiguous states would have to reduce sulfur emissions from all sources by another four million tons. (Baker-IVI)
W85-01178

EROSION OF EARTH COVERS USED IN SHALLOW LAND BURIAL AT LOS ALAMOS, NEW MEXICO,
Los Alamos National Lab., NM.
J. W. Nyhan, G. L. Depoorter, B. J. Drennon, J. R. Simanton, and G. R. Foster.
Journal of Environmental Quality, Vol. 13, No. 3, p 361-366, July-September, 1984. 5 Fig, 2 Tab, 19 Ref. DOE contract W-7405-Eng.

Descriptors: *Underground waste disposal, *Radioactive wastes, *Soil erosion, *Los Alamos, *New Mexico, Rainfall, Infiltration, Leaching, Universal Soil Loss Equation, Vegetation.

The most popular method currently in use for disposing of low-level radioactive wastes is shallow land burial. After waste materials are placed in the trenches, current management practices range from simple backfilling of the trench to more elaborate installation of multilayered trenchcaps and revegetation programs. The most serious problems arise in relation to water management as water comes into contact with the buried wastes either from infiltration of precipitation or from trench cap erosion leading to the exposure of the buried waste. The water balance and erosional behavior of burial trench caps were investigated under several cover conditions. Eight 3.05 by 10.7 m plots were installed with bare soil, tilled, and vegetated surface treatments on a 15 by 3 m trench cap constructed from soil and crushed tuff layers. A rotating boom rain simulator was used to estimate the soil erodibility and cover management factors of the USLE for this trench cap and for two undisturbed plots with natural vegetative cover. The hydrograph and sedigraph measurements demonstrated that antecedent soil water content of the surface soils significantly affected infiltration and erosion rates for all erosion plots. Values of runoff/precipitation ratios were much lower on the plots with natural cover than plots on the highly disturbed trench cap. Soil losses from the plots were influenced more by variations in sediment concentrations than by discharge rates. Variation in soil loss between replicated plot treatments was less on the trench cap plots than on the natural plots. Soil loss from the plots with natural cover was about 2% of that from the cultivated plots on the trench cap, and the soil loss from plots with the bare soil and barley cover treatments on the trench cap had 66 and 33% respectively of the soil loss from the cultivated plots. Soil loss ratio values for the barley plots on the trench cap were about 20 times larger than corresponding soil loss ratios for the natural plots. (Baker-IVI)
W85-01282

MINED LAND RECLAMATION USING POLLUTED URBAN NAVIGABLE WATERWAY SEDIMENTS: I. TRACE METALS,
Argonne National Lab., IL. Energy and Environmental Systems Div.
For primary bibliographic entry see Field 5B.
W85-01287

MINED LAND RECLAMATION USING POLLUTED URBAN NAVIGABLE WATERWAY SEDIMENTS: II. ORGANICS,
Argonne National Lab., IL. Energy and Environmental Systems Div.
For primary bibliographic entry see Field 5B.
W85-01288

MINED LAND RECLAMATION USING POLLUTED URBAN NAVIGABLE WATERWAY SEDIMENTS: III. EXPERIENCE AT A DEMONSTRATION SITE,
Argonne National Lab., IL. Energy and Environmental Systems Div.
A. Van Luik, and W. Harrison.
Journal of Environmental Quality, Vol. 13, No. 3, p 423-431, July-September, 1984. 5 Fig, 2 Tab, 25 Ref.

Descriptors: *Mine wastes, *Land reclamation, *Sediments, *Ottawa, *Illinois, Trace metals, Lysimeters, Soil water, Water pollution sources, Water pollution control.

Eroding ridges of acidic coal-mine spoil near Ottawa, Illinois were leveled to form a gently sloped raised plateau. Four test plots were constructed. One served as control while the other three treatment plots received a 0.9 m thick cover of dredged material. Two treatment plots received lime application and all plots were seeded with a grass mixture. Porous ceramic cup soil water samplers were installed at two levels in the control plot and at three levels in the treatment plots, corresponding with dredged material, the dredged material/mine spoil interface, and the underlying mine spoil. Nineteen water quality parameters were monitored during the four yr study period. The near surface soil water in the control plot deteriorated with respect to pH during the first 2 yr and stabilized thereafter. The deeper control plot samples showed no significant change in soil water quality. The dredged material soil-water pH decreased slightly after placement, with the onset of lush vegetative growth. The solutions collected from the dredged material/mine spoil interface were neutralized during the first 2 yr of study, and dissolved trace metal levels dropped significantly during the first and succeeding years. The applied dredged material has significantly ameliorated the

acidity and trace metal levels of water in the underlying mine spoil, and appears to be an effective and safe reclamation medium, under proper use and management. (Baker-IVI)
W85-01289

EFFECTS OF WHITE AMUR (CTENOPHARYNGODON IDELLA) ON A FLORIDA LAKE: A MODEL,
Florida Univ., Gainesville. School of Forest Resources and Conservation.
K. C. Ewel, and T. D. Fontaine.
Ecological Modelling, Vol. 16, No. 2/3/4, p 251-273, August, 1982. 15 Fig, 6 Tab, 18 Ref.

Descriptors: *Model studies, *Eutrophication, *Lake Conway, *Florida, *White amur, Water quality, Biomass, Algae, Computer models, Productivity, Simulation, Fish stocking.

The Lake Conway model was formulated as a structure that would incorporate general physical characteristics of the lake, in order to predict long term changes in major groups of organisms rather than in individual species within the community. The model contains 21 state variables, is programmed in Continuous System Modeling Program, and simulates the effects of white amur on the lake over a 10 yr period. The model predicts that stocking white amur will decrease lake productivity and respiration, increase epipelic algae biomass for two years, and increase biomass of benthic invertebrates and biomass and number of secondary predator fish for at least nine years. Water quality, as defined by submersed macrophyte abundance, phytoplankton biomass, orthophosphate in the epilimnion, and amount of dead particulate organic matter in the water column, increases during the 10 yr simulation. Rates of phosphorus flows between live organic matter and interstitial water increase. Because of the nature of white amur growth and assimilation rates, simulated grazing impact is heaviest three years after stocking. Carbon flow through both grazing and detritus food chains increases in the simulation, in spite of decreased photosynthesis. By introducing an herbivore that eats a wide variety of aquatic macrophytes, water quality in general may improve and there may be an increase in secondary predator fish, a category that includes several sport fish. These results provide an index to the sensitivity of the model. The usefulness of models such as this in assisting with planning and impact analysis supports the need for a more holistic and quantitative approach to lake analysis. (Baker-IVI)
W85-01306

COFLOCCULATION OF ALGAE AND CLAY TO CLARIFY TURBID IMPOUNDMENTS,
Technion - Israel Inst. of Tech., Haifa.
Y. Avnimelech, and R. G. Menzel.
Journal of Soil and Water Conservation, Vol. 39, No. 3, p 200-203, May-June, 1984. 2 Fig, 1 Tab, 18 Ref.

Descriptors: *Impoundments, *Coflocculation, *Turbidity, *Clay, *Algae, Water quality control, Flocculation, Algae control, Cycling nutrients, Costs, Sedimentation.

Two pairs of comparable turbid ponds were selected to test the practicality of algal-clay coflocculation as a means of clarifying turbid ponds. One pond of each pair was fertilized with nitrogen and phosphorus. The other was left as an unfertilized control. Algal growth was induced in both fertilized ponds, leading to a significant reduction of turbidity. The sedimentation of the algal-clay clusters removed clay, algae, and nutrients from the water column. Significant removal of suspended matter occurred when algal growth was enhanced by fertilizer applications. Still lacking, however, is knowledge of the optimal rates or timing of nutrient additions. Long-range effects are not known. Except for rapidly flushed systems, it seems likely that added nutrients will have a significant carry over effect through nutrient cycling between bottom sediments and the overlying water column. Concerning cost factors, the application cost of the low dosage of fertilizers is certainly lower than the equivalent cost for a large gypsum dosage. Also noted is that the increased primary production resulting from fertilization should enhance fish production. (Baker-IVI)
W85-01324

STORM RUNOFF AND WATER QUALITY ON THREE EPHEMERAL WASHES IN THE PRICE RIVER BASIN, UTAH,
Unitex Corp., Salt Lake City, UT.
For primary bibliographic entry see Field 5C.
W85-01325

RISK-RELIABILITY PROGRAMMING FOR OPTIMAL WATER QUALITY CONTROL,
California Univ., Davis. Dept. of Civil Engineering.
S. P. Simonovic, and G. T. Orlob.
Water Resources Research, Vol. 20, No. 6, p 639-646, June, 1984. 6 Fig, 4 Tab, 21 Ref.

Descriptors: *Water quality management, *Reservoir operation, *Multipurpose reservoirs, *New Melones Reservoir, *California, Water quality standards, Flood control, Fisheries, Irrigation, River flow.

A risk-reliability programming approach is developed for optimal allocation of releases for control of water quality downstream of a multipurpose reservoir. Additionally, the approach allows the evaluation of optimal risk/reliability values. Risk is defined as a probability of not satisfying constraints given in probabilistic form, e.g., encroachment of water quality reservation on that for flood control. The objective function includes agricultural production losses that are functions of water quality, and risk-losses associated with encroachment of the water quality control functions on reservations for flood control, fisheries, and irrigation. The approach is demonstrated using data from New Melones Reservoir on the Stanislaus River in California. Results indicate that an optimum water quality reservation exists for a given set of quality targets and loss functions. Additional analysis is presented to determine the sensitivity of optimization results to agricultural production loss functions and the influence of statistically different river flows on the optimal reservoir storage for water quality control. Results indicate the dependence of an optimum water quality reservation on agricultural production losses and hydrologic conditions. (Author's absatract)
W85-01336

INTERNATIONAL RIVER BASIN MANAGEMENT,
World Health Organization, Copenhagen (Denmark). Regional Office for Europe.
J. I. Waddington.
Water Science and Technology, Vol. 16, No. 5-7, p 1-11, 1984. 1 Tab, 19 Ref.

Descriptors: *International agreements, *Water quality, *River basin management, Water pollution control, Environmental effects, Political aspects, Riparian waters, Water diversion, Water resources development.

With growing volumes of sewage and industrial wastes being discharged to international rivers, the effects on downstream riparian countries are clearly increasing at a time when they are themselves requiring more water for their own use. Deterioration of water quality may be exacerbated by impoundment or diversion of water by the upstream country. The river flow and sediment regime may be substantially affected by upstream changes in land use or the constructions of barrages. There are political difficulties in reaching agreement on water quality management between the very different interests of upstream and downstream riparian countries. Problems in relation to transboundary water quality are multiplying as pressures on limited water resources increase. Micro-pollutants in water, sediments and biota are of particular significance. Sporadic pollution causes special difficulties. Even though there are special difficulties in relation to transboundary water problems, cooperation among riparian countries will undoubtedly intensify, albeit slowly and often in a less than systematic way. Each potential opportunity sho be grasped as it occurs and stong efforts made ensure that the various elements should be progr sively incorporated into an overall collaborat framework which can eventually form the basis national river basin management. (Moore-IVI)
W85-01388

RIVER QUALITY ASSESSMENT AND MO TORING OF THE DANUBE - AN EXAMP OF INTERNATIONAL COOPERATION,
Bundesanstalt fuer Wasserguete, Vienna (Austri
For primary bibliographic entry see Field 6E.
W85-01389

DISPOSAL OF DRAINAGE WATER FROM I RIGATED ALLUVIAL PLAINS,
Taylor (John) and Sons, London (England).
J. F. Robson, R. F. Stoner, and J. H. Perry.
Water Science and Technology, Vol. 16, No. 5 p 41-55, 1984. 7 Fig, 1 Tab.

Descriptors: *Alluvial plains, *Irrigation effec *Drainage water, *Saline water, Iraq, Pakist Tigris-Euphrates Outfall Drain, Indus Pla Drainage systems, Water pollution contr Tubewells.

An important side effect of irrigation developm on alluvial plains is an increase in saline inflow the groundwater. Drainage water salinity m vary considerably depending on the salinity of t irrigation water, the residual salt concentrations the soil, and the salinity conditions of the grou water reservoir being tapped. Four methods disposal for saline drainage water include dispo into the sea, into rivers, into canals, and into na ral depressions or man-made evaporation basi Drainage problems that occur on plains contain between two rivers are illustrated using the Tig and Diyale Rivers as they contain the plain imm diately north of Baghdad. Figures from 1979 giv salinity level in the lower Euphrates at Nasiriy of 1,700 mg/l, an increase of about 800 mg/l nine years. The basis of the long term solution is stop all but a very limited amount of saline dra age water from being discharged into either t Tigris or Euphrates and centers on the Tigr Euphrates outfall drain (TEOD) which would c lect the drainage water from some 1.4 million ha irrigated land. This would involve extending t TEOD at its southern end to the Shatt al Basr crossing the Euphrates in an inverted siphon. series of subsidiary link drains would feed t drainage water either into existing depressions the lower reaches of the Shatt al Arab. Over m of the lower Indus plain, aquifer conditions such that tubewells can be successfully used field drainage. The need for a main outfall syste together with tubewell or buried pipe field dra was recognized in the mid-1960s. Two major o fall drains were proposed, one on the Indus rig bank and one on the left bank. (Baker-IVI)
W85-01392

COSTS AND BENEFITS OF ESTUARINE AN COASTAL POLLUTION CONTROL,
Taylor (John) and Sons, London (England).
For primary bibliographic entry see Field 6B.
W85-01394

APPLICATION OF THE EUROPEAN CO MUNITIES DIRECTIVE ON DANGERO SUBSTANCES TO LIST II SUBSTANCES THE U. K.,
Water Research Centre, Stevenage (England).
G. Mance, and A. R. O'Donnell.
Water Science and Technology, Vol. 16, No. 5 p 159-169, 1984. 2 Tab, 23 Ref.

Descriptors: *Water quality control, *Manag ment, *Standards, Heavy metals, Water use, De sion making, Water pollution control.

The Europeans Communities Dangerous Su stances Directive requires the Member States reduce pollution by List II substances by setti limit values on the basis of environmental qual

iectives (EQO). The EQO approach to water ality management is discussed and the terms)O and environmental equality standard (EQS) defined. A proposed list of water uses is pre- ted. The derivation of EQSs for each use is cussed and the EQS values proposed for six list substances are reported. An EQO is a qualitative tement of the management aim for a particular ter body. In practical terms it is almost impossi- for the EQO to be expressed other than in ns of the uses that are or will be made of a body water. The EQO specified for any single body water should take into account the use required any water body into which that water will sequently discharge. The derivation of stand- s for the protection of fish, shellfish and other atic life is based on input from laboratory toxic- tests, comparison with field data, and applica- of findings. (Baker-IVI)
5-01399

LATING EFFLUENT CONTROL PARAM- ERS TO RIVER QUALITY OBJECTIVES ING A GENERALISED CATCHMENT SIMU- TION MODEL,
mes Water Authority (England). Northern
Bowden, and S. R. Brown.
ter Science and Technology, Vol. 16, No. 5-7, 7-206, 1984. 3 Fig, 4 Tab, 9 Ref.

scriptors: *River Wey, *England, *Simulation, ater pollution control, Water quality standards, nputer models, Wastewater disposal, Effluents, chment area, Model studies.

computer model has been developed which bines a simulation based approach with the ular logic of the steady-state catchment ap- ach, and provides facilities for calibration and fication of simulated data against observed . Temporal correlation of simulated variables flow and concentration) is also possible. This el has been used to study the River Wey basin a view to assessing the impact of twelve ificant sewage effluent discharges upon the r, to identify where action is needed to restore maintain the quality of the River Wey and its utaries, and to seek a solution combining the ous options of revising sewage works' operat- targets and making improvements to work's ormance. This study having been completed, preferred options have been identified and are g put forward for discussion within the mes River) Authority. (Author's abstract)
5-01402

OMIUM BALANCE AND RESTORATION ATEGY FOR A RIVER BASIN,
rverband, Essen (Germany, F.R.).
primary bibliographic entry see Field 5D.
5-01409

ERATIONAL RIVER WATER QUALITY NAGEMENT,
erial Coll. of Science and Technology, London gland). Dept. of Civil Engineering.
. Jowitt, J. P. Lumbers, M. B. Beck, and W. enkins.
er Science and Technology, Vol. 16, No. 5-7, 1-392, 1984. 5 Fig, 14 Ref.

criptors: *Water quality management, *Fuzzy c, *Operational control, *River basins, tewater treatment, Model studies, Objectives, ources management.

re has been a rapid increase in the various ands made on surface waters for water abstrac- and the assimilation of wastewater discharges. has resulted in a need to establish flexible ational control hierarchies reflecting conflict- ses of surface waters and overall basin econo- The advantages of operational control will not ealized without a rational means of assessing controlling system performance against a ework of multiple ill-defined river basin objec- . Fuzzy logic is suggested as the vehicle for control. Dynamic models could be used as a ictive tool to link downstream river quality to wastewater treatment plant performance. Fuzzy logic would be used firstly in formulating global river basin objectives and translating them into required operational models for each of the elements concerned. Secondly, fuzzy logic could be employed as vehicle for assessing the degree of success or failure of management performance against global objectives and, when necessary, identifying appropriate actions which best satisfy the conflicting interests of users of the river system. (Moore-IVI)
W85-01414

WATER QUALITY MODELLING OF THE RIVER RHINE AND ITS TRIBUTARIES IN RELATION TO SANITATION STRATEGIES,
Waterloopkundig Lab., Delft (Netherlands). Environmental Hydraulics Branch.
J. A. Van Pagee.
Water Science and Technology, Vol. 16, No. 5-7, p 393-406, 1984. 10 Fig, 4 Tab, 13 Ref.

Descriptors: *Water quality, *Model studies, *River Rhine, *Netherlands, Eutrophication, Wastewater treatment, Water quality control, Nutrients, Biological wastewater treatment.

Modelling techniques can be used to evaluate and predict the influence of sanitation measures for domestic and industrial wastewater loads in the River Rhine drainage area. Because of serious eutrophication problems in the Dutch fresh water lakes that are fed by the River Rhine, special attention is given to the quantification of sanitation measures that can reduce the nutrient concentrations. As a base for modelling the River Rhine water quality, a one-dimensional steady-state model MODQUAL (a modified version of the QUAL-II model) was developed and applied on the river system downstream of Lake Constance, including the main tributaries Neckar, Main and Mosel and the Dutch branches IJssel, Lek and Waal. The development of wasteloads and the introduction of biological (secondary) treatment since 1973, has resulted in a significant improvement of water quality components such as DO, BOD5, COD, Kjeldahl-N and NH4-N. The influences of tertiary treatment directed on nitrogen or phosphorus removal and the introduction of phosphate-free detergents are quantified for various hydrological conditions. A crucial question in the study of water quality modeling of the River Rhine is the accuracy of predictions. As most input data for the model are based upon data without any specification of its accuracy, a simple quantification of errors for predictive simulations is impossible. (Moore-IVI)
W85-01415

SIGNIFICANCE OF WATER QUALITY PARAMETERS FOR DECISION-MAKING IN WATER POLLUTION CONTROL - A CASE STUDY: LAKE PAIJANNE IN FINLAND,
National Board of Waters, Helsinki (Finland).
H. Nyroos.
Water Science and Technology, Vol. 16, No. 5-7, p 407-418, 1984. 6 Fig, 1 Tab, 16 Ref.

Descriptors: *Lake Paijanne, *Finland, *Decision making, *Water pollution control, Water quality, Water resources development, Municipal wastewater, Pulp and paper industry, Toxicity, Cost-benefit analysis, Water use.

Estimation of water quality impacts plays an important role in the planning of water pollution control. In this paper the connection of water quality aspects with the rest of the planning procedure is examined in the light of a case study area, Lake Paijanne in Finland. For this area an integrated water resource development plan was made by the Finnish water authorities. In order to diminish the adverse effects resulting from effluents of pulp and paper mills and municipalities, different pollution control alternatives were drawn up. Next, forecasts about the development of water quality in different alternatives were made. The most important parameters from the point of view of the different modes of water utilization were taken into account. These parameters were oxygen, phosphorus, COD, lignin and color. In addition, in assessing the impacts, toxicity of effluents was taken into consideration. The impacts of these parameters on the usability and utilization of water areas were analyzed. The forecasts of impacts on vacation settlement, water supply and fisheries were made. In the comparison of the alternatives, numerous intangible factors were involved. In the assessment of the alternative the costs of water pollution control measures, the benefits and the adverse effects were taken into consideration. The impacts of intangible factors were assessed in each alternative by comparing the water use possibilities with the goals that had been set. (Author's abstract)
W85-01416

WATER QUALITY MANAGEMENT IN SAKARYA RIVER BASIN: I. PLANNING PHASE,
Technical Univ. of Istanbul (Turkey). Dept. of Environmental Engineering.
I. E. Gonenc, D. Orhon, and R. Artan.
Water Science and Technology, Vol. 16, No. 5-7, p 435-441, 1984. 3 Fig, 4 Ref.

Descriptors: *Sakarya River Basin, *Turkey, *Water quality management, *Planning, Water resources development, Monitoring, River basins, Water pollution control, Effluents, Model studies.

In order to develop a better understanding of water resources management and to explore the possibilities of integrated river basin management as the foundation of comprehensive management of the national water resources for all purposes, it was decided to undertake a pilot-project in the Sakarya River Basin in Turkey. The main purposes of the water quality management project are to deliver information to water resources management, to assess the effects of water resources management on water quality, and to ascertain the effect of alterations on pollution control works. All activities have been planned for development of a water quality model, by which assessment of detrimental effects of present and possible future effluent discharges on water quality may be possible. A detailed account is given of the procedure for mathematical model development and application, and the methodology for monitoring system design. (Moore-IVI)
W85-01418

STRATEGY IN WATER QUALITY MANAGEMENT IN THE REPUBLIC OF CHINA,
Taiwan Water Pollution Control Agency, Taichung.
C. D. Lee.
Water Science and Technology, Vol. 16, No. 5-7, p 443-452, 1984. 2 Fig, 5 Tab.

Descriptors: *Taiwan, *Water quality management, *Water pollution control, River basin management, Wastewater treatment, Animal wastes, Industrial wastewater, Municipal wastewater, Monitoring, Legal aspects.

Over the past 20 years, Taiwan has seen rapid economic and population growth, resulting in pollution of the major rivers. The water quality of rivers in Taiwan has been gradually improved since the National Water Pollution Control Act was promulgated in 1974 and Taiwan Provincial Water Pollution Control Agency was set up in 1975. The measures for water pollution control include the following: enactment of laws and regulations; conducting river basin management planning for water pollution control; control of and assistance for industrial wastewater treatment; promoting the planning and construction of municipal sewerage systems; prevention of manure pollution from livestock farms; setting up water quality monitoring systems; strengthening research on pollution control techniques; and instruction of pollution control personnel and enhancement of of pollution control equipment. (Moore-IVI)
W85-01419

GULF COAST WASTE DISPOSAL AUTHORITY: A REGIONAL APPROACH TO WATER QUALITY MANAGEMENT,

Gulf Coast Waste Disposal Authority, Houston, TX.
L. J. Davis.
Water Science and Technology, Vol. 16, No. 5-7, p 473-480, 1984.

Descriptors: *Gulf Coast Waste Disposal Authority, *Water quality management, *Galveston Bay, *Texas, Public opinion, Public participation, Siting, Hazardous wastes, Waste disposal, Political aspects.

The Gulf Coast Waste Disposal Authority is a regional public agency created by the State of Texas in 1969 to design and implement water quality management systems in three counties surrounding Galveston Bay. One of the primary intents in the creation of the Authority was to provide a governmental unit with a clear mandate and the appropriate powers to effectively deal with the various political subdivisions involved in water quality management in the large Houston/Galveston metropolitan area. Authority income is derived from treatment facility management fees and bond financing fees. Throughout its existence, the Authority has emphasized joint or combined treatment and the regional concept. In 1978, the Authority proposed a regional hazardous waste management center. The proposal met with little genuine technical opposition, few financial difficulties, and loud but localized public opposition and political resistance. A new approach to help resolve the siting issues is presented. The approach involves a preapplication project review by citizens and a handbook to be used by communities and facility proposers. (Moore-IVI)
W85-01422

WATER QUALITY PLANNING IN DENMARK,
Miljoestyrelsen, Copenhagen (Denmark).
O. H. Jorgensen.
Water Science and Technology, Vol. 16, No. 5-7, p 493-497, 1984.

Descriptors: *Denmark, *Water quality, *Planning, Water pollution control, Regulations, Rivers, Lakes, Coastal waters.

In 1983 the National Agency for Environmental Protection in Denmark published guiding regulations for water quality planning, based upon the rules in the Environmental Protection Act of 1974 with recent changes in 1982. The planning system contains three steps - determination of water quality objectives, calculation of discharge consents and control activities. A list of suggested quality objectives for rivers, lakes and coastal waters is included as well as a strategy for handling discharges of chemical compounds not originally found in the water. (Author's abstract)
W85-01424

DEVELOPMENT AND APPLICATION OF MODELS FOR WATER QUALITY MANAGEMENT,
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
M. B. Beck.
Water Science and Technology, Vol. 16, No. 5-7, p 541-560, 1984. 6 Fig, 77 Ref.

Descriptors: *Model studies, *Water quality managment, Organic matter, Eutrophication, Nitrates, Toxic substances, Water pollution control, Water treatment, Planning, River basin management.

A brief survey of contemporary problems and future prospects for the development and application of water quality models is given. The main body of the paper is prefaced by a discussion of the way in which developments in modelling have tended to cluster around four types of pollution problem, easily degradable organic wastes, eutrophication, nitrates, and the discharge of toxic substances. The increased importance of uncertainty in the development of models (system identification; model calibration), in the use of models for prediction, and in strategies for the management of water quality is noted. Special attention is also drawn to the need for the analysis of interactions among the four categories of pollution problems, among the traditionally separate components of wastewater treatment, the receiving water body, and water purification, and between long-term planning and short-term operational management. Aspects of planning and operations in the face of contingencies and continually changing priorities for river basin management are discussed. (Author's abstract)
W85-01427

RISK ANALYSIS, FUZZY LOGIC AND RIVER BASIN MANAGEMENT,
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
P. W. Jowitt.
Water Science and Technology, Vol. 16, No. 5-7, p 579-585, 1984. 3 Ref.

Descriptors: *Fuzzy logic, *Risk analysis, *River basin management, Water pollution control, Operational control, Mathematical modelling, Hierarchical control, Expert systems, Wastewater treatment.

River basin management involves hierarchical control. The management hierarchy must act as an expert system. The problems of pollution control are not time-invariant and it must be accepted that objectives will change in time. The link between the need for operational control and the mathematical modelling of badly-defined environmental systems is examined, using the example of local and global control of a wastewater treatment plant located some distance upstream of a water supply abstraction point. The robustness of process models and control measures is more important than their sophistication. Because of the nature of such systems, control robustness can be effected in many cases through the exercise of experience and acquired expertise, formalized through expert systems and fuzzy set theory. For the same reason, there is a duality between control and system identification and classical identification methods should be tempered by the application of fuzzy sets and expert systems theory. (Moore-IVI)
W85-01430

MODELLING NITRATE AND ALGAL BEHAVIOUR IN THE RIVER THAMES,
Institute of Hydrology, Wallingford (England).
P. G. Whitehead, and R. J. Williams.
Water Science and Technology, Vol. 16, No. 5-7, p 621-633, 1984. 8 Fig, 25 Ref.

Descriptors: *Nitrates, *Algal growth, *Water quality control, *Model studies, *Thames River, River basins, Population dynamics, Denitrification, Kalman filter.

As part of a collaborative project with Thames Water Authority a multi-reach, multitributary flow and quality model has been developed for the Thames River System. Nitrate and algal models have been developed using routinely collected water authority data. The models are being used to investigate design and operational management problems within the Thames River basin. Where algal growth processes dominate, a mechanistic model is required to account for the highly nonlinear behavior. In this situation model identification and estimation is particularly difficult and a generalized sensitivity analysis technique can be used to determine the important parameters and hence restrict the number of parameters requiring estimation. In the case of the Thames algal model three significant parameters have been identified out of the nine model parameters using the generalized sensitivity analysis technique. The extended Kalman filter technique has been applied to estimate final parameter values. (Baker-IVI)
W85-01434

CALCULATING FUTURE LEVELS OF NITRATE IN RIVERS AND PUMPED STORAGE RESERVOIRS,
Anglian Water Authority, Huntingdon (England).
A. E. Warn.
Water Science and Technology, Vol. 16, No. 5-7, p 635-642, 1984. 5 Fig, 1 Tab, 14 Ref.

Descriptors: *Nitrates, *Pumped storage *R Stour, *Abberton Reservoir, *England, W quality control, Prediction, Water supply devel ment, Storage reservoirs, Multiple regress Computers, Simulation, Model studies.

A method is described for calculating the effe water quality standards on the future use (5-15 of water supplies drawn from rivers and impou ments. Day to day variations of nitrate in riv have been modelled by regression analysis these models have been used to estimate the qua of water supplies drawn from pumped stor reservoirs. Computer simulation has been usec examine ways of controlling water quality so a comply with water quality standards. The appli tion of the methodology to the River Stour Abberton Reservoir is described. The River St is used as a source of public water supply. Pres ly the quality of water pumped into supply controlled by blending or replacing the sup drawn direct from the river with water from berton Reservoir or another of the water com ny's resources. For the future it is necessary to able to calculate whether increased demar droughts, rising trends or new water quality sta ards will place additional constraints on the source. (Baker-IVI)
W85-01435

BIOLOGICAL PROTECTION OF IMPERV ABLE FLY-ASH LAYERS,
Polish Academy of Sciences, Gdansk. Inst. I downictwa Wodnego.
J. Nowakowa.
Environmental Pollution (Series A), Vol. 35, N 1, p 1-16, 1984. 4 Fig, 5 Tab, 15 Ref.

Descriptors: *Revegetation, *Erosion contr *Waste disposal, *Fly ash, *Grasses, Permeabili Plant growth, Land reclamation.

Composite materials of fly-ash are used to fo impermeable layers for the bottoms of waste res voirs and to cover powerplant waste storage si to prevent erosion. Impermeable layers are form from mixtures of fly ash, water glass, and an ac vator. After a field compaction process, an unco pacted thin top layer (UTTL) forms which granular. Laboratory and field tests suggest th the structure and chemical composition of t UTTL of the impermeable layer is suitable f grass growth. How well grass grows on UTT depends on the kind of fly ash, the quantity a kind of lime and on the concentration of wa glass. The properties of these layers for gr growth may be improved by leaching with wat Because of this it is important that grass seed sown after the first rainfall or after irrigation. T possibility of growing grass on the thin top layer impermeable fly ash increases the value of fly a composite materials in the revegetation of waste (Baker-IVI)
W85-01447

EFFECT ON WATER CHEMISTRY AND PH TOPLANKTON OF ARTIFICIAL INFLOW C THE RIVER RADOVNA INTO LAKE BLE (YUGOSLAVIA),
Ljubljana Univ. (Yugoslavia). Biological Inst.
D. Vrhovsek, G. Kosi, and M. Zupan.
Hydrobiologia, Vol. 96, No. 3, p 225-242, Octobe 1982. 22 Fig, 3 Tab, 21 Ref.

Descriptors: *Lake restoration, *Limnolog *River Radovna, *Lake Bled, *Yugoslavia, Arti cial watercourses, Lake stages, Lake morpholog Phytoplankton, Water analysis, Water chemistr Nutrients.

Limnological investigations of Lake Bled we carried out at monthly intervals from Septemb 1978 until October 1979. Vertical profiles of phy cal and chemical variables and phytoplankton we determined. The Lake lies at an altitude of 457 above sea level, is typically alpine with a maximu depth of 30.2 m, average depth of 17.9 m, surfa area of 14.38 sq km and volume of 25.69 million c m. The lake has a large number of small natur inflows, the longest being the streams Misca ar

znik with their annual discharge into the lake
g about 13 million cu m. The Radovna carries
ut 8 million cu m of fresh, oxygen rich water
annum. The lake's only outflow is the River
rnica at Milno. Renewal time of lake water is
years. The number of phytoplankton species is
lower than in previous years. From a biologi-
point of view, the lake's condition has not
roved but rather is continually deteriorating.
follows from the appearance of species char-
ristics of the alpha-mesosaprobic state and indi-
ons of organic pollution. The presence of Ana-
a flos-aquae was alarming. By introducing the
alpine waters from the River Radona, tem-
atures in the lake were lowered and thus the
lopment of A. flos-aquae was kept at reduced
ls. The formation of an aerobic zone during
mer stratification prevented the diffusion of
ients into the upper layers. The positive effect
ncreasing inflow became particularly evident
r its termination in August of 1979, when nutri-
were soon detected in the upper layers.
ker-IVI)
5-01473

**DEL STUDY OF JET-INDUCED CIRCULA-
N AND MIXING IN A RESERVOIR,**
ningham Univ. (England). Dept. of Civil Engi-
ing.
primary bibliographic entry see Field 8B.
5-01523

**UIFER PROTECTION PLANNING IN THE
RTH EASTERN UNITED STATES,**
calf and Eddy, Inc., Boston, MA.
I. Kilner, W. J. Rizzo, Jr., and J. F. Shawcross.
nal of the Institution of Water Engineers and
ntists, Vol. 38, No. 3, p 247-258, June, 1984. 5
1 Tab, 4 Ref.

criptors: *Water quality control, *Groundwat-
rotection, *Burlington, *Littleton, *Massachu-
, Water supply development, Well siting, Plan-
, Groundwater pollution, Trichloroethylene,
ifer Protection Planning, Regulations, Legal
cts.

ifer Protection Planning (APP) outlines a
egy for the protection of a community's
ndwater supply and provides necessary tech-
support for its adoption. The communities of
ington and Littleton, Massachusetts, each had
rent reasons for initiating the protection plan-
schemes. In Burlington, the stimulus was pre-
inantly remedial; it had lost one of its wells to
loroethylene contamination. The objective of
Littleton effort was primarily preventative, it
in the process of selecting a new well site and
ed to assure the long-term protection of its
ty. Both APPs recommended a combination
ructural measures, regulations, and contingen-
lans to protect town groundwater supplies.
traditional approach to well-siting is consid-
to be inadequate; the process of locating a
based on its likely yield does not respond to
nore important question of its long-term pro-
bility. There is a need for regional treatment
protection of groundwater quality, but legal
anisms may not exist. (Moore-IVI)
-01524

**NICIPAL WATERSHED MANAGEMENT -
NIQUE OPPORTUNITY IN MASSACHU-
TS,**
achusetts Cooperative Extension Service,
erst. Community Resource Development.
. Archey, and J. C. Mawson.
nal of the New England Water Works Asso-
on, Vol. 98, No. 2, p 138-147, June, 1984. 1
6 Ref.

criptors: *Watershed management, *Forest wa-
eds, *Massachusetts, *Forest management,
omic aspects, Water quality control, Plan-
Cost-benefit analysis, Water yield.

application of sound forest management prac-
to watershed lands even on the small town
is not out of place. Applied forest manage-
techniques can be used to increase quality water production from forested watersheds on a sustained basis. Experiments in the northeastern US have shown that vegetation management can result in annual water yield increases ranging from a small amount up to 14 area inches by clearcutting. The economic benefits resulting from such controlled harvests of forest products are capable of not only offsetting the cost of acquiring the services of a forest manager, but produce additional revenue as well. To the municipality the forest may be regarded as capital, the annual growth likened to interest, and the interest used to offset the municipal tax rate, the cost of water, or reinvested in the forest with a predictable rate of return. To encourage forest management, a cooperative project was developed. On one watershed it was estimated that the town could expect $25,000 per year from management. The first year the harvest cut produced $27,000 and the next year $29,000. The only complaint was that the assessment of cull was too low, yet gross volume estimates were very accurate. Ideally the information a municipality should have before a project is started includes: the boundary of the entire watershed, the boundary of lands owned by the municipality within the watershed on a small scale map, and boundaries visibly marked on the land. In all cases undertaken in the cooperative program the prime purpose of management was to maintain or improve the quality and quantity of water and timber produced and at the same time generate municipal revenue. (Baker-IVI)
W85-01621

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

RETURN PERIOD ANALYSIS OF MINIMUM EVENTS USING SLIDING POLYNOMIALS,
Agricultural Research Service, Washington, DC.
A. W. Thomas, and W. M. Snyder.
Transactions of the ASAE, Vol. 27, No. 2, p 464-469, March-April, 1984. 7 Fig, 9 Ref.

Descriptors: *Mathematical analysis, *Sliding polynomials, *Minimum events, *Minimum flow, Simulation, Minimum rainfall, Minimum air temperature, Rainfall, Air temperature, Model studies, Management planning, Cost-benefit analysis.

A form-free method has been developed for determination of return periods of minimum values of stochastic events. Such minima represent expectancies of limited availability of natural resources. As such, analyses of minima provide information to assist planners and managers of agricultural production systems. The method for return-period analysis of minimum events is similar to a method recently presented for analysis of maximum events. Both use form-free sliding polynomials as smoothing operators, thus reducing the bias produced by assuming some particular probability function as a smoothing operator. Investigations of minimum rainfall, streamflow and temperatures show a number of unique features in the sample data revealed by flexibility in shaping the smoothing curves while maintaining faithful adherence to the sample data. Simulations were used to compute an expected range of future events associated with any level of risk chosen by the planner or manager. Long-period and short-period possible future minima for different return periods were simulated. These simulations show that the uncertainties faced by planners and managers are highly conditioned by unique features of particular data sets and by the length of the return period over which costs and benefits might be averaged. (Author's abstract)
W85-01194

DAMS - FOR WHOM AND FOR WHAT PURPOSES (DES BARRAGES - POUR QUI, POUR QUOI),
Ecole Polytechnique Federale de Lausanne (Switzerland). Dept. de Genie Rural et Geometre.
R. Sinniger.
Wasser, Energie, Luft, Vol. 75, No. 9, p 215-219, January, 1983. 11 Fig.

Descriptors: *Dams, *Earth dams, Reservoirs, Lakes, Flow, Water use.

The consequences of the important variations of flow in the water courses as well as the influence and the different utilization of lakes and reservoirs are described. The evolution of the number of dams and the technical development in the earth dam design are discussed. A judgement on the actual knowledge followed by some remarks concerning the future evolution concludes the paper. (Author's abstract)
W85-01263

CENTRAL ARIZONA WATER CONTROL STUDY: A CASE FOR MULTIOBJECTIVE PLANNING AND PUBLIC INVOLVEMENT,
Bureau of Reclamation, Denver, CO.
C. A. Brown.
Water Resources Bulletin, Vol. 20, No. 3, p 331-337, June, 1984. 1 Fig, 1 Tab, 35 Ref.

Descriptors: *Multiobjective planning, *Public involvement, *Flood control, *Phoenix, *Arizona, Water resources development, Environmental effects, Social aspects, Water storage, Planning, Decision making.

A multiobjective planning framework, incorporating substantial public involvement, was successfully applied to a major water resources decision involving intense conflicts. The study, the Central Arizona Water Control Study (CAWCS), was initiated to help resolve more than a decade of controversy over a project proposed to control flooding and provide regulatory storage in the Phoenix, Arizona, area. The goal of the study was to find a plan that could address the various issues, including flood control, water storage, environmental concerns, and social concerns, and be acceptable to the many parties involved. The public was actively involved in the development of study goals and the specification of acceptable tradeoffs between multiple objectives. A wide range of structural and nonstructural alternatives was formulated and evaluated in relation to these objectives, and broad-based support was developed for a new plan, the New Waddell Plan. Factors that appear to have promoted success include: motivation to seek a solution; public involvement; multiobjective planning, sufficient resources committed, involement of key decisionmakers; and the patience and flexibility of decisionmakers. (Moore-IVI)
W85-01387

SIGNIFICANCE OF WATER QUALITY PARAMETERS FOR DECISION-MAKING IN WATER POLLUTION CONTROL - A CASE STUDY: LAKE PAIJANNE IN FINLAND,
National Board of Waters, Helsinki (Finland).
For primary bibliographic entry see Field 5G.
W85-01416

WATER QUALITY MODELLING AND WATER RESOURCES PLANNING,
Environmental Protection Agency, San Francisco, CA. Region IX.
K. Richard-Haggard, and P. A. Krenkel.
Water Science and Technology, Vol. 16, No. 5-7, p 511-519, 1984. 1 Fig, 17 Ref.

Descriptors: *Water quality control, *Legislation, *Model studies, Mathematical models, Planning, Management, Water management, Water resources development.

Several laws aimed at maintaining or improving the quality of the nation's waters have been promulgated during the past few decades in response to a great surge in public environmental awareness. Water quality modeling can be a very useful tool to managers if applied properly. A mathematical model is a simple analytic representation of the real world. It only incorporates phenomena relevant to the problem at hand, and necessarily cannot include all portions of a real world system. Models are commonly used as links between water quality and the contiguous environment. Such models are constructed for two basic reasons: to improve the

understanding of the processes that contribute to water quality variations, and to form a basis for predicting the effects of engineering control devices on water quality. (Baker-IVI)
W85-01426

GROWTH AND HEAVY METAL REMOVAL BY KLEBSIELLA AEROGENES AT DIFFERENT PH AND TEMPERATURE,
Biological Research Center, Baghdad (Iraq). Dept. of Environmental Pollution.
M. F. Al-Shahwani, S. F. Jazrawi, E. H. Al-Rawi, and N. S. Ayar.
Journal of Environmental Science and Health, Vol. A19, No. 4, p 445-457, 1984. 4 Fig, 22 Ref.

Descriptors: *Klebsiella, *Biological wastewater treatment, *Heavy metals, Hydrogen ion concentration, Temperature, Lead, Zinc, Nickel, Cadmium, Wastewater treatment, Bacterial growth.

A strain of Klebsiella aerogenes isolated from Rustamiyah Station for treatment of wastewater was examined for its ability to grow in a media supplemented with maximum tolerance concentrations of Pb(++), Zn(++), Ni(++) and Cd(++), separately, at different temperature and initial pH. The results indicated that at 28 degrees C and during the first 24 hr, Pb(++) and Ni(++) had no effect on the growth of the bacteria, while the presence of Zn(++) and Cd(++) decreased the cell count. The growth reached a maximum level after the second day and started to decrease gradually. At 37 degrees C, the bacterial count was less than that of 28 degrees C in the presence of Pb(++) and Ni(++), while the presence of Zn(++) and Cd(++) had affected the growth slightly. No bacterial multiplication occurred at 44 degrees C. There was little difference between heavy metal removal at 28 and 37 degrees C. At 44 degrees C, no considerable removal took place. In general, slightly acidic or neutral medium, was better for both the growth and metal removal. (Author's abstract)
W85-01439

HYDRO SYSTEM PLANNING OF THE TVA,
Tennessee Valley Authority, Norris.
J. E. Giles, and W. O. Wunderlich.
International Water Power and Dam Construction, Vol. 36, No. 7, p 11-16, July, 1984. 4 Fig, 12 Ref.

Descriptors: *Planning, *Hydroelectric plants, *Tennessee Valley Authority, Water management, Electric power production, Water use, Navigation, Optimization, Systems analysis, Flood control.

Operation of a group of hydropower stations on a common grid needs careful planning to take into account conflicting requirements of the consumers and the suppliers. The procedures developed by the Tennessee Valley Authority (TVA) show how one authority has responded to this problem. Navigation needs are satisfied by maintaining minimum depths in the navigable portion of the river system mainly through maintaining minimum levels of impoundments. The amount of energy in storage available at any time of the year depends on flood control considerations and on future energy requirements in that order of priority. The strategy of optimal use of the available hydro capability is to maximize the replacement of the most expensive thermal generation. This is usually the capacity and energy that is required to meet peak power system demands that would otherwise be met by the more expensive coal plants or combustion turbines. Newer, more descriptive simulation software is coming into use, with optimization features capable of solving large, complex formulations of system scheduling problems. In addition, the use of the most economical mode of hydro unit operation (best efficiency or maximum capacity) will be increasingly of interest to assure best use of available system capability and resources. (Baker-IVI)
W85-01547

DECENTRALIZED HYDROPOWER CONTROL,
Sulzer-Escher Wyss Ltd., Zurich (Switzerland).
A. H. Glattfelder, and J. Steinbach.
International Water Power and Dam Construction, Vol. 36, No. 7, p 16-20, July, 1984. 5 Fig, 4 Ref.

Descriptors: *Planning, *Systems analysis, *Hydroelectric plants, Electric power production, Optimization, Management, Water management, Microprocessors, Computers.

The introduction of microprocessor-based control systems makes decentralized control for complex systems more feasible. Systems engineering methods are applied to structure hydropower control systems on hierarchical levels and to produce functional block diagrams in a form which can be easily adapted to a specific case. Since the design and operation of control systems are becoming more complex, maintaining an overview is particularly important. A useful tool is the so-called top-down approach developed by system engineering. It yields a well structured system in which each function is performed at its optimal location. The general top down method is applied to the particular needs of hydropower control down to the functional level, where the well known block diagram description for feedback control loops or ladder diagrams for logic control modules will take over. (Baker-IVI)
W85-01548

REAL-TIME RESERVOIR OPERATIONS BY GOAL PROGRAMMING,
Lakehead Univ., Thunder Bay (Ontario). School of Engineering.
E. K. Can, and M. H. Houck.
Journal of Water Resources Planning and Management, Vol. 110, No. 3, p 297-309, July, 1984. 2 Fig, 3 Tab, 19 Ref, 2 Append.

Descriptors: *Green River Basin, *Kentucky, *Goal programming, *Reservoir operation, Model studies, Systems analysis, Dynamic programming, Reservoirs, Optimization.

Preemptive goal programming is applied to the real-time, daily operation of multiple-purpose, multiple-reservoir systems. A significant advantage of the goal programming approach is that it may be based on physical operating criteria. It does not require the penalty-benefit functions that may be difficult to define but are essential to other real-time operating models. Therefore, it is easier to implement. The goal programming model was applied to the Green River Basin (GRB) system (Kentucky) comprising four multipurpose reservoirs. The GRB system operations resulting from use of the goal programming model were compared to operations resulting from another optimization model which is more data intensive and which was designed specifically for the GRB system. Both sets of operations are comparable in their effectiveness, although in some cases the goal programming operations are better. (Author's abstract)
W85-01566

WATER MANAGEMENT USING INTERACTIVE SIMULATION,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
A. B. Cunningham, and J. R. Amend.
Journal of Water Resources Planning and Management, Vol. 110, No. 3, p 310-322, July, 1984. 8 Fig, 3 Ref.

Descriptors: *Management planning, *Simulation, *Water management, Regional planning, Resources management, Public participation, Computers.

Interactive simulators utilizing current microprocessor technology have been developed and applied to several categories of contemporary water planning and management problems. Specific issues addressed include real time system operation, training programs for system managers and technicians, demonstration of system management alternatives, and public education programs and workshops. Both generalized and site-specific water management systems have been modeled by simulators which allow the user to interact directly with the computational stream of the system model. Simulator units have been constr using various combinations of visual displays itors, and printed output devices to monitor s performance. Results of this 4-yr investigatior cate that interactive simulator technology offe effective and flexible alternative to traditional tal computer simulation. (Author's abstract)
W85-01567

OPTIMIZATION MODEL FOR GROU WATER PLANNING,
Humboldt State Univ., Arcata, CA. Dept. of ronmental Resources Engineering.
R. Willis, and P. Liu.
Journal of Water Resources Planning and Ma ment, Vol. 110, No. 3, p 333-347, July, 198 Fig, 3 Tab, 28 Ref. NSF grant INT-7816648.

Descriptors: *Groundwater, *Model studies, timization models, *Yun Lin basin, *Taiwan, gation effects, Aquifer management, Manage planning.

A planning model was developed for the op management of groundwater systems. The m which was formulated as a bi-objective optii tion problem, allocates over a series of plar periods, groundwater to competing water (ir tion) demands in a river basin. The model predicated on the response equations of ground-water system. Equations were devel for an inhomogeneous, isotropic aquifer sy with the Galerkin finite element method. matrix calculus was used to obtain a contin solution in time relating the hydraulic head an initial state of the system, the system's time pendent boundary conditions, and the planni management policies. The planning model wa plied to the Yun Lin groundwater basin in s western Taiwan. Parametric linear program was used to generate optimal planning policies set of non-inferior solutions, and the relatior between the total water deficit and: the maxi pumping rate and the minimum permissible values in the aquifer system. (Author's abst
W85-01569

MANAGING A PUBLIC INVOLVEMENT P GRAM,
Army Engineer District, St. Louis, MO.
R. F. Astrack, N. A. Baumann, and G. L. Reynolds.
Journal of Water Resources Planning and Man ment, Vol. 110, No. 2, p 153-166, April, 198 Fig, 2 Tab, 26 Ref. U.S. Army Corps of Engin contract DACW 43-78-C-0149.

Descriptors: *Public participation, *Water sources development, *St. Louis, *Missouri, D sion making, Planning, Project planning, Man ment planning.

Federal law now requires public participation part of the planning for water resources deve ment. The U.S. Army Corps of Engineers de oped and managed a Public Involvement Prog for a segment of the East St. Louis and Vici Interior Flood Control Project. The public volvement program used such methods as a De panel, public meetings and workshops, public formation fact sheets, media contacts, and infor tion packets. These methods were used in iden ing water-related problems and evaluating alte tives to those problems. The Delphi panel effective in increasing sensitivity to public pre ences which enabled better planning of pu meetings and workshops. Panelists responded n favorably to identifying water resource probl and concerns than to evaluating options to rec or eliminate the identified problems. Public m ings and workshops provided people the oppo nity to identify water-related problems and c cerns, evaluate options, receive factual study in mation, and exchange ideas. The flexibility public involvement program should be a m consideration to allow for change as a study gresses. (Collier-IVI)
W85-01574

3. Evaluation Process

ATER-PROTECTION AND POWER EFFI-ENCY OF RESERVOIR DRAWDOWN,
. Gordin.
drotechnical Construction, Vol. 17, p 543-547, vember, 1983. 5 Fig, 6 Tab. Translated from drotekhnicheskoe Stroitel'stvo, No. 11, p 5-8, vember, 1983.

scriptors: *Reservoir operation, *Drawdown, ydroelectric plants, *Wastewater dilution, ter quality control, Dilution, Discharge, Water nagement.

e construction of reservoirs intended for dilu- of wastewaters of downstream regions and ultaneously for electric power generation com- ate the problem of the interrelations of partici- ts of the water management complex when gning hydroelectric schemes and preparing wdown schedules. The water protection effi- cy of drawdown is determined by the dis- rge and quality of the water being discharged the lower pool. During justification of the pivino hydroelectric scheme project the prob- of the rationality of the construction of special rvoirs for wastewater dilution was considered. ution of the problem of selecting optimum con- of the release from the reservoirs is described. ker-IVI)
5-01140

AT VALUE WETLANDS,
rson Polytechnical Inst., Toronto (Ontario). t. of Applied Geography.
primary bibliographic entry see Field 2L.
5-01321

COME DISTRIBUTION IMPACTS OF IRRI-TION WATER DISTRIBUTION POLICY,
orado State Univ., Fort Collins. Dept. of Agri-ural and Natural Resource Economics.
. Sampath.
er Resources Research, Vol. 20, No. 6, p 647- June, 1984. 1 Tab, 11 Ref, 1 Ref.

criptors: *Developing countries, *Income dis-ution, *Public policy, *Irrigation water, Water cation, Mathematical models, Economic as-s.

the majority of lesser developed countries C's) there is acute inequality in income distri-on in the rural sector, particularly between e and small farms on the one hand and between owners and the landless on the other. Irriga- water distribution policy of the government is an economic and political problem. It has equity and efficiency implications. It has ef- s on both the level and distribution of income. paper deals with the conditions under which g water redistribution as an effective govern-tal policy variable can reduce inequality in the ibution of income. This paper also deals with relationship between the objectives of equity efficiency in water distribution under different ctive realities, such as dualistic versus nondua- conditions, two-sector versus three-sector eling, optimum versus equal water distribu- specifically to derive the conditions under ch promotion of equity promotes efficiency vice versa and the conditions under which it not. (Author's abstract)
5-01337

STS AND BENEFITS OF ESTUARINE AND ASTAL POLLUTION CONTROL,
lor (John) and Sons, London (England).
. M. Roberts, and P. G. Holmes.
er Science and Technology, Vol. 16, No. 5-7, -82, 1984. 3 Tab. 13 Ref.

criptors: *Water pollution control, *Estuaries, onomic aspects, Cost-benefit analysis, Coastal ers, Industrial wastes, Public health, Municipal ewater.

The background to estuarine and coastal water pollution control is described and the various costs and benefits associated with improvement measures are examined. Comparative costs associated with different engineering solutions are considered with reference to particular examples. Pollutants present in estuaries are derived from two main sources, namely discharges of municipal sewage and direct discharge of industrial effluents. Other sources may include storm overflows from sewerage systems. A typical example of how the many aspects of a river catchment, once grossly polluted, have been brought under critical control and improvements engineered with obvious success is that of the River Thames. Recommendations were made in 1972 that the two following criteria should be a minimum management aim for the estuary: the ability of the estuary to support on the mud bottom the fauna essential for supporting sea fisheries, and the ability to support the passage of migratory fish at all stages of the tide. Improvements have been noted in the records of annual minimum average dissolved oxygen levels for the tidal Thames. In order to improve estuarine or coastal water pollution conditions some degree of capital investment is required. The amount involved depends upon many considerations, not the least of which must be the will of the community to make the necessary committment. Benefits derived in economic terms may be marginal, but with the present upsurge in environmental awareness, concern for the conservation of resources and general appreciation of amenity values, any scheme will be considered beneficial. (Baker-IVI)
W85-01394

IMPROVE OPERATION OR BUILD NEW PROJECTS,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
D. P. Sheer, and D. D. Meredith.
Journal of Water Resources Planning and Management, Vol. 110, No. 3, p 351-355, July, 1984. 1 Tab, 7 Ref.

Descriptors: *Water resources development, *Planning, Construction, Cost analysis, Benefits, Evaluation.

Benefits from water resources projects can be increased by constructing new facilities or by improving the operation of existing facilities. This note suggests that it is possible to achieve benefits by improving the operation of existing facilities at about 1% of the cost of constructing new facilities to produce the same amount of benefits. The value of existing federal water resources projects is estimated from historical construction costs. The value of improved operation of existing facilities is then estimated and shown to be at least as large as the value of new construction for the next 20 years. Recommendations are presented for reviewing and improving the operation of existing projects. (Baker-IVI)
W85-01570

ESTIMATING O AND M COST WHEN COSTS VARY WITH FLOW,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
T. M. Walski.
Journal of Water Resources Planning and Management, Vol. 110, No. 3, p 355-360, July, 1984. 4 Fig, 6 Ref.

Descriptors: *Maintenance costs, *Evaluation, Flow, Maintenance, Operation, Facilities.

The operation and maintenance costs of facilities, such as pumping stations, wellfields and water and wastewater treatment plants are highly dependent on the actual flow pumped or treated. In order to precisely determine the contribution of operation and maintenance to the average annual cost of a project, it is necessary to: determine the average annual cost for a given period (usually a year), find the present worth of that cost, sum the present worth of each year's operation and maintenance cost, and amortize the present worth of operation and maintenance cost over the life of the project. Some easy to use graphs are presented to determine the equivalent flow and the year in which it occurs. First some preliminaries are presented to make the formulas as general as possible. Then the general formulas for equivalent flow and the year in which it occurred are derived. Finally, the graphs are presented and an example problem is worked. (Baker-IVI)
W85-01571

INCREASED DIVERSION AT CHICAGO: INITIAL ASSESSMENT,
International Environmental Consultants, Inc., Golden, CO.
P. D. Kilburn, D. J. Tate, and S. White.
Journal of Water Resources Planning and Management, Vol. 110, No. 2, p 238-253, April, 1984. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Lake Michigan, *Illinois River, *Chicago, *Diversion, *Environmental effects, Economic evaluation, Electric powerplants, Navigation, Erosion.

The Corps of Engineers has proposed and analyzed the effects of diverting Lake Michigan waters down the Illinois River in times of above average lake levels. Effects would vary considerably depending upon the rate and timing of diversion. Major benefits on the river portion will be an improvement in water quality, increased benefits to commercial navigation and increased power generation. On the Great Lakes the major benefits would be reduction in shoreline erosion and flooding. Adverse effects would be significant. On the river major adverse effects are due to increased flooding over existing conditions and longer flooding duration in the lower reaches. Current trends of habitat destruction and loss of species diversity in natural ecosystems will be accelerated by the increased diversion, resulting in the deterioration of natural ecosystems. Managed ecosystems such as leveed farmlands and duck clubs will suffer higher drainage costs as a result of the increased flooding. Unleveed areas will experience substantial crop losses, especially in low water years, and diversion may ultimately preclude agriculture in such areas. On the lakes, major adverse effects would result from power loss, lowered ship capacity resulting from shallower draft at docking facilities, and loss of water-edge ecosystems. (Author's abstract)
W85-01580

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

MICROCOMPUTER BILLING FOR THE SMALL WATER UTILITY,
Amory Engineers, Duxbury, MA.
D. F. Edson.
Journal of the New England Water Works Association, Vol. 98, No. 1, p 48-56, March, 1984. 2 Fig.

Descriptors: *Automation, *Utilities, *Billing, *Microcomputers, Computers, Management, Decision making.

The nature of water utility billing encompasses record keeping, repetitive calculations and the printing of bills on standard forms. Thus, billing is a process which lends itself well to computerization. Computerized billing can save time, reduce errors and improve overall performance and quality control - items which can result in reduced costs and increased customer satisfaction. Three main options are available to water utilities for computerized billing: own your own computer, share a computer with others or use a service bureau. The recent advent of low cost, powerful microcomputer systems has made the first option feasible for small utilities. Packaged programs providing billing capabilities are available along with others providing word processing, budgeting and accounting. When evaluating a microcomputer billing system, the utility should define its needs and consider such factors as cost, capabilities, ease

of use and the availability of service and technical assistance. (Baker-IVI)
W85-01316

PRICE RIGIDITY AND QUANTITY RATIONING RULES UNDER STOCHASTIC WATER SUPPLY,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 3D.
W85-01339

6D. Water Demand

RELATIVE EFFECTS OF U.S. POPULATION SHIFTS (1930-80) ON POTENTIAL HEATING, COOLING AND WATER DEMAND,
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
For primary bibliographic entry see Field 2B.
W85-01153

WATER REQUIREMENTS FOR COAL-FIRED POWER PLANTS,
Colorado State Univ., Fort Collins. Dept. of Economics.
N. L. Dalsted, and J. W. Green.
Natural Resources Journal, Vol. 24, No. 1, p 137-141, January, 1984.

Descriptors: *Water demand, *Coal, *Powerplants, Power, Coal conversion, Water use, Water supply, Consumptive use.

The impacts of alternative patterns of coal development on natural resources and rural communities were investigated. Study of readily available data bases and models revealed that existing analytical tools and supporting data bases would not provide sufficient detail at the rural community level without substantial post-model disaggregation. A major sub-objective of the study has been to identify individual mine suppliers of coal fired power plants each year from 1975 through 1982. The data, when combined with files describing current plants for new coal-fired units and conversions, can be used to perform short run analyses of coal demand in the electric utility industry. Model runs were made for 89 power plants using western coal in 1975, and 154 plants using the same coal in 1985. Steam electric coal production in the western states was projected to increase from 65 million tons in 1975 to 286 million tons in 1985. Greater future emphasis on evaporative cooling technologies, such as wet cooling towers, will significantly increase total consumption of water. Once base runs describing best estimates of the structure of the coal network for any year have been made, the linear programming constraints can be selectively relaxed to generate a picture of the coal network resulting from alternative policy scenarios. Many other analyses are possible with the comprehensive data bases organized at Colorado State University. (Baker-IVI)
W85-01241

LEGISLATION ON DOMESTIC AND INDUSTRIAL USES OF WATER: A COMPARATIVE REVIEW,
United Nations, New York. Dept. of Technical Co-operation for Development.
For primary bibliographic entry see Field 6E.
W85-01242

STATUS OF MINING CLAIMS WITHIN THE NATIONAL RIVERS OF THE UNITED STATES,
For primary bibliographic entry see Field 6E.
W85-01245

PRIOR APPROPRIATION, IMPAIRMENT, REPLACEMENTS, MODELS AND MARKETS,
Rodey, Dickason, Sloan, Akin and Robb, Albuquerque (New Mexico).
For primary bibliographic entry see Field 6E.
W85-01248

REASONABLE GROUNDWATER PUMPING LEVELS UNDER THE APPROPRIATION DOCTRINE: UNDERLYING SOCIAL GOALS,
Idaho Univ., Moscow. School of Law.
For primary bibliographic entry see Field 6E.
W85-01249

OPTIMIZATION MODEL FOR GROUNDWATER PLANNING,
Humboldt State Univ., Arcata, CA. Dept. of Environmental Resources Engineering.
For primary bibliographic entry see Field 6A.
W85-01569

6E. Water Law and Institutions

DELAWARE RIVER BASIN, DROUGHT MANAGEMENT,
For primary bibliographic entry see Field 4A.
W85-01121

REGIONAL TENSIONS COMPLICATE SEARCH FOR AN ACID RAIN REMEDY,
For primary bibliographic entry see Field 5G.
W85-01178

LEGISLATION ON DOMESTIC AND INDUSTRIAL USES OF WATER: A COMPARATIVE REVIEW,
United Nations, New York. Dept. of Technical Co-operation for Development.
S. Burchi.
Natural Resources Journal, Vol. 24, No. 1, p 143-159, January, 1984. 114 Ref.

Descriptors: *Legislation, *Water use, *Water demand, Water quality control, Metering, Conservation, Appropriation, Water resources development, Water allocation, Land use, Domestic water, Industrial water.

Domestic legislation of countries in different regions of the world is reviewed concerning or related to domestic and industrial uses of fresh water resources. In broad outline, since the government may find it impractical to extend its control over many small water appropriations, the appropriation of water for a domestic purpose from sources owned or controlled by the government is frequently exempted from administrative permit requirements and, correspondingly, from relevant appropriation charges. Domestic and industrial water appropriation charges, if levied, tend to reflect the amount of water appropriated or actually consumed, and may foster an efficient allocation of water resources of different quality among competing uses. Government controls over water appropriations are effected by instituting licensing and reporting requirements and procedures and sometimes quotas and standards for the amount of water which can be appropriated. When water is appropriated for distribution to and consumption by, the public, restrictions on land use and water withdrawals frequently are relied on for the protection of sources and intakes of the public distribution system. Metering of water supplied to consumers, and billing thereof according to consumption is practiced in some countries, but does not appear to amount to a trend. Another practice observed in some countries is the levying of higher charges in respect of industrial as opposed to domestic consumers in order to effect an efficient allocation of potable-quality water. Concerns for the health of the public at large, for the safety of the environment, and for subsequent uses of stream water and groundwater have dictated a widespread trend toward regulating the disposal of domestic and industrial wastewaters. (Baker-IVI)
W85-01242

MIXING WATER AND THE COMMERCE CLAUSE: THE PROBLEMS OF PRACTICE, PRECEDENT, AND POLICY IN SPORHASE V. NEBRASKA,
P. M. Barnett.
Natural Resources Journal, Vol. 24, No. 1, p 161-194, January, 1984. 157 Ref.

Descriptors: *Legislation, *Sporhase vs Nebra *Commerce Clause, Water law, States rights, ural resources, Water export.

The Sporhase vs Nebraska case is reviewed three areas of significance: first, what Sporh means from a water law perspective; secon how Sporhase departs from earlier doctrine; thirdly, the policy question of whether Sporh reaches a sound result. While the opinion voice Sporhase is ambiguous in several regards, it se to give states the power to restrict the export water when sufficiently important state inter are at stake. Furthermore, because the implicati of the case cannot soundly be limited to wa Sporhase can be read to give states equival power over other resources. When analyzed fr a policy perspective, Sporhase is not a compell decision. States should not be given broad pow to embargo water because that would permit sta to enact embargoes which protect instate consu ers from out of state competition. In additi states should not be allowed to protect only imp tant state interests with embargoes; a state always enact evenhanded regulations to acco plish that objective. Although Sporhase does draw the right line between desirable and unde able embargoes, both kinds of embargoes ex Embargoes are desirable in at least three situati arising from the commons nature of water. though differentiating between embargoes acco ing to their merits concededly will be diffic differentiation is preferable to following a r which either automatically upholds or automati ly invalidates all export restrictions. (Baker-I W85-01243

COMMERCE CLAUSE CURBS STATE CO TROL OF INTERSTATE USE OF GROU WATER: CITY OF EL PASO V. REYNOLD
S. P. Gross.
Natural Resources Journal, Vol. 24, No. 1, p 2 220. January, 1984. 37 Ref.

Descriptors: *Legislation, *Groundwater, *N Mexico, *Commerce Clause, Water manageme Water conservation, Natural resources, Sta rights, Water export.

Since the court held in Sporhase that water was article of commerce and subject to commer clause analysis, the federal district court felt co pelled to find New Mexico's underground wat embargo unconstitutional. The underground wat embargo is facially discriminatory against out state users. The embargo is unconstitutional cause New Mexico failed to show that it w narrowly tailored to a public health purpose. T court's decision erodes New Mexico's control ov its water resource, but does not preclude the stat shaping its economic future through rational pla ning. Since the federal district court decision, Ne Mexico has acted to regain control through legisl tion that allows export of groundwater and esta lishes conservation guidelines for approval of state and out of state use of underground wat (Baker-IVI)
W85-01244

STATUS OF MINING CLAIMS WITHIN TH NATIONAL RIVERS OF THE UNITE STATES,
D. Viramonte.
Natural Resources Journal, Vol. 24, No. 1, p 22 227, January, 1984. 39 Ref.

Descriptors: *Legislation, *Land use, *Minir claims, *Buffalo River, Arkansas, Water deman Water use, Natural resources, Conservation, N tional parks, Wilderness areas.

The conflict in this case is between the preserv tion of a river's pristine, undeveloped charact and public accessibility to the land for miner location. The conflict is between the Minir Claims Act of 1872 and the Wilderness Act 1964. Mining claims in the area of the Buffa River were disallowed because, even though th River is not a natural park or monument, the are involved were acquired for purposes which woul

rustrated if mineral claims were allowed. The ellate Court reached a result based on proper tory interpretation. The court refused the opunity to expand on the specific purpose doc-. At worst, the court's refusal to apply the ific purpose doctrine can be viewed as a rejec- of the doctrine as the higher court chose to e with the District Court in the result, but greed with the District Court on the best path at result. Under these circumstances, the 8th uit opinion may be viewed as confusing the of further mineral exploration within the Nal Park System. This confusion may weaken sefulnesss of the doctrine as a powerful legise and judicial tool. Increased reliance on nonwable resources stresses the importance of an rly progression policy concerning mineral exation within our national parks and wilderness s. (Baker-IVI)
-01245

TER LAW,
ichwald.
ral Resources Journal, Vol. 24, No. 1, p 219- January, 1984. 24 Ref.

criptors: *Legislation, *Water reuse, *Reyn- vs City of Roswell, Wastewater treatment, er supply development, Water rights, Arid res.

eynolds v. City of Roswell, two problems are lved. The first is whether an owner of water s can change the place of use of these rights out restrictions. The second issue is whether a icipality can reuse its sewage effluent to the nt it desires. The State Engineer intertwined e two problems when he imposed the condi- on his approval of the City of Roswell's ication for change of place of use of its water s, that condition being that the sewage effluresulting from the water use to be returned to ral streams or underground reservoirs. It was luded that the State Engineer should condi- the change of place of use only when other r rights are affected and should not condition change on whether a municipality will contino discharge its treated sewage effluents into ral streams or underground reservoirs. It is ortant that the Court held that municipalities ot required to discharge any of their treated ge effluent because allowing municipalities to e their own sewage effluent provides for the efficient use of the water which is appor- to the municipality. In light of environmenoncerns related to sewage effluents and the increasing struggle for water in the arid hwest, this case gives municipalities and other r owners additional water from their own ge without affecting the water interests of rs. (Baker-IVI)
-01246

QUIREMENT OF BENEFICIAL USE AS A SE OF WASTE IN WATER RESOURCE ELOPMENT,
rado Univ., Boulder. School of Law.
Williams.
ral Resources Journal, Vol. 23, No. 1, p 7-23, ary, 1983. 2 Tab, 33 Ref.

criptors: *Legislation, *Beneficial use, *Water urces development, Prior appropriation, Water Natural resources, Water conservation.

doctrine of prior appropriation is a rule of ure. Ways in which prior appropriation law gs about waste in water resource development considered. The logical cure is examined which lves authorization of anticipatory water rights ch would vest without application to a benefiuse. Finally, this cure is related to some special tutional features of water resource allocation: role of governmental agencies as water rights ers and inter-regional conflict over water. ter-IVI)
5-01247

OR APPROPRIATION, IMPAIRMENT, RECEMENTS, MODELS AND MARKETS,
Rodey, Dickason, Sloan, Akin and Robb, Albuquerque (New Mexico).
W. C. Schaab.
Natural Resources Journal, Vol. 23, No. 1, p 25-51, January, 1983. 122 Ref.

Descriptors: *Legislation, *Water demand, *Prior appropriation, States rights, Water rights, Water conservation, Water supply development, Water management.

The prior appropriation doctrine allowed the staking of a claim against a water supply, regardless of the extent of the resource, and was therefore helpless to prevent over-appropriation of the available supply. The prior appropriation rule was adopted throughout the western states with local variations. The rule was popular because it invited rapid development and use of western surface supplies, but new appropriations could not be limited unless a senior interest sought an injunction. Creation of water bureaucracies based on executive rather than judicial authority halted the growth of the court created prior appropriation doctrine. Creation of a governing administrative office charged with examining closely all transfers of water rights impeded creation of active and open markets for water rights. The rigid administrative prohibition of necessary uses without a convincing scientific basis which followed inevitably led to adjustments in the non-impairment requirement. The courts were able to modify the non-impairment rule to foster maximum use of water resources. In many western states, as groundwater has become more widely used and the practical consequences of the rigid protection of senior claims has become more clearly understood, impairment has been defined by statute as an unreasonable lowering of the water or pumping level. Where a statute permitting some degree of infringement of senior rights is unavailable, many courts have found unflinching application of the priority doctrine impossible in practice and have therefore used a variety of practical remedies to achieve a reasonable accommodation among conflicting uses and thus permitted desirable junior uses to begin or continue. (Baker-IVI)
W85-01248

REASONABLE GROUNDWATER PUMPING LEVELS UNDER THE APPROPRIATION DOCTRINE: UNDERLYING SOCIAL GOALS,
Idaho Univ., Moscow. School of Law.
D. L. Grant.
Natural Resources Journal, Vol. 23, No. 1, p 53-75, January, 1983. 89 Ref.

Descriptors: *Groundwater management, *Economic aspects, States rights, Prior appropriation, Legislation, Social aspects, Pumping, Water demand, Natural resources.

A brief look at the normative incompleteness of the economic efficiency goal as pursued through cost benefit analysis is presented. Detailed consideration of possible social goals under the reasonable pumping level statutes and related appropriation doctrine laws and traditions is offered along with general thoughts on implementing the reasonable pumping level concept. The common law priority principle started out with a wealth distribution facet that may well have some continuing vitality in appropriation doctrine states. Groundwater use preference statutes exist in some appropriation doctrine state. In a sense, these statutes constitute a merit good preference. General appropriation doctrine laws and traditions may include other values that are not priced directly or separately in the marketplace, namely, a special justice dimension to being there first and a life of its own for security of investment. (Baker-IVI)
W85-01249

TENTH AMENDMENT NOT VIOLATED BY REQUIRING LOCAL GOVERNMENTAL COMPLIANCE WITH THE CLEAN WATER ACT,
N. R. Long.
Natural Resources Journal, Vol. 23, No. 1, p 273-276, January, 1983. 22 Ref.

Descriptors: *Legislation, *Dredging, *Clean Water Act, Federal jurisdiction, Permits, Local jurisdiction.

The Plaquemines Parish Mosquito Control District began dredging in a wetland area without a permit in December of 1977. A cease and desist order for dredging without a permit was issued in March of 1978 by the Army Corps of Engineers. After a second notice was served, suit was brought against the dredging company. The court concluded that the effectiveness of the Clean Water Act would be drastically impaired by states acting only for their citizens' best interest and in disregard of the effect of their actions on the navigable waters. This decision is a logical result of Hodel v. Virginia Surface. The method of regulation in the Clean Water Act is similar to those in the environmental statutes discussed in Virginia Surface. The environmental statutes addressed all employ the permit system of regulation. By comparison, the court in Parish necessarily concluded that the Tenth Amendment does not bar the federal government from requiring local government agencies to comply with permit procedures. Even if the permit systems were not so similar, however, there is ample support for finding that the federal environmental legislation does not violate the Tenth Amendment because of the strong federal interest in protecting the nation's environment. This interest was expressly acknowledged in the concurring opinion to National League of Cities, the case that provides the basis for the Tenth Amemdment challenge. (Baker-IVI)
W85-01250

PRACTICABLY IRRIGABLE ACREAGE AND ECONOMIC FEASIBILITY: THE ROLE OF TIME, ETHICS, AND DISCOUNTING,
New Mexico Univ., Albuquerque. Dept. of Economics.
H. S. Burness, R. G. Cummings, W. D. Gorman, and R. R. Lansford.
Natural Resources Journal, Vol. 23, No. 2, p 289-303, April, 1983. 4 Tab, 52 Ref.

Descriptors: *Economic aspects, *Irrigation, *Practicably Irrigable Acreage, Water rights, Indians, Cost-benefit analysis.

The practicably irrigable acreage criterion for quantifying water rights reserved for Indian tribes was established in Arizona v. California. This case was reopened in 1980-81 for the purpose of adjudicating water for omitted and boundary lands of the several Indian tribes. The Court's adoption of economic feasibility, indicated by a benefit-cost ratio greater than unity, as a means for demonstrating practicably irrigable acreage may be viewed as one step towards removal of some of these ambiguities. However, there are ambiguities associated with the definition of economic feasibility. There is no single, objective approach for economic feasibility. Results from a benefit cost study may be very sensitive to underlying assumptions. More important issues to be considered include time and a rational for discounting. The manner in which time is treated in a benefit-cost analysis can be of critical importance in quantifying practicably irrigable acreage. First, planning standards change through time. Secondly, benefit-cost analysis was not specifically developed for irreversible types of decisions such as those involving the quantification of water rights. At issue in determining a rationale for discounting is whether satisfaction of future needs by the Indians should be weighed differently from the satisfaction of current needs and just what future means. Given a rationale for discounting, a real, inflation free discount rate must be chosen. (Baker-IVI)
W85-01251

ENVIRONMENTAL WATER LAW,
J. Schrandt.
Natural Resources Journal, Vol. 23, No. 2, p 451-457, April, 1983. 41 Ref.

Descriptors: *Legislation, *Judicial decisions, *Water pollution control, Injunction, Legal aspects, Policy making, Permits.

The Romero-Barcelo decision has important implications concerning the continued enforcement of the Federal Water Pollution Control Act and other

environmental acts. The decision explicitly allows district courts to perform an equitable balancing under the FWPCA when faced with a continuing violation of the Act. Thus, in a case where the pollution is potentially more hazardous than in Romero-Barcelo, the district court is left with the task of finding facts of a technical nature concerning harm to the environment. Until a permit is granted or denied by the EPA, the district court is allowed to substitute its non-expert findings in place of the EPA's expertise concerning water pollution control. Furthermore, the only review of the district court's decision by an appellate court will be for abuse of its equitable discretion. The implication of this decision to other environmental acts is also important. The Supreme Court is telling Congress that a statute's policy enunciation is only one of many factors courts need consider when weighing equitable considerations. Behavior condemned by Congress may not automatically be enjoined by the judiciary. (Baker-IVI)
W85-01252

FEDERAL WETLANDS LAW: THE CASES AND THE PROBLEMS,
W. L. Want.
Harvard Environmental Law Review, Vol. 8, No. 1, p 1-54, 1984. 487 Ref.

Descriptors: *Wetlands, *Legislation, Legal aspects, Clean Water Act, Rivers and Harbors Act, Canals, Environmental effects, Federal jurisdiction.

Throughout much of the history of this country, wetlands have been destroyed in the name of progress. Suddenly in the last decade, their protection has become a national cause, warranting a special newsletter. Some argue that wetlands protection has gone too far and that the Corps' program is a paragon of government red tape and over regulation. The Reagan administration substantially revised the Corps' wetlands regulations in July of 1982, for the stated purpose of eliminating regulatory excesses. Environmentalists have challenged these revisions in court, contending that they eliminate important protections and will result in large wetlands losses. Specifically examined in this article are the scope of the Corps' jurisdictional authority with interest expressed in the Rivers and Harbors Act Section 10, Clean Water Act Section 404, and Scope of Corps Review of Section 404 Permit Applications. Attention is also directed toward a judicial review of Corps wetlands determinations and permit decisions. (Baker-IVI)
W85-01253

SURFACE WATER AND NUISANCE LAW: A PROPOSED SYNTHESIS,
D. L. Burnett, Jr.
Idaho Law Review, Vol. 20, No. 2, p 185-195, Spring, 1984. 40 Ref.

Descriptors: *Legal aspects, *Surface water, Trespass, Nuisance, Reasonable use, Flooding.

The diverse rules of law applicable to surface water cases are surveyed. Surface water flooding may be analyzed under general rules of nuisance law or under certain narrower rules specifically relating to surface water. It is urged that these sets of rules be integrated. Principles underlying the rules are identified and a synthesis of the rules by accommodating those principles is undertaken. Surface water litigation usually arises when one landowner alters a natural drainage pattern and causes flooding of another's property. Depending on the circumstances, the surface water invasion may be characterized as a nuisance or as a trespass. The courts have in general been slow to apply nuisance law in surface water cases. These cases have evolved rules of their own. Differentiations among civil law rules, common enemy and reasonable use rules must be decided in the courtroom. (Baker-IVI)
W85-01307

SECTION 10 OF THE RIVERS AND HARBORS ACT AND WESTERN WATER ALLOCATIONS - ARE THE WESTERN STATES UP A CREEK WITHOUT A PERMIT,
M. G. Proctor.
Boston College Environmental Affairs Law Review, Vol. 10, No. 1, p 111-182, 1982. 478 Ref.

Descriptors: *Resource allocation, *Legal aspects, *Permits, Semiarid lands, Rivers and Harbors Act, Water supply, Water use.

The specific issues left unresolved by the Supreme Court in the California v. Sierra Club are analyzed and the extent to which the Rivers and Harbors Act can and should be used by the federal government to expand its role in western water allocations is examined. A discussion is offered of the history and development of western water law and the traditional role of the federal government in western waters. A discussion of the growing conflict over control of western waters and the possible motivation for an increased federal role follows. The Rivers and Harbors Act is examined in detail, focusing on the potential applicability of section 10 of the Act to state water allocations. Accordingly, the territorial and subject matter jurisdiction of the Act and the permit process are detailed. (Baker-IVI)
W85-01308

WHEN THE WELL RUNS DRY: A PROPOSAL FOR CHANGE IN THE COMMON LAW OF GROUND WATER RIGHTS IN MASSACHUSETTS,
T. N. Lukas.
Boston College Environmental Affairs Law Review, Vol. 10, No. 2, p 445-502, 1982. 370 Ref.

Descriptors: *Water supply, *Groundwater management, *Legal aspects, *Massachusetts, Riparian rights, Water rights, Water use, Property rights, Ownership, Water allocation.

Urban development and increased water consumption has resulted in a limiting of ground water supplies in Massachusetts. The common law rules of ground water rights are assessed and a new rule in this area is proposed for Massachusetts. Basic principles of hydrology and common ground water problems are described to provide a background for a discussion of ground water law. A set of criteria which forms the test for a rational and equitable system of ground water rights is proposed. These criteria are then used to analyze the rule of absolute ownership and each of three other judicial approaches to ground water allocation - the American rule of reasonable use, the doctrine of correlative rights, and the rule of the Restatement of Torts. From the analysis of these alternative approaches, a rule which best satisfies the requirements of a modern system of water law emerges. This rule should replace the inadequate doctrine which now govern ground water rights in Massachusetts. Three features of the Restatement formulation of ground water rights make it especially appropriate for the commonwealth. First, because it is based on concepts of reasonableness and the reciprocal rights of landowners having access to a common aquifer, this rule is compatible with riparian doctrine in the jurisdiction. Second, the Restatement rule provides for sharing scarce water supplies. Finally, courts will be able to uphold the administrative allocations of ground water for public water supply which are already being made by the state environmental agency. (Baker-IVI)
W85-01309

QUARTER CENTURY OF INDUSTRIAL WATER USE AND A DECADE OF DISCHARGE CONTROLS,
Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 5D.
W85-01382

INTERNATIONAL RIVER BASIN MANAGEMENT,
World Health Organization, Copenhagen (Denmark). Regional Office for Europe.
For primary bibliographic entry see Field 5G.
W85-01388

RIVER QUALITY ASSESSMENT AND MO[N]ITORING OF THE DANUBE - AN EXAMP[LE] OF INTERNATIONAL COOPERATION,
Bundesanstalt fuer Wasserguete, Vienna (Austri[a]).
L. J. Ottendorfer.
Water Science and Technology, Vol. 16, No. 5, p 13-20, 1984. 2 Fig, 6 Ref.

Descriptors: *Danube River, *Monitoring, *Wa[ter] quality, International agreements, West Germa[ny], Austria, Czechoslovakia, Hungary, Yugoslav[ia], Romania, Bulgaria, Russia.

The main characteristics of the Danube wh[ich] passes through the following eight European co[un]tries (Fed. Rep. of Germany, Austria, CSSR, Hu[n]gary, Yugoslavia, Romania, Bulgaria and Russ[ia] are described. International cooperation and acti[vi]ties include the work of: a) 'Internationale Arbei[tsg]emeinschaft Donauforschung'; b) ECE (Declar[a]tion of Policy on the Rational Use of Water; Lo[ng] Term Perspectives or Water Use and Supply in t[he] ECE Region) c) cooperation within the 'Intern[a]tional Hydrological Program' resulting in the pre[pa]ration of a Hydrological Monography (part I: Precipitation and Discharge; part II: Water Quali[ty] Assessment of the Danube). Some of the specif[ic] problems encountered in the Danube Countries a[re] discussed. (Author's abstract)
W85-01389

APPLICATION OF THE EUROPEAN COMMU[NI]TIES DIRECTIVE ON DANGEROUS SU[B]STANCES TO LIST II SUBSTANCES IN THE U[.]K.,
Water Research Centre, Stevenage (England).
For primary bibliographic entry see Field 5C.
W85-01399

SETTING OF WATER QUALITY STANDARD[S] - SOUTH AFRICAN EXPERIENCE AND VIEW[-]POINTS,
Water Research Commission, Pretoria (South Africa).
W. H. J. Hattingh, H. J. Best, and A. F. H. Zunckel.
Water Science and Technology, Vol. 16, No. 5-7, p 171-182, 1984. 5 Ref.

Descriptors: *South Africa, *Water quality stand[-]ards, Water supply development, Legislation, Standards, Water use, Effluents.

Available water supplies in South Africa will b[e] fully utilized shortly after the turn of the century. A water act was passed in 1956 to ensure that th[e] rather limited water resources are developed and used to maximum efficiency. The act vested al[l] authority over water matters in one central author[-]ity, called for the setting of effluent standards and required that such purified effluents be discharged to the rivers as the act placed heavy emphasis on riparianism. Effluent standards were promulgated in 1962 comprising a general standard, and a spe[-]cial standard for protected catchments. To date the South African view has been to set a fixed stand[-]ard for effluents and then to assess the value of this standard in cases where a dispute arises or where it is difficult to achieve that standard by means of negotiation. A strong plea is being made that more use of statistical methods be incorporated into the setting of limits, whether it be for effluents or purified water for domestic and/or industrial use. More thought is also needed concerning sampling procedures. Standards should be based on the best available technology to reach the limits imposed and should not necessarily prescribe the technology to be used to achieve the goal. (Baker-IVI)
W85-01400

DECIPHERING THE CODE: HOW FEDERAL EFFLUENT GUIDELINES AFFECT THE PULP AND PAPER INDUSTRY,
L. Derleth.
Paper Trade Journal, Vol. 168, No. 10, p 20-25, May 30, 1984. 4 Tab.

ptors: *Regulations, *Pulp and paper indus-Effluents, Water quality standards, Water on control, Phenols, Zinc.

PA effluent quidelines and standards for the nd paper point source category are ad-l. The regulations establish effluent guide-nd standards for the three defined segments industry: integrated segment, secondary segment, and nonintegrated segment. At , best conventional pollutant control tech- (BCT) limitations have not been promul-or the pulp and paper point source catego-e EPA has proposed that BCT limitations be o the BPT limitations already set up. Pre-ent standards are needed because PCP, nd zinc are known to pass through munici-vage treatment plants. It may be necessary ase by case basis to adjust the categorical tment standards and effluent limitations. A or indirect discharger may apply for an nent to a standard or limitation when factors entally different from those considered in ping the regulations justify the institution of ficantly different discharge limit. Indirect gers are required to submit baseline moni-reports either to the public-owned treatment (POTW) or to the appropriate EPA region-ctor including the following information: neasurements of process wastewaters and ater discharged into the POTW, the results mpling and analysis program that identifies ure and concentration of all regulated pol- in the discharge; a statement indicating r the pretreatment standards are being met onsistent basis and, if not, listing the meas-eeded to meet the standards. (Baker-IVI) 1500

E APPLICATION TO LAND: THE LAND-SSUE,
ia Polytechnic Inst. and State Univ., Blacks-Dept. of Civil Engineering.
rimary bibliographic entry see Field 5D. 1564

R USE AND PUBLIC POLICY IN FLOR-
a State Univ., Tallahassee. Dept. of Urban egional Planning.
Dzurik.
l of Water Resources Planning and Manage-Vol. 110, No. 2, p 167-179, April, 1984. 2 Tab, 25 Ref.

ptors: *Public policy, *Florida, *Water use, r law, Human populations, Population dy-, Water management, Irrigation require-Competing use.

a has experienced an increase in water re-ents and anticipates a continued increase in ming decades. The state's population has dramatically over the past decades with f the growth taking place in the metropoli-gions. Most metropolitan growth will contin-coastal areas; that will impose a special set of supply problems because water resources are lentiful in these areas. The greatest freshwa-e is for irrigation, but municipal supplies the greatest problems in times of water ge. Population and municipal water use by county, show the greatest growth in Florida coastal areas. Projections of water the year 2000 follow a similar pattern. tant policy issues are the ability to provide ture needs and the effectiveness of public for dealing with the interrelations of growth unicipal water use. The state's variety of nd policies for managing water resources lated land use form a complex management that is not always well integrated, and often in conflict, inconsistency and overlap. supply policy is being well served by the water management districts, but additional must be placed on planning for municipal shortages. (Collier-IVI) 1575

6F. Nonstructural Alternatives

WATER QUALITY STANDARDS AS A BASIS OF AN ECONOMIC INCENTIVE SYSTEM,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
A. Homonnay.
Water Science and Technology, Vol. 16, No. 5-7, p 21-31, 1984. 1 Tab.

Descriptors: *Water quality standards, *Hungary, *Economic incentives, Monetary returns, Benefits, Standards, Legislation, Water pollution control, Water quality management.

The present state of water quality management in Hungary is centralized and directed by the National Water Authority, which is the responsible organization for all activities with respect to water resource management and water pollution control. More than fifty rules exist to deal with different aspects of water pollution control, some of them relating only to a special task of environmental protection. A new concept of economic incentives affords the possibility of judging the polluting behavior of each individual discharger against the individual standards imposed, an essential and important factor in water pollution control. Conditions to be met by the economic incentive plan include the following: guarantee the achievement of optimum water quality management requirements for discharges located in the region by economic means; be adaptable to enable each discharger to be set individually prescribed quality standards; produce sufficient incentive for the discharger to meet standards naturally under economically rational conditions; ensure not only the achievement of the necessary investment, but also the realization of the facilities within the appropriate time scale; discourage under-investment which can result from waiting until the discharge standards are broken; not to restrict water quality management investments to technologies determined as optimum, if other alternatives seem to be more economic from the point of view of the discharger, presuming that these alternatives also meet the required objectives; and be in proportion with the actual level of pollution. (Baker-IVI)
W85-01390

6G. Ecologic Impact Of Water Development

APPLICATION OF A CONVENTIONAL FISHERY MODEL FOR ASSESSMENT OF ENTRAINMENT AND IMPINGEMENT IMPACT,
Michigan Univ., Ann Arbor. School of Natural Resources.
A. L. Jensen, and T. A. Hamilton.
Environmental Biology of Fishes, Vol. 7, No. 2, p 181-185, 1982. 3 Tab, 12 Ref.

Descriptors: *Lake Erie, *Perch, *Entrainment, *Impingement, *Monroe Powerplant, *Fishery model, Biomass, Population density, Dynamic pool model, Powerplants, Lake fisheries.

The dynamic pool stock assessment model was applied to determine the impact of entrainment and impingement at the Monroe Power Plant on the yellow perch stock of the Western basin of Lake Erie. Water is pumped by the plant from the Raisin River and Lake Erie; the maximum pumping capacity is 2.8 X 10 to the 9th cu m/yr. Entrainment and impingement studies were conducted concurrently from April 1975 to April 1976 (Anon. 1976. Monroe Power Plant: Study Report on Cooling Water Intake. Detroit Edison Company. Detroit, Michigan. 167 pp.). Parameters of the model are estimated using power plant data, biological data available in the literature, and commercial catch data. The model is applied to estimate the age structure and biomass of the perch stock and to estimate the impact of the power plant on abundance of the impingeable stock and abundance and biomass of the exploited stock. The level of impact was examined under a range of mortality conditions. Under the most extreme conditions examined of full pumping, high fishing mortality, and low natural mortality, the fishable biomass is reduced by 1.7%. This impact is not large, but there are several other power plants and many additional water intakes around the Western basin of Lake Erie. (Collier-IVI)
W85-01118

MINIMIZING THE POSSIBLE EFFECTS OF A TIDAL POWER BARRAGE ON THE SHOREBIRD POPULATIONS OF THE SEVERN ESTUARY,
University Coll., Cardiff (Wales). Dept. of Zoology.
P. N. Ferns, M. P. Hastings, and T. L. Shaw.
Journal of Environmental Management, Vol. 18, No. 2, p 131-143, March, 1984. 11 Fig, 3 Tab, 14 Ref.

Descriptors: *Severn Estuary, *England, *Tidal powerplants, *Water birds, *Ecological effects, *Barrage, *Estuaries, Environmental effects, Electric powerplants, Intertidal areas, Water birds, Waterfowl, Tidal range.

If the tides of the Severn Estuary (Great Britain) are harnessed to produce electricity by the construction of a barrage, the high and low water levels in the reservoir formed by the barrage will change. The range of levels will be reduced, and this reduction will decrease the total area of intertidal mud and sand flats available as potential feeding grounds for the nine species of shorebirds that occur there. The reductions in tidal range considered here (to low tide levels of -2, 0, and +2 m O.D.) would reduce the intertidal mud flats to about 40%, 20%, and 10% of their existing areas, respectively. These reduced tidal ranges would then be similar to those experienced in many British estuaries, some of which support much greater densities of wading birds and wildfowl than the Severn. The Severn would no longer provide one of the larger intertidal feeding areas in the country. It may be possible to select new low tide levels which would minimize the effects on birds without sacrificing too much power output. (Collier-IVI)
W85-01158

RISK-RELIABILITY PROGRAMMING FOR OPTIMAL WATER QUALITY CONTROL,
California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W85-01336

TEMPORAL CHANGES IN THE COMPOSITION AND ABUNDANCE OF THE MACROINVERTEBRATE COMMUNITIES OF THE RIVER HULL,
Hull Univ. (England). Dept. of Zoology.
R. G. Pearson.
Archiv fur Hydrobiologie, Vol. 100, No. 3, p 273-298, June, 1984. 11 Fig, 3 Tab, 11 Ref.

Descriptors: *River Hull, *England, *Invertebrates, *Water pollution effects, *Environmental effects, Dredging, Aquatic weed control, Species diversity, Flow discharge, Population density.

The benthic macroinvertebrate fauna of the River Hull, a lowland stream in northern England, was sampled monthly over a two-year period at seven stations. Changes in discharge, temperature, dissolved oxygen, abundance of macroinvertebrates and community composition were monitored. Variation in the invertebrate communities was surprisingly high at all stations both between months and between years. This variation was due not only to normal life-history changes but also to one or more of the following factors: changes in the flow regime; organic pollution, which varied according to the rate of freshwater discharge; the effects of dredging; and the effects of weedcutting. Variability in population levels and diversity was greatest in the more disturbed stations. Recovery from disturbance was more rapid in the stream fauna of the upper zone than in the more lacustrine-like fauna of the lower zones. The stability of communities, in terms of composition and abundance, was much

lower in the River Hull than expected for a lowland stream. (Moore-IVI)
W85-01371

NEW GOALS AND STRATEGY ADOPTED IN FINLAND FOR THE PROTECTION OF RIVERS,
National Board of Waters, Helsinki (Finland). Water Research Inst.
H. Laikari.
Water Science and Technology, Vol. 16, No. 5-7, p 481-492, 1984. 6 Fig, 1 Ref.

Descriptors: *Finland, *Water resources development, *Environmental effects, *Rivers, Social aspects, Aesthetics, Construction, Dam effects, Fisheries, Dredging.

Water power plants and artificial lakes have been constructed in the Finnish rivers. Rivers beds have been cleared and the natural lakes discharging into them have been regulated. These works have been carried out primarily to protect cultivated lands from flood and to increase the production of electricity. Dams and dredgings have affected adversely fisheries in the rivers and estuaries. Now the aim is to restrict river construction e.g. by drawing up a relevant water protection program for the period 1985-95. According to the program some valuable rivers or sections of rivers are to be totally protected against construction. Cultural and scenic values should be given more weight when decisions concerning river construction works are made. State works should be directed towards maintenance and protection of watercourses instead of construction. (Author's abstract)
W85-01423

EFFECTS OF SEDIMENT RELEASES FROM A RESERVOIR ON STREAM MACROINVERTEBRATES,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
For primary bibliographic entry see Field 5C.
W85-01471

SEASONAL AND AREAL FEATURES OF THE LAGOONAL ENVIRONMENT IN LAKE NAKANOUMI, A SHALLOW COASTAL LAGOON IN JAPAN,
Tokyo Univ. (Japan). Inst. of Applied Microbiology.
H. Ohtake, K. Kondo, Y. Seike, and Y. Date.
Hydrobiologia, Vol. 97, No. 1, p 15-26, November, 1982. 11 Fig, 4 Tab, 14 Ref.

Descriptors: *Land reclamation, *Lake Nakanoumi, *Japan, *Lagoons, Environmental effects, Salinity, Water temperature, Dissolved oxygen, Phosphorus, Nitrogen, Phytoplankton.

Lake Nakanoumi is a shaliow coastal lagoon connected with the Japan Sea by a narrow channel. Over the past decade, land reclamation resulted in a 33% reduction of the lagoon's surface area. The remaining water basin of Lake Nakanoumi is scheduled to be artificially freshened to supply irrigation water for the newly reclaimed lands. The annual range of water temperature is considerably wide, extending over about 20 degrees C in both the surface and bottom waters. The vertical differences between surface and bottom waters were to the extent of 0-3 degrees C. The inverse vertical temperature differences were usually observed during the winter months. Both the surface and bottom salinities remarkably decreased towards the interior of the lake. The main Nakanoumi usually exhibited a vertical salinity profile with a remarkable halocline. On a yearly basis, precipitation could be regarded as the major cause of surface salinity variation. Regular seasonal changes in the surface salinity were observed; the surface salinity was minimum in early spring and maximum in summer. The surface waters were almost saturated with dissolved oxygen throughout a year. The oxygen content of the bottom waters in the main Nakanoumi and the Yonago Embayment showed a distinct seasonal cycle with remarkably low values in summer. The concentrations of total phosphorus and total nitrogen were high in the Yonago Embayment. Total phosphorus concentration in the main Nakanoumi had a distinct seasonal cycle with quite high values during the summer months, which was closely connected with the release of phosphate-phosphorus from lake sediments. The phytoplankton communities of Lake Nakanoumi had salient areal features which were closely related with the surface salinity. (Baker-IVI)
W85-01476

HISTORICAL CHANGES IN THE CONDUCTIVITY AND IONIC CHARACTERISTICS OF THE SOURCE WATER FOR THE SHARK RIVER SLOUGH, EVERGLADES NATIONAL PARK, FLORIDA, U.S.A.,
Everglades National Park, Homestead, FL. South Florida Research Center.
M. D. Flora, and P. C. Rosendahl.
Hydrobiologia, Vol. 97, No. 3, p 249-254, December, 1982. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Shark River Slough, *Everglades National Park, *Florida, *Conductivity, Water quality, Hydrological regime, Sodium, Chloride, Environmental effects, Flood control, Land reclamation, Water storage.

Extensive man-made alterations to the natural flow pattern for the purposes of flood control, land reclamation and water storage have greatly altered the hydrological regime north of Everglades National Park. The changes in the hydrological regime have significantly altered the conductivity and ionic composition of water in the Shark River Slough system of Everglades National Park. The three distinct types of water input are marsh water, canal delivery water, and bulk precipitation. The shift in water inputs from unregulated marsh water flow to regulated delivery of canal water has resulted in a 140% increase in conductivity and 149% increase in total ionic concentration since the early 1960s. Associated with this change has been a 300-400% increase in sodium and chloride concentrations in the waters entering the Shark River Slough of Everglades National Park. While the present quality of delivery water to Everglades National Park still meets existing standards, temporal changes in conductivity and ionic relationships indicate that degradation of the quality of water resources north of the park may have an impact on the water quality in the Shark River Slough. (Moore-IVI)
W85-01483

GROWTH RESPONSES OF FISH TO CHANGING ENVIRONMENTAL CONDITIONS IN A SOUTH CAROLINA COOLING RESERVOIR,
Soil Conservation Service, Ottawa, IL.
D. H. Barwick, and W. E. Lorenzen.
Environmental Biology of Fishes, Vol. 10, No. 4, p 271-279, May, 1984. 4 Fig, 4 Tab, 30 Ref.

Descriptors: *Keowee Reservoir, *South Carolina, *Dam effects, *Fish growth, Postimpoundment, Bluegill, Bass, Crappies, Shad, Fish stocking, Heated water, Nuclear powerplants, Temperature effects.

Keowee Reservoir, in northwestern South Carolina, was impounded in April 1968 and reached full pool in March 1971. It was built primarily to provide condenser cooling water for Oconee Nuclear Station, but it also serves as the lower pool for a pumped storage hydroelectric plant and provides water for a hydroelectric plant. Significant changes in growth of bluegills, Lepomis macrochirus, largemouth bass, Micropterus salmoides, and black crappies, Promoxis nigromaculatus, were observed in Keowee Reservoir, South Carolina, during the 10 years (1968-1977) following impoundment. During this period the reservoir filled, water temperatures were increased by heated effluent from a nuclear power plant, and threadfin shad, Dorosoma petenense, were stocked. Elevated water temperatures appeared to have no measurable effect on growth of bluegills, largemouth bass or black crappies, and stocking of threadfin shad failed to increase growth rates of bluegills. Stocking of threadfin shad may have improved growth rates of 2-year-old largemouth bass and 2-, 3-, and 4-year-old crappies (Moore-IVI)
W85-01496

PLANKTON COMMUNITY OF AN ACID BLACKWATER SOUTH CAROLINA POWER PLANT IMPOUNDMENT,
Carolina Power and Light Co., New Hill, NC. Harris Energy and Environmental Center.
M. A. Mallin
Hydrobiologia, Vol. 112, No. 3, p 167-177, May 1984. 7 Fig, 4 Tab, 37 Ref.

Descriptors: *Robinson Impoundment, *South Carolina, *Plankton, Cooling ponds, Powerplants, Diatoms, Chlorophyta, Rotifers, Copepods, Cladocera, Thermal pollution, Environmental effects, Primary productivity.

Robinson Impoundment, an acid blackwater system in the South Carolina sandhills, serves as a cooling pond for a 854 MW power plant. It is divided by a causeway into an upper and lower impoundment. The upper impoundment is narrow, shallow, exhibits higher flow, and much more periphytic and rooted aquatic macrophyte vegetation. The lower impoundment is wide and deep with many sandy shoreline areas and little macrophyte vegetation. The zooplankton and phytoplankton communities of both the lower and upper impoundment were investigated over a three-year period (1980-1982) in an effort to determine power plant discharge effects on the plankton. Primary productivity rates were low, characteristic of an oligotrophic system. The phytoplankton community was dominated by the Bacillariophyceae and Chlorophyceae in cell density and the Chlorophyceae in species richness. The zooplankton community was dominated numerically by copepods, rotifers, and cladocerans, respectively. Principal zooplankton species included Diaptomus mississippiensis, Bosmina longirostris. Diaphanosoma brachyurum, Keratella americana, K. cochlearis, Pompholyx sulcata, and Conochiloides coenobasis. The rotifers were dominant in species richness, while crustacean zooplankton species richness was usually quite low. Statistical analyses performed using phytoplankton and zooplankton population variables indicated that in most cases upper impoundment densities were significantly lower ($p < 0.05$) than lower impoundment densities which were likely a function of the lotic upper impoundment habitat. No significant differences were found between the discharge area and the rest of the lower impoundment stations suggesting that localized power plant discharge effects did not occur during the study. Peak midsummer thermal discharge (36.0 degrees C) may have caused temporary reductions in D. mississippiensis and several rotifers. Thermal stimulation during summer may have caused population increases for the filter-feeding cladocerans, B. longirostris and D. brachyurum. (Author's abstract)
W85-01498

WATER TEMPERATURE CHANGE CAUSED BY ABSTRACTION,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
J. R. Dymond.
Journal of Hydraulic Engineering, Vol. 110, No. 7, p 987-991, July, 1984. 1 Fig, 6 Ref.

Descriptors: *Model studies, *Water temperature, *Abstraction, *Environmental effects, Thermal capacity, Mathematical equations, Prediction, Water level.

A simple method is presented for predicting water temperature change caused by a constant abstraction. The method requires little data collection, no computer modeling nor lengthy analysis, nor the assumption that the water surface is not shaded. The analysis as presented is not exact as the effects of surface heat transfer and velocity modifications on temperature change during abstraction are not represented, but depth change is implied as the primary cause of temperature change. Important assumptions are that the change of long wave radiation, change of convective-conductive heat

sfer and the change of evaporative heat loss
ed by abstraction are small. This is true for
l temperature changes only. The effect of ig-
ng these terms is demonstrated. (Baker-IVI)
-01561

NG-RANGE RESERVOIR OUTFLOW TEM-
ATURE PLANNING,
inia Polytechnic Inst. and State Univ., Blacks-
. Dept. of Civil Engineering.
). Wunderlich, and M. C. Shiao.
nal of Water Resources Planning and Manage-
, Vol. 110, No. 3, p 285-295, July, 1984. 7 Fig,
b, 3 Ref, 1 Append.

criptors: *Reservoir releases, *Water tempera-
*Fisheries, Reservoir operation, Planning,
roelectric power, Tailwaters, Downstream.

effect of large impoundments on the tempera-
regime of streams can be utilized to provide a
water fish habitat in the tailwater and in a
reach several miles downstream from the
provided that the cold water can be reliably
lied. A method for long-range reservoir oper-
planning to meet an outflow temperature
is described. For downstream water uses it
be beneficial to keep the maximum outflow
erature in fall at or below a target tempera-
This goal can be accomplished by limiting the
amount of discharge after the spring filling of
reservoir. The limit on discharge is expressed
he cold water index (CI), which is the ratio of
discharge during the planning period to the
rvoir volume at the start of the period. The CI
empirical number that must be developed for
particular reservoir considered. Once the CI is
vn, it can be included as a water temperature
ctive in a multi-purpose release planning
el practically without increase in computation-
rden. Achieving the water temperature goal
require shifting of releases from summer to
The decrease in summer output is about 3% of
project's unmodified annual output. This loss is
ly recuperated later in fall resulting in an
al reduction of about 1%. (Moore-IVI)
-01565

ALUATION OF THE INCREMENTAL
THODOLOGY FOR RECOMMENDING IN-
EAM FLOWS FOR FISHES,
homa Cooperative Fishery Research Unit,
water.
. Orth, and O. E. Maughan.
nsactions of the American Fisheries Society,
111, No. 4, p 413-445, July, 1982. 15 Fig, 8
, 109 Ref.

criptors: *Glover Creek, *Oklahoma, *Incre-
tal methodology, *Fish management, *In-
am flow, *Stream fisheries, *Stream discharge,
itats, Population density, Fish populations,
dtom, Stoneroller, Darter, Bass.

reas where there are competing demands for
er, the maintenance of adequate instream flows
fish complicates management of stream fisher-
Instream flow incremental methodology, an
rational method of quantifying the effects of
red stream flow regimes on fish habitat, was
luated for warmwater streams. Application of
'incremental methodology' is limited in many
ations because quantitative information on mi-
habitat preferences of fishes is scarce, and be-
se few field tests of the validity of the assump-
s have been conducted. The incremental meth-
logy was applied in a warmwater stream in
theast Oklahoma. Fish population estimates
e made quarterly over 2 years at four study
s concurrent with estimates of weighted usable
a for each species. Instream flow recommenda-
ns then were developed on the basis of the
emental methodology, the wetted-perimeter
hod, and the Montana (Tennant) method. For
freckled madtom, the central stoneroller, and
orangebelly darter, the assumption of inde-
dence of habitat-suitability functions was vio-
d for at least one of the three possible two-way
nbinations. Violation of this assumption was
atest for the interaction of depth and velocity.
ere were no significant correlations between weighted usable area and standing stock for adult and juvenile smallmouth bass in any season. For the freckled madtom, the central stoneroller, and the orangebelly darter, correlations between weighted usable area and standing stock were consistently significant during the summer. Monthly instream flows recommended for Glover Creek equaled or exceeded the historical flows in typical water years. Flow recommendations based on the Montana and wetted-perimeter methods were similar to those based on the incremental methodology for the low-flow season (July-December) only. (Collier-IVI)
W85-01623

7. RESOURCES DATA

7A. Network Design

OPTIMIZATION OF WATER QUALITY MONITORING NETWORKS,
Waterloopkundig Lab., Delft (Netherlands).
S. Groot, and T. Schilperoort.
Water Science and Technology, Vol. 16, No. 5-7, p 275-287, 1984. 7 Fig, 1 Tab, 8 Ref.

Descriptors: *Monitoring, *Water quality, *Networks, *Optimization, *Netherlands, Cost analysis, Sampling frequency.

The water quality monitoring network in the main surface waters in The Netherlands includes almost 400 sampling locations with a sampling interval of 1 to 4 weeks. The number of water quality variables analyzed at a sampling location varies from 15 up to 100. A general approach for monitoring network optimization involves five steps: identification and quantification of objectives, including the definition of an effectiveness measure; determination of the relevant process dynamics; evaluation of the effectiveness as a function of the monitoring effort; evaluation of the costs as a function of the monitoring effort; execution of a cost effectiveness analysis. The techniques to be used in the third step strongly depend on the monitoring objectives; a careful definition and quantification of these objectives in statistical terms is a prerequisite for any optimization. For the application of these techniques, knowledge of the correlation structure of the processes is required. When this knowledge is based on observations only, black-box techniques like time series analysis are appropriate. One of these techniques, based on the ideas of Lettenmaier, has been used for the optimization of the sampling frequency of the routine water quality monitoring network in The Netherlands with the detection of trends as the main objective. (Moore-IVI)
W85-01406

7B. Data Acquisition

DETERMINING SOIL MOISTURE FROM GEOSYNCHRONOUS SATELLITE INFRARED DATA: A FEASIBILITY STUDY,
National Aeronautics and Space Administration, Greenbelt, MD. Lab. for Atmospheric Sciences.
For primary bibliographic entry see Field 2G.
W85-01152

DUVAS AS A REAL-TIME, FIELD-PORTABLE WASTEWATER MONITOR FOR PHENOLICS,
Oak Ridge National Lab., TN. Health and Safety Research Div.
A. R. Hawthorne, S. A. Morris, R. L. Moody, and R. B. Gammage.
Journal of Environmental Science and Health, Vol. A19, No. 3, p 253-266, April, 1984. 7 Fig, 2 Tab, 10 Ref. DOE contract W-7405-eng-26.

Descriptors: *Spectrophotometry, *Phenols, *Wastewater, *Monitoring, Instrumentation, Industrial wastes, Coal conversion, Cresols, Xylenols.

A real-time, field-portable Derivative UV-Absorption Spectrometer (DUVAS) has been designed, built, and tested as a monitor for phenolic constituents in wastewater. The monitor has applicability in a variety of industries, including coal conversion facilities for the determination of phenols, cresols, and xylenols. Derivative UV-absorption spectrophotometry has the advantage of enhancing the detection of narrow absorption bands while reducing the spectrometer response to broad absorption bands, to long-term drift of light source and/or detector, and to sample turbidity or opacity. This technique measures the second derivative, or curvature of the absorption band. Two techniques for obtaining second-derivative spectra were evaluated: a previously described monitor based on wavelength modulation with detection of the second harmonic of the modulated frequency providing a response proportional to the second derivative of the sample absorption; the second prototype instrument obtains the second-derivative signal by numerical methods in the integral microcomputer. The second approach simplifies construction of the optics by removing the need for a vibrating mirror and associated electronics; it also uses a solid state photodetector instead of a photomultiplier tube. The new unit has advanced software which enables monitoring of up to 8 wavelength pairs, conversion of the response to ppm, and comparison of the values with alarm set points. The instrument is useful as a real-time, rapid response, field-portable monitor for phenolics at ppm concentrations; the sensitivity is highest for phenols, with xylenols producing a smaller signal. (Collier-IVI)
W85-01159

AUTOMATED WEATHER DATA COLLECTION FOR RESEARCH ON IRRIGATION SCHEDULING,
Agricultural Research Service, Bushland, TX.
T. A. Howell, D. W. Meek, C. J. Phene, K. R. Davis, and R. L. McCormick.
Transactions of the American Society of Agricultural Engineers, Vol. 27, No. 2, p 386-391 and 396, March-April, 1984. 6 Fig, 2 Tab, 29 Ref.

Descriptors: *Weather data collections, *Irrigation scheduling, *Automation, Planning, Computers, Sensors.

The installation and operation of an automated microcomputer weather station network is presented. The network uses off the shelf equipment, yet demonstrates the potential for agricultural weather networks. The network has operated successfully for nearly three years. Problems encountered in its operation have been few and can be divided into three categories: system, maintenance, and operation. When the system is installed, the sensor wiring must allow for quick sensor removal or replacement. This has been a particular problem with the relative humidity sensor. The relative humidity sensor should have a weather proof connector so that replacement sensors can be installed without disconnecting an entire wiring harness. (Baker-IVI)
W85-01181

SOIL SENSOR CONTROL OF HIGH-FREQUENCY IRRIGATION SYSTEMS,
Agricultural Research Service, Fresno, CA.
For primary bibliographic entry see Field 3F.
W85-01182

MODIFICATION OF A STEVENS TYPE-F RECORDER FOR SIMULTANEOUS RECORDING OF RAINFALL AND WATER LEVEL,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
J. V. Savage.
Transactions of the American Society of Agricultural Engineers, Vol. 27, No. 2, p 443-444, March-April, 1984. 2 Fig, 4 Ref.

Descriptors: *Measuring instruments, *Rainfall, *Water level, Recorders, Rain gages.

A modification made to a Stevens Type-F Water Level Recorder, converting it to a dual input instrument, enables rainfall and water level to be recorded simultaneously on a common time basis. The conversion uses commercially available com-

ponents to produce a twin drum recorder. The additional drum is designed to be incrementally rotated by electrical impulses from a tipping bucket rain gauge. The prototype instrument has operated successfully over several years in an area where tropical high intensity rainfall is the norm. The records produced by this recording configuration are of high quality, easily interpreted and suited to digitizing. The water level chart drum and the clock driven pen carriage are unimpeded and operate in the normal way, providing a concurrent record of rainfall and water level. This modification could be carried out by any competent small machine shop. A dual input recorder is thus produced which should be of value in many areas where a single, inexpensive and simple short term instrument is required. (Baker-IVI)
W85-01191

UTILIZATION OF SATELLITE SNOW-COVER OBSERVATIONS FOR SEASONAL STREAMFLOW ESTIMATES IN THE WESTERN HIMALAYAS,
Howard Univ., Washington, DC.
B. Dey, D. C. Goswami, and A. Rango.
Nordic Hydrology, Vol. 14, No. 5, p 257-266, 1983. 4 Fig, 3 Tab, 12 Ref. NASA grant NAG5-224.

Descriptors: *Remote sensing, *Himalayas, *Satellite technology, *Snow cover, *Stream discharge, *Seasonal variation, *Indus River, *Kabul River, *Pakistan, Photography, Hydrologic models, Future planning, Resources management.

Through simple photo-interpretation techniques and linear regression analysis, satellite derived snow cover extent data was successfully used for hydrologic modelling of snowmelt runoff in remote, data-sparse mountain basins like those of the Indus and Kabul Rivers. NOAA-VHRR satellite images have been used to delineate the areal extent of snow cover for early April over the Indus and Kabul River basins in Pakistan. Simple photointerpretation techniques, using a zoom transfer scope, were employed in transferring satellite snow-cover boundaries onto base map overlays. A linear regression model with April 1 through July 31 seasonal runoff (1974-1979), combined with data for 1969-73, as a function of early April snow cover explains 60% and 90% of the variance, respectively, of the measured flow in the Indus and Kabul Rivers. A multiple regression model, with April 1 through July 31, 1969-79, seasonal runoff in the Indus River as a function of early April snow-covered area of the basin and concurrent runoff in the adjoining Kabul River, explains 79% of the variability in flow. Multiple regression modeling further improved the results. The study has operational relevance to water resource planning and management in the Himalayan region. (Collier-IVI)
W85-01233

USE OF A SIMPLE WATER COLUMN SAMPLER TO MONITOR CHEMICAL AND BIOLOGICAL CONDITIONS IN SHALLOW WATERS,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
M. J. Youngbluth, R. A. Gibson, and J. K. Holt.
Florida Scientist, Vol. 46, No. 1, p 15-21, 1983. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Water sampling, *Shallow water, *Sampling, Water analysis, Water depth, Phytoplankton, Chlorophyll, Lagoons.

A simple method is introduced for comparing data derived from interval depth and discrete depth sampling. Field studies conducted in a shallow lagoon indicated that quantitatively reliable estimates of inorganic nutrients, active phytoplankton chlorophyll a, and copepod nauplii can be obtained with a tube type sampler. The simplicity of its design makes the tube type sampler energy efficient and maintenance free, unlike a pump sampler which requires a source of power and periodic inspection of its component parts. In regions where shallow, well mixed waters prevail the tube sampler is a simpler and more rapid alternative to sampling discrete depths with a series of closely spaced bottles. (Baker-IVI)
W85-01239

AUTOMATION IN RESERVOIR CONTROL.
For primary bibliographic entry see Field 4A.
W85-01254

DATA TRANSMISSION FOR AUTOMATIC DAM CONTROL (AUTOMATISIERUNG IN DER TALSPERRENUBERWACHUNG),
Brown, Boveri und Cie A.G., Baden (Switzerland).
For primary bibliographic entry see Field 4A.
W85-01255

AUTOMATIC DATA COLLECTION FOR CONCRETE AND EARTH DAMS,
Inbaber der Huggenberger A.G., Zurich (Switzerland).
J. Ziltener.
Wasser, Energie, Luft, Vol. 74, No. 11/12, p 298-300, 1982. 6 Fig.

Descriptors: *Data acquisition, *Automation, Concrete dams, Earth dams, Dam safety, Water level, Interstitial water, Semiconductors, Transmission, Monitoring.

Procedures and instruments for the automatic collection of data to ensure the safety of concrete and earth dams are described. Progress in this field has been particularly great in semiconductor technology, but increased packing density has resulted in very small distances between conducting parts, which means demands for a long life and protection against voltage surges are not being met. Use of this technology must therefore be restricted to accessible places where replacement is possible. At the beginning of the long chain of measurements and their processing is measurement collection using transmitters, followed by transmission of the signal through a cable to a primary manual or automatic measuring station. Examples of systems are given for measuring water level and for measuring pore water pressure with an intermittently oscillating cord, with a pneumatic or hydraulic system, and with a resistance wire. Criteria for choosing a system focus on the robustness of transmitter and cables and demand that the transmitter have the same life as the dam. There are three possibilities for remote transmission of pendulum movement: optical measurement; inductive measurement; and mechanical reading translated into capacitive value. (Gish-IVI)
W85-01256

ELECTROMAGNETIC DEVICE FOR AUTOMATIC DETECTION OF BEDLOAD MOTION AND ITS FIELD APPLICATIONS,
Birkbeck Coll., London (England).
For primary bibliographic entry see Field 2J.
W85-01276

PHOTOGRAMMETRIC TECHNIQUE FOR MEASURING SOIL EROSION,
Georgia Univ., Athens. Dept. of Geography.
R. Welch, T. R. Jordan, and A. W. Thomas.
Journal of Soil and Water Conservation, Vol. 39, No. 3, p 191-194, May-June, 1984. 6 Fig, 1 Tab, 10 Ref.

Descriptors: *Soil erosion, *Measuring instruments, *Photogrammetry, Erosion control, Prediction, Gully erosion, Channel erosion, Computers, Aerial photography.

Prediction of gully and channel erosion requires improved measurement procedures. Close-range photogrammetric techniques using relatively low-cost 35 mm or 70 mm cameras, readily available cartographic digitizers, and analytical computational methods can provide conservationists with X, Y, Z terrain coordinates accurate to within a few centimeters. Fieldwork is limited to the recording of stereophotographs at desired time intervals before and after storm events. Lab tasks involving coordinate measurement and data reduction require about 2 hr per stereopair. Terrain coordinates are used to form digital terrain models from which contour maps, profiles, and three dimensional perspectives can be created with the aid of computer graphics routines. By registering digital terrain models from two dates, soil loss due to erosion can be computed. This method can be applied to develop data for predictive models to estimate gully and channel erosion. Experiments show that the photogrammetric approach can be used effectively with low-altitude aerial photographs to monitor ephemeral gully erosion in farm fields and to assess sites for farm ponds and terrace construction. (Baker-IVI)
W85-01323

STAGE-ACTIVATED TRIGGERING DEVICE FOR AUTOMATIC PUMPING SAMPLERS,
Oklahoma State Univ., Stillwater. Dept. of Forestry.
D. J. Turton, and P. J. Wigington, Jr.
Water Resources Bulletin, Vol. 20, No. 3, p 443-447, June, 1984. 3 Fig, 7 Ref.

Descriptors: *Automation, *Pumping samplers, *Triggering device, Samplers, Switches.

A device to trigger automatic pumping samplers at discrete stages on headwater streams in southeastern Oklahoma was developed. The magnetic switch column employs a sequence of magnetic reed switches wired in parallel and set at 0.03 m (0.10 ft) intervals. A magnetic float inside the column closes the reed switches, thereby triggering the sampler as stage rises and falls. The columns were constructed from inexpensive, readily-available materials. Following installation and field calibration, the columns provided reliable and representative sampling during 12 storms, at three sites. The magnetic switch column may be used in a wide range of research and monitoring sites to improve water quality sampling. (Author's abstract)
W85-01380

AUTOMATIC MONITORING OF RIVER WATER QUALITY,
National Board of Waters, Helsinki (Finland).
For primary bibliographic entry see Field 5A.
W85-01407

ON-LINE MONITORING, DATA MANAGEMENT AND FORECASTING SYSTEM FOR THE BEDFORD OUSE RIVER BASIN,
Institute of Hydrology, Wallingford (England).
P. G. Whitehead, D. E. Caddy, and R. F. Templeman.
Water Science and Technology, Vol. 16, No. 5-7, p 295-314, 1984. 9 Fig, 4 Tab, 10 Ref.

Descriptors: *Bedford Ouse river basin, *England, *Automation, *River flow, *Water quality, Data management, Monitoring, Forecasting, Computers, River forcasting.

Data from automatic water quality monitors and gauging stations on the Bedford Ouse are telemetered to the Cambridge office of the Great Ouse River Division of the Anglian Water Authority. A mini-computer has been installed to log data from the out-stations, convert data to meaningful units, prepare data summaries, check for alarm conditions and forecast flow and quality up to 80 hours ahead at key locations along the river system. The system provides information on flow and quality conditions in real time and has been used to forecast the movement of pollutants along the river system. A generalized suite of computer programs have been developed for data management and forecasting and a micro-processor controlled water quality monitor is currently under development. (Author's abstract)
W85-01408

, Evaluation, Processing and
blication

FECT OF CENSORING TRACE-LEVEL
TER-QUALITY DATA ON TREND-DETEC-
ON CAPABILITY,
ological Survey, Reston, VA.
. Gilliom, R. M. Hirsh, and E. J. Gillroy.
vironmental Science and Technology, Vol. 18,
7, p 530-535, July, 1984. 5 Fig, 1 Tab, 8 Ref.

criptors: *Trace levels, *Data interpretation,
ater quality, *Censored data, Monte Carlo ex-
ments, Data collections, Simulation analysis,
istical analysis, Detection limits.

nte Carlo experiments were used to evaluate
ether trace-level water-quality data that are
tinely censored (not reported) contain valuable
rmation for trend detection. Measurements are
monly censored if they fall below a level asso-
ed with some minimum acceptable level of
ability (detection limit). Trace-level organic
a were simulated with best- and worst-case esti-
es of measurement uncertainty, various concen-
ions and degrees of linear trend, and different
soring rules. The resulting classes of data were
jected to a nonparametric statistical test for
nd. For all classes of data evaluated, trends were
st effectively detected in uncensored data as
mpared to censored data even when the data
sored were highly unreliable. Thus, censoring
a at any concentration level may eliminate valu-
e information. Whether or not valuable informa-
n for trend analysis is, in fact, eliminated by
soring of actual rather than simulated data de-
nds on whether the analytical process is in statis-
l control and bias is predictable for a particular
e of chemical analyses. (Author's abstract)
5-01125

CROCOMPUTER BILLING FOR THE
ALL WATER UTILITY,
nory Engineers, Duxbury, MA.
r primary bibliographic entry see Field 6C.
5-01316

PLICATION OF PROGRAMMABLE CAL-
LATORS TO WATER WORKS PRACTICE,
H. Babcock.
rnal of the New England Water Works Asso-
tion, Vol. 98, No. 1, p 57-74, March, 1984. 6
, 4 Ref.

scriptors: *Utilities, *Automation, *Water sys-
ns, *Programmable calculators, Planning, Deci-
n making, Computers, Management.

e history and development of calculators is
ced from the time of Napier (1550-1617), Pascal
23-1662) and Leibnitz (1646-1716), each of
om invented calculators for doing arithmetic.
e ordinary pocket calculator has the following
ncipal components: keyboard, display, oper-
ons, and data memory. To these are added pro-
am memory, program input, and program library
make a programmable calculator. Examples of
rious softwater components are listed. The pro-
ammable calculator has become a powerful tool
hich can be used in all phases of water works
actice. It replaces entire libraries of tables with
ta of accuracy not previously available. It can be
ght to perform the most complex of calculations
a tireless never ending fashion. It can free the
anager, engineer, superintendent, and foreman
om numerous repetitive, complex, and boring
sks. It is a tool of incredible usefulness which has
st begun to be explored for this industry. (Baker-
I)
85-01317

8. ENGINEERING WORKS

8A. Structures

FORECAST AND PROVISION OF CAVITATION-EROSION SAFETY IN HIGH-HEAD SPILLWAYS,
P. E. Lysenko, G. A. Chepaikin, and S. A. Tumanov.
Hydrotechnical Construction, Vol. 17, p 552-556, November, 1983. 2 Fig, 1 Ref. Translated from Gidrotekhnicheskoe Stroite'stvo, No. 11, p 11-13, November, 1983.

Descriptors: *Spillways, *Cavitation, *Design criteria, Erosion control, Erosion, Forecasting, Construction, Flow aeration, Cavitation erosion.

A cavitation-safe layout (design) is one for which the depth of the expected erosion is technically admissible and sufficiently clearly forecastable. Technical admissibility means that for the worst case of erosion the integrity or bearing capacity of the structural elements is not threatened and the damaged places can be repaired. The occurrence of a vacuum and cavitation upon separation of the flow from the gate, its sill, and grooves is not admissible in a cavitation-safe layout. All such separation zones should be reliably aerated. In the case of attachment of the through-going flow to the walls of the gate chamber below the maingate, all excess energy of the wall part of the flow which can cause cavitation erosion should be absorbed by a cavitation-resistant lining and dissipated by it. After the through-going flow attached to the walls acquires a direction parallel to them it is expedient to accelerate in every possible way the dissipation of the excess energy of the wall part of the flow by creating local separation with aeration of the flow by means of reverse steps and fins. In the presence of a lining of minimum local technological irregularities (such as weld beads), the lining can be considered safe if it does not lose strength upon the occurrence of cavitation erosion with a depth equal to two heights of the irregularity and four heights of the expected grains of the conditionally uniform roughness. (Baker-IVI)
W85-01142

CALCULATION OF THREE-DIMENSIONAL STABILITY OF DEFORMATION-INHOMOGENEOUS EARTH DAMS,
For primary bibliographic entry see Field 8D.
W85-01143

CALCULATION OF STONE SIZE IN RIPRAP BANK PROTECTION,
M. A. Mikhalev.
Hydrotechnical Construction, Vol. 17, p 585-589, November, 1983. 5 Fig, 5 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 32-34, November, 1983.

Descriptors: *Shear stress, *Mathematical equations, *Riprap, Stress, Slope, Slope stability, Flow, Bank stabilization.

An equation is given which makes it possible to determine the shear stress corresponding to the start of particles located in a fluid flow on a bank slope. In practical calculations the need arises to determine the size of stone in the channel itself, stably resisting the oncoming flow. An equation is given expressing the average value of the shear stress within limits of the stream bottom. (Baker-IVI)
W85-01146

AUTOMATION ON RUN-OF-RIVER POWER PLANTS ON THE INN (AUTOMATISIERUNG VON LAUFWASSERKRAFTWEKEN AM INN),
Innwerk A.G., Toeging (Germany, F.R.).
W. Bernhauer, and J. Gahwiler.
Wasser, Energie, Luft, Vol. 74, No. 11/12, p 304-307, 1982. 7 Fig, 1 Tab.

Descriptors: *Inn River, *Hydroelectric plants, *Automation, *Computers, Powerplants, Process control, Operating costs, Data processing.

An example on the Inn shows how an economical, automatic operation of a river power station can be easier achieved. The process computer, which has considerable resources for this purpose, carries out the manifold functions of the local process control. An essential requirement for the most favorable application of the computer is the analysis of the system-dependent interrelations. The concentration of the most important data in the control center allows the monitoring of several barrages by one person. The experience has proved that, already for smaller power stations, an automatic control lowers the operating expenses. (Author's abstract)
W85-01258

AERATION OF THE DISCHARGE JET IN LARGE FLOOD-CONTROL FACILITIES (DIE BELUFTUNG DES ABFLUSSSTRAHLS BEI GROSSEN HOCHWASSERENTLASTUNGSANLAGEN),
Societe Generale pour l'Industrie Ingenieurs-Conseils, Geneva (Switzerland).
W. Giezendanner, and H. P. Rufenacht.
Wasser, Energie, Luft, Vol. 75, No. 11/12, p 281-282, 1983. 2 Fig, 13 Ref.

Descriptors: *Jets, *Cavitation, *Flood control structures, *Aeration, Erosion control, Discharge channels, Sills.

Water flowing at high speed can cause cavitation damage in discharge channels in flood-control facilities, but aeration can reduce cavitation potential to the extent that design specifications for the channel surface need be less stringent. Erosion power of the jet is reduced by this together with a slightly decreased speed and lower density caused by aeration. In order to produce the necessary non-pressure jet on the channel floor, a sill is constructed. Air is introduced from the side into the chamber that forms between the jet issuing from behind the sill and the floor. The lower limit, in terms of economics, for the aeration of discharge channels is a discharge speed of 20 - 35 m/sec. At this level, sills 1.0 - 1.5 m high producing jets of 10 - 15 m are optimal. In order to maintain the 3 - 8% air content required to prevent cavitation, aeration units must be constructed 50 - 80 m apart or 40 - 60 m after the point at which the jet hits the channel floor. (Gish-IVI)
W85-01262

DAMS - FOR WHOM AND FOR WHAT PURPOSES (DES BARRAGES - POUR QUI, POUR QUOI),
Ecole Polytechnique Federale de Lausanne (Switzerland). Dept. de Genie Rural et Geometre.
For primary bibliographic entry see Field 6A.
W85-01263

NEW BOTTOM OUTLET FOR THE SCHRAH DAM AT THE WAGITAL POWER STATION, SIEBNEN (NEUER GRUNDABLASS FUR DIE STAUMAUER SCHRAH DER AG KRAFTWERK WAGITAL, SIEBNEN),
Ingenieurburo fuer Bauliche Anlagen der Stadt Zurich (Switzerland).
G. Peter.
Wasser, Energie, Luft, Vol. 75, No. 9, p 223-224, 1983. 4 Fig, 2 Ref.

Descriptors: *Schrah Dam, *Siebnen, *Switzerland, Outlets, Underwater construction, Gates, Dam construction, Construction costs.

The discharge capacity of the existing bottom outlet of the Schrah dam at the Wagital power station, Siebnen, Switzerland was too small to allow sufficiently rapid partial or total emptying of the resevoirs. It was therefore necessary to construct a second outlet. The new outlet consisted of a steel plated duct with an inner diameter of 2.20 m and two sliding panel gates measuring 1.10/1.60 m - a control gate and a gate on the upstream side to be used for inspection purposes and operated by an

automatic crane on the crown of the dam. The control gate and the entrance to the duct lie 834.7 and 838.9 m above sea level, respectively. Since the water level of the Innerthal resevoir could only be reduced to 880.0 m above sea level due to slope failures within its catchment area, the bottom-outlet duct had to be inserted on the upstream side under at least 40 m of water. This required that a pressure-resistant, watertight steel assembly capsule be attached to the dam wall, within which the duct could be inserted. The new bottom outlet was operational in June 1984, the total cost being 4,200,000 Swiss Francs. (Gish-IVI)
W85-01264

OFFICIAL START-UP OF THE OBERAAR-GRIMSEL PUMP-FED POWER STATION (PUMPSPEICHERWERK OBERAAR-GRIMSEL OFFIZIELL IN BETRIEB),
Kraftwerke Oberhasli A.G., Innerkirchen (Switzerland).
F. Benelli.
Wasser, Energie, Luft, Vol. 75, No. 9, p 225-226, 1983. 2 Fig.

Descriptors: *Pumped storage, *Oberarr-Grimsel Power Station, *Switzerland, Hydroelectric power, Construction costs.

The final stage of improvements at the Oberhasli power stations in Switzerland was completed with the opening in September, 1983 of the Oberaar-Grimsel pump-fed power station. By circulating water between the two existing reservoirs, lakes Grimsel and Oberaar, enough water can be pumped at night or over the weekend to supplement natural supplies during the five work days and cover periods of peak and heavy energy demand. The plant was designed for a production of 300 MW that could be increased to 600 MW. In winter the circulated water volume is 625 million cu m in the turbine mode and 565 million cu m in the pump mode (13 hr peak and 51 hr heavy demand energy production, 42 hr night and 32 hr weekend pumping). The corresponding figures for summer are 480 and 544 million cu m (8 and 65 hr peak and heavy demand energy production, 57 and 42 hr night and weekend pumping). The total annual circulated water volume is thus 1,100 million cu m, requiring a retention space of 8 million cu m. Annual energy production is 1,000 GWh, for which 1,390 GWh of pumping energy must be expended. The cost of the facility together with that of the Grimsel II Ost headquarters was approximately 448 million Swiss Franks. Construction began in 1973 and was completed in 1980. (Gish-IVI)
W85-01265

5-YEAR-DAM-INSPECTION. AIMS AND PROCEDURES; GEODETIC DEFORMATION MEASUREMENTS (ZIEL UND VORGEHEN BEI DER 5-JAHRES-EXPERTISE SOWIE HINWEISE AUF DIE BEDEUTUNG DER GEODATISCHEN DEFORMATIONSMESSUNG),
Electrowatt Engineering Services Ltd., Zurich (Switzerland).
For primary bibliographic entry see Field 4A.
W85-01271

GEZHOUBA - SUPERPOWER STATION ON THE CHANG JIANG,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
E. Gruner.
Wasser, Energie, Luft, Vol. 75, No. 11/12, p 279-281, 1983. 4 Fig.

Descriptors: *Gezhouba Project, *Chang Jiang River, *China, Dam construction, Hydroelectric plants, Locks, Navigation, Reservoirs, Sluice gates.

It has only recently been possible to realize the energy potential of the Chang Jiang river (a section of the Yang Tze in China) due to difficult geographical and geological conditions. The Gezhouba project began in 1975 with construction of a concrete dam, maximum height 70 m, its 2,561 m length determined by an estimated 1,000-yr flood of 110,000 cu m/sec. The contruction site was divided into three open sites, each able to divert a flood up to 50,000 cu m/sec. The usable head of 23 m lies between 66 and 43 m above sea level. From the right to the left bank, the project consists of site 1, construction begun fall 1982, on an arm of the river separated by an island; site 2, the components of which began operating before the 1982 high water; and site 3, completed before high water 1980. Site 1 comprises 9 sluice gates, width 166 m; a lock for ships up to 10,000 t, 32 x 280 m, width 75 m; power house no. 1 with 14 125-MW units, total 1,750 MW, width 388 m. Site 2 includes 27 flood gates with sector gates, width 500 m; power house no. 2 width 2 m. Site 3 consists of a lock for ships up to 10,000 t, 32 x 280 m, width 75 m; 6 sluice gates for the sand-removal facility, width 105 m; and 1 lock for ships up to 3,000 t, 18 x 120, width 40 m. Total annual power output will be 15,100 MWh. The reservoir was filled in May 1981, in June shipping was rerouted, and in July, power was produced. The entire project will be in operation in 1985. (Gish-IVI)
W85-01273

TUCURUI, GIGANTIC HYDRO POWER PLANT IN BRAZIL (TUCURUI: GIGANTISCHE WASSERKRAFTANLAGE IM AMAZONAS-URWALD),
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
R. Bischof.
Wasser, Energie, Luft, Vol. 74, No. 10, p 278-282, 1982. 7 Fig, 4 Tab, 19 Ref.

Descriptors: *Concrete construction, *Tucuri, *Hydroelectric plants, *Brazil, Roller compaction, Dam construction, Core material, Forests.

Following a short introduction on layout and main characteristics of the scheme the article describes the application of Roller Compacted Concrete, the extraction of core material and the clearing of the forest in the future reservoir area. (Author's abstract)
W85-01362

LARGE SPILLWAYS IN BRAZIL - THREE IMPRESSIONS FROM THE ICOLD-CONGRESS IN RIO DE JANEIRO (HOCHWASSERENTLASTUNGEN BRASILIANISCHER TALSPERREN; DREI EINDRUCKE VOM ICOLD-KONGRESS 1982 IN RIO DE JANEIRO),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
D. Vischer.
Wasser, Energie, Luft, Vol. 74, No. 10, p 283-286, 1982. 5 Fig, 3 Tab, 9 Ref.

Descriptors: *Spillways, *Cavitation, *Reinforced concrete, *Brazil, Dam construction, Air entrainment, Concrete construction, Dam discharges.

Taking some Brazilian dams as an example, the author describes three new developments in the construction of large spillways: the choice of high specific discharges up to 185 cu m/s m, the prevention of cavitation through air entrainment of the order of some percent of the discharge and the application of steel fiber reinforced concrete as a protection against erosion. (Author's abstract)
W85-01363

SELLRAIN-SILZ GROUP OF POWER STATIONS,
G. Brux.
Wasser, Energie, Luft, Vol. 74, No. 10, p 286-289, 1982. 3 Fig, 7 Ref.

Descriptors: *Sellrain-Silz group, *Austria, *Hydroelectric plants, Hydroelectric power, Catchment area, Dam construction.

The Sellrain-Silz group of high-pressure-reservoir power stations is under construction in the Austrian Alps and consists of a top level, including the Finstertal resevoir (60 million cu M) 2,325 m above sea level, a 1.77-km pressure duct (4.40 - 3.00-m diameter), the Kuhtai shaft power station, and the Langental intermediate reservoir (3 million cu m) 1,900 m above sea level, together with a low level comprising a 4.7-km pressure duct (3.30- diameter), a surge tank with a 2.42-km pressu shaft, and the Silz power station with its 1.15-k underwater pipe to the Inn river. The pressuriz waterway for the Sellrain-Silz group is only times the length of the natural head of 1,678 yielding 3.8 KWh of energy per cu m reservo water. The Finstertal reservoir only has a 6-sq-k catchment area and receives 87% of its spring a summer supplies from the Langental reservo partly from the latter's 17-sq-km catchment ar and partly via stream diversions from the 140-s km Otztal, Stubai, and Sellrain catchment area; winter it is emptied to produce energy. Energy f pumping is supplied by the network, while th Kuhtai power plant supplies the network in winte Preparation of the construction sites began in 197 construction was started in 1977, and operatio start-up occurred in 1981. The annual energy pr duction of the Tirol hydroelectric power plan was thereby increased by 30% to 2,385 millio kWh with peak production increasing 55% to 1.3 kW. The Tirol exports this peak current in e change for base-load energy from German therm plants. (Gish-IVI)
W85-01364

EFFECTS OF RISK AND RELIABILITY O OPTIMAL RESERVOIR DESIGN,
University of Petroleum and Minerals, Dhahra (Saudi Arabia). Dept. of Earth Sciences.
H. Yazicigil, and M. H. Houck.
Water Resources Bulletin, Vol. 20, No. 3, p 41 423, June, 1984. 7 Fig, 4 Tab, 22 Ref.

Descriptors: *Reservoir design, *Linear program ming, *Risk, *Reliability, Gunpowder River Maryland, Streamflow, Predictions, Flood control Reservoir capacity, Water supply, Optimization

A chance-constrained linear programming model which utilizes multiple linear decision rules and i useful for river basin planning, is used to evaluate the effects of risk and reliability on optimal reser voir design. Streamflow forecasts or prediction can be explicitly included in the linear program The risk associated with the predictions is included in the model through the use of cumulative distri bution functions (CDF) of streamflows which are conditioned on the predictions. A multiple-purpose reservoir on the Gunpowder River in Maryland is used to illustrate the effectiveness of the model. In order to provide the decision makers with com plete and useful information, trade-off curves relat ing minimum reservoir capacity (a surrogate for dam costs), water supply and flood control targets, and the reliability of achieving the targets are developed. The trade-off curves may enhance the decision maker's ability to select the best dam capacity, considering technological and financial constraints as well as the trade-offs between tar gets, risks, and costs. (Author's abstract)
W85-01378

DESIGN NOMOGRAPHS FOR TRICKLE IRRIGATION SYSTEMS,
North Carolina State Univ. at Raleigh. Dept. of Soil Science.
A. Amoozegar-Fard, A. W. Warrick, and D. O. Lomen.
Journal of Irrigation and Drainage Engineering, Vol. 110, No. 2, p 107-120, June, 1984. 6 Fig, 3 Tab, 26 Ref. Department of the Interior project B-097-ARIZ.

Descriptors: *Trickle irrigation, *Irrigation systems, *Design criteria, Soil water potential, Soil-water-plant relationships, Permeability coefficient, Nomographs, Mathematical studies.

Nomographs relating discharge rate, plant uptake and soil water potential at a reference point are developed for trickle irrigation systems. The hydraulic conductivity K is assumed to be related to pressure head h by K sub 0 exp (alpha h) in which K sub 0 and alpha are empirical constants representative of the specific soil. Point or disc sources located at the soil surface as well as arrays of line sources located at the soil surface or buried at

d are considered. For point or disc sources, ant water uptake is from a cylindrical volume uried horizontal disc. For line source arrays, ver, a one-dimensional uptake is assumed. eference point for line sources is chosen at z sub M midway between the line emitters. isc or cylindrical uptake, the reference point ted at the outer edge of the maximum depth hdrawal. The nomographs are easy to use rovide answers without performing tedious tations. (Author's abstract)
01505

ANGULAR MEASURING FLUMES FOR D AND EARTHEN CHANNELS,
ultural Research Service, Phoenix, AZ. Conservation Lab.
Clemmens, J. A. Replogle, and M. G. Bos.
al of Irrigation and Drainage Engineering, 110, No. 2, p 121-137, June, 1984. 6 Fig, 4 Ref, 1 Append.

iptors: *Flumes, *Design criteria, *Channels, ion water, Weirs, Head discharge, Head Lined channels, Earth channels, Measuring .

water management in irrigated agriculture es that irrigation water be accurately meas- Design procedures and rating tables are pre- for modified broad-crested weirs (which act ulically as long-throated flumes) that have gular control sections. The ratings are pre- in terms of discharge per unit width so that gular broad-crested weirs of a variety of can be used. This makes it easier for the er to adapt the flume to the site rather than ersa. These weirs or flumes can be placed in and unlined canals of any shape. The rating are presented for rectangular lined canals given values of sill or crest height. An adjust- procedure is given to develop rating tables her approach area and sill height combina- The head loss across the weir required to in a unique head discharge relationship is resented. Finally, a design example is given rectangular lined canal. With this informa- a rectangular measuring flume can be de- for a wide variety of site conditions. (Au- abstract)
01506

MIZING CAPITAL COSTS OF MULTI- ET PIPELINES,
(J.M.) Inc., Fresno, CA.
ban, D. Shacham, and J. Loftis.
al of Irrigation and Drainage Engineering, 110, No. 2, p 165-178, June, 1984. 8 Fig, 2 0 Ref, 1 Append.

iptors: *Capital costs, *Pipelines, Design cri- Conveyance structures, Sprinkler irrigation, e irrigation, Manifold lines, Optimization, uters.

cedure was presented for optimal design of a ne with multiple outlets. The optimum ed is global over the entire set of feasible ns. The procedure assumes uniform slope, outlet spacing, and equal outlet discharge a specified range of pressure heads. The opti- on technique suggested is the Lagrange Mul- s method using the Newton Raphson method ve a system of nonlinear equations. The pro- e is applicable both to laterals for sprinkler or irrigation systems and to manifold lines r pipes) for a group of laterals. The cost could be quite significant when a large er of laterals and manifolds are installed in eld. The procedure allows the designer to the sensitivity of the change of one or more les. This is easily done since the design is d out entirely by computer. (Moore-IVI)
01509

ABOLIC CANAL DESIGN AND ANALY-

gradskii Politekhnicheskii Inst. (USSR).
Mironenko, L. S. Willardson, and S. A.

Journal of Irrigation and Drainage Engineering, Vol. 110, No. 2, p 241-246, June, 1984. 1 Fig, 4 Tab, 3 Ref.

Descriptors: *Canal design, *Parabolic canals, Hydraulic design, Stability, Canal construction, Prefabrication.

River beds, unlined canals, and irrigation furrows all tend to approximate a stable parabolic shape. Unlined canals can be made more hydraulically stable by initially constructing them in a parabolic shape. The extra stability of the parabolic channel is due to the fact that only one point of the cross section is at maximum side slope. Small parabolic ditches can be constructed by parabolic-shaped buckets, and large parabolic channels can be constructed by bulldozers and other types of large earth moving equipment. A lined parabolic channel has no sharp angles of stress concentration where cracks may occur, and can be prefabricated in molded section. The structural shape of a prefabricated parabolic section makes it possible to use the section as a suspended flume with support only at the joints. (Moore-IVI)
W85-01515

SULBY RESERVOIR, ISLE OF MAN: DESIGN AND CONSTRUCTION,
P. G. Eccles, and K. A. Kaye.
Journal of the Institution of Water Engineers and Scientists, Vol. 38, No. 3, p 197-216, June, 1984. 4 Fig, 2 Tab, 12 Ref, 2 Append.

Descriptors: *Isle of Man, *Sulby Reservoir, *Dam design, *Dam construction, Hydroelectric plants, Water resources development, Geology, Asphaltic concrete, Earth dams, Dam cores.

The Isle of Man has a resident population of about 62,000. Due to the large increase in consumption during the summer holiday period, when the Island's population can almost double temporarily, water storage is essential, especially in dry years. In 1976, a feasibility study and report on the construction of a new impounding reservoir at a site close to Druidale, in the Sulby valley. The earth dam was initially planned to be constructed in two stages, but the incorporation of hydroelectric development in the project led to continuing with the second stage of the dam immediately, to make use of the surplus water Particular items described include the site geology, the asphaltic concrete core and membrane, and the supporting rockfill shell of the dam, from both design and construction aspects. The two-stage design does not appear to have been detrimental to the overall safety and performance of the dam. The geotechnical (grouting and testing) work has indicated good results. Asphaltic concrete has proved in use to be both suitable and satisfactory for this purpose. Reservoir impoundment reached TWL at the end of April 1983. (Moore-IVI)
W85-01521

OVERLAPPING PILES FORM CUTOFF WALL AT THAI DAM,
A. Alfonso, B. De Paoli, and S. Stefani.
International Water Power and Dam Construction, Vol. 36, No. 6, p 17-21, June, 1984. 7 Fig, 4 Ref.

Descriptors: *Dam construction, *Piles, *Cutoff walls, *Khao Laem Dam, *Thailand, Drilling equipment, Design criteria, Dam foundations, Grouting.

The dam for the Khao Laem multipurpose project in Thailand had to be constructed on poor quality karstic limestone foundations. The concrete cutoff wall consisting of overlapping piles in rock which the contractor used to overcome the problems is described. The solution involved the use of a 762 mm diameter downhole drill. The diaphragm wall drilling revealed the presence of extremely large cavities in the foundation rock. Some of these were of approximately 50 cu m and, in several piles, the volume of concrete tremied into place was about five times the theoretical value. Nevertheless, checks revealed that deviations in the piles were practically negligible, being of the order of 150 mm per 50 m depth. The quantities involved in subsequent drilling and grouting in those areas where cutoff walls are present confirmed that the choice of technique for solving the foundation problems at Khao Laem, with both positive cutoffs and conventional grouting, has been correct. Severe hole collapses have been experienced in the outer grout rows, giving a clear indication of the extremely poor geological conditions in several areas. Outer consolidation row grout takes demonstrated that the drill's down hole flushing effect enhanced the desired substitution of compressible material in the foundation with grout, leading to an effective consolidation of the dam's plinth foundation. (Baker-IVI)
W85-01543

DESIGN AND CONSTRUCTION OF THE AGUS IV POWER CAVERN. PART ONE: GEOTECHNICAL INVESTIGATIONS,
National Power Corp., Manila (Philippines).
For primary bibliographic entry see Field 8E.
W85-01544

DEVELOPMENT OF THE WUJIANG RIVER,
Ministry of Water Resources and Electric Power, Beijing (China).
X. Cheng.
International Water Power and Dam Construction, Vol. 36, No. 6, p 30-32, June, 1984. 3 Fig, 1 Tab.

Descriptors: *Dam construction, *China, *Wujiangdu River, *Design criteria, Construction, Hydroelectric plants, Planning, Water resources development.

One of the difficulties of many dam sites in China is the lack of space to accommodate all the various components of a hydropower station, as a result of the country's characteristically narrow high gorges. How this problem, and a number of others, are overcome is described by reference to a number of particular interrelated projects. The Wujiangdu project controls a drainage area of 27,790 sq km and deals with an average river flow of 502 cu m/sec. The width of the river channel is only 70 m during the dry season, and the valley width at reservoir full level is only about 350 m. A very compact layout was devised and is decribed. The dam is of the conventional concrete arch gravity type. Karstic formation and curtain grouting are described along with other construction features and the spillway performance tests. (Baker-IVI)
W85-01545

EVOLUTION OF BUTTRESS DAMS, PART ONE,
Motor-Columbus Ingenieurunternehmung A.G., Baden (Switzerland).
N. J. Schnitter.
International Water Power and Dam Construction, Vol. 36, No. 6, p 38-42, June, 1984. 6 Fig, 1 Tab.

Descriptors: *Dam construction, *History, *Buttress dams, Dams, Construction, France, United States, Italy, Spain, Roman Empire.

Historic buttress gravity dams and true buttress dams are discussed. The rapid evolution of this type of structure at the beginning of the 20th century is traced. The evolution of reinforced concrete construction and the development of two distinct types of the multiple-arch and the flat-slab buttress dams are mentioned. Buttress dams are derived from the massive gravity types by the introduction of intermediate spaces, which allow water seepage through the foundation and dam body to discharge, not only downstream, but also sidewards and upwards into these spaces, thus greatly reducing the uplift pressures. Roman engineers introduced the buttress dam. The buttress dam concept did not re-emerge until the 1500's, in Spain. In the early 1800s the leadership in the field of dam engineering to France where the first large dams were built for the water supply of the epochal Canal du Midi. Almost a century later a similar design to the French construction across the Belubula river was being undertaken in Salt Lake City, Utah. The first multiple-arch dam of reinforced

concrete was completed in 1908 in only 114 working days to impound the Hume Lake logging and fluming reservoir on the Ten Mile Creek 80 km east of Fresno in the California Sierra Nevada mountains. Shortly after completion of this dam, the replacement of the extremely slender Big Bear Valley single-arch dam was undertaken. Overall a dozen multiple-arch dams were built in the following decade. Large scale multiple arch dams were pursued further by the prominent French dam designer Andre Coyne after World War II. (Baker-IVI)
W85-01546

EVOLUTION OF BUTTRESS DAMS, PART TWO,
Motor-Columbus Ingenieurunternehmung A.G., Baden (Switzerland).
N. J. Schnitter.
International Water Power and Dam Construction, Vol. 36, No. 7, p 20-22, July, 1984. 3 Fig, 35 Ref.

Descriptors: *Dam construction, *History, *Buttress dams, Dams, Construction, Multiple arch dams, Flat-slab dams, Costs, Dam failure.

The most powerful competitor to the multiple-arch dam at the beginning of the 20th century was the flat-slab buttress type developed and patented by Nils F. Ambursen. The Ambursen dam type soon became quite popular and by the end of 1910 almost 60 such dams had been built. By the end of the 1920s more than 200 such dams had been built. Outside the US the flat-slab buttress type was adopted, especially after World War II. Economic factors such as the rise of labor costs in relation to prices of materials and the ensuing mechanization worked strongly against the flat-slab type of dam. Several of them deteriorated unexpectedly quickly under the severe climatic conditions they were sometimes exposed to, or they developed cracks or leaks. Some designers reverted to dam types in which the arches or slabs were replaced by enlargements at the upstream heads of thicker and closer spaced buttresses and which were more amenable to modern mass concrete techniques. Most of the buttress dams built in the last decades followed either Marcello's double buttress or Noetzli's single buttress design, sometimes with rather trivial variations. (Baker-IVI)
W85-01549

DEVELOPMENT OF THE WUJIANG RIVER, PART TWO,
Ministry of Water Resources and Electric Power, Beijing (China).
X. Cheng.
International Water Power and Dam Construction, Vol. 36, No. 7, p 32-34, July, 1984. 7 Fig, 2 Tab, 6 Ref.

Descriptors: *Water resources development, *Maotiaohe River, *China, *Wujiang River, Dam construction, Flood control, Irrigation, Navigation, Hydroelectric power.

The proposed development of the Wujiang River and its major tributary, the Maotiaohe, is described as it relates to the construction of the Wujiang dam and hydro plant. An overall plan to develop the Wujiang has been studied for more than 20 years. The major functions considered in the planning are: flood control, power, navigation, and irrigation. A master plan has been devised to develop the whole length of the main stream. Eight projects are going to be built with a total capacity of 5590 MW. The total storage capacity of the eight projects will be 9,100 million cu m. The Maotiaohe River is quite small with a drainage area of only 3133 sq km. But its gradient is steep with a 549 m drop in a river length of 180 km. Six projects were constructed on the Maotiaohe with a total installed capacity of 239 MW, while total annual generation is 918 GWh in an average year. Over 70% of the drainage area of the Maotiaohe is composed of carbonate rocks. Karstic cavities and water channels are widely spread. Careful measurements were taken to ensure the watertightness of the dam foundations. In the first, second, third, and sixth stations, the dam foundations were treated by curtain grouting. Concrete cutoff walls were used at one station. At another station there is only a low dam, and its foundation was treated with consolidation grouting. (Baker-IVI)
W85-01551

DESIGN AND CONSTRUCTION OF THE AGUS IV POWER CAVERN, PART TWO: DESIGN AND CONSTRUCTION,
Massachusetts Metropolitan District Commission, Southborough. Water Div.
R. P. Falcon, C. Kutzner, and M. R. Uy.
International Water Power and Dam Construction, Vol. 36, No. 7, p 35-40, July, 1984. 5 Fig, 7 Ref.

Descriptors: *Construction, *Underground powerplants, *Design criteria, *Tunnels, New Australian Tunnelling Method, Rocks, Reinforced concrete, Grouting.

In view of the very high permeability of the rock and the problems of dewatering excavations below the groundwater table for construction of the Agus IV power cavern, it was decided to place the cavern at the highest possible elevation in view of the requirements of energy generation and the economics of the project. The elevation of the deepest part of the cavern bottom was determined at 227.75, taking into account the pits for the draft tubes. This is about 6 m below the average groundwater table, and 130 m below the natural ground. The influence of the major fault was minimized by locating the cavern as far south as possible, a distance of 6-12 m from the fault. The weak tuff layer would have been exposed to stresses which would have exceeded the material's compressive strength and thus it was decided to replace the tuff materials with concrete, applying conventional underpinning techniques. The grouting proved to be successful, in terms of the strength achieved, in the discontinuities of the rock mass. Steps taken to provide rock support and the use of prestressed anchors are described. The New Australian Tunnelling Method was used for the first time in the Philippines and was not instantly well received by the workers who initially did not feel safe working in a tunnel without the usual steel structures and lumbers above their heads. As they develop their skills with this new method, work is moving along at a more rapid pace. (Baker-IVI)
W85-01552

8B. Hydraulics

ROLE OF LARGE-SCALE TURBULENCE AND PROBLEMS OF STABILITY OF EARTH CANALS,
V. S. Altunin, S. A. Abdrasilov, and A. A. Tursunov.
Hydrotechnical Construction, Vol. 17, p 589-596, November, 1983. 4 Fig, 3 Tab, 11 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 37-41, November, 1983.

Descriptors: *Canals, *Turbulence, *Stability, *Earthworks, Runoff, Mathematical equations, Waves, Turbulent flow, Wind, Eddies, Velocity.

In connection with the increase of irrigated areas and intense use of the runoff of local streams, large canals of considerable length, including canals for regional redistribution of water resources, are being constructed and planned. In long earth canals, phenomena of a loss of general stability of the flow occur, which can lead to deviation of the flow in plan, meandering. Therefore it is important to establish the criteria of planar stability of the flow preventing irreversible channel deformations. A hydrotechnical classification is presented of earth canals on the basis of a capacity criterion. Equations are described which permit a complete determination of the cross sectional shape and size of a canal. These equations are valid for conditions of uniform, steady flow of water. In reality these conditions will be disturbed by waves from wind, waves from ships, steep traveling wave surges caused by starting or stopping the pump units operating the gates of the cross regulators, and entry into the canal of part of the floods of local streams. The general stability of a mean turbulent flow in canals was examined under conditions of steady, uniform flow. The turbulent structure o flow in an earth canal of sufficiently large size w investigated to establish large scale eddies in su canals. Special experiments were also conducted determine the character of the distribution of t bulent fluctuations of the longitudinal velocity various points of the cross section of the can (Baker-IVI)
W85-01147

FEATURES TO PROTECT THE OUTLETS O THE TIEFENCASTEL POWER HOUSE FRO GRAVEL DEPOSITION (MASSNAHMEN ZU VERHINDERUNG DER GESCHIEBEABL GERUNGEN IN DEN AUSLAUFEN DER ZE TRALE TIEFENCASTEL),
Eidgenoessische Technische Hochschule, Zuri (Switzerland). Versuchsanstalt fuer Wasserba Hydrologie und Glaziologie.
W. Peter.
Wasser, Energie, Luft, Vol. 75, No. 5/6, p 120-12 January, 1983. 9 Fig, 1 Ref.

Descriptors: *Outlets, *Gravel, *Model studi *Tiefencastel Hydroelectric Plant, *Switzerlan Hydraulic models, Hydroelectric plants.

The Tiefencastel, with an installed capacity of MW, lies only a kilometer below the locality of t same name on the Albula. Model studies with 1:40 model were conducted to determine featur which would protect the outlets of the Tiefencast powerhouse from gravel deposition. Gravel dep sition in the power house outlets can be prevent by landscaping the bed topography with blocks that smaller discharges are diverted to form concentrated flow across the outlets. Special atte tion is given to the model calibration by reprodu tion of the existing situation. (Moore-IVI)
W85-01267

INTERFACIAL RESISTANCE IN STRATIFIE FLOWS,
Thessaloniki Univ., Salonika (Greece). Lab. of Hy draulic Structures.
V. Dermissis, and E. Partheniades.
Journal of Waterway, Port, Coastal and Ocea Engineering, Vol. 110, No. 2, p 231-250, Ma 1984. 20 Fig, 24 Ref. NSF grant ENG 76-1153

Descriptors: *Interfacial friction, *Stratified flo Density stratification, Mathematical models, Hy drodynamics, Friction coefficient, Reynold number, Froude number.

Density stratification in fluids, as a result of di solved salts, heat and suspended sediment, is fr quently encountered in nature and it may drastica ly affect the hydrodynamic behavior and the asso ciated transport processes in natural flow system A key factor in the modeling of stratified flo systems is the interfacial friction, and the associa ed friction coefficient. The interfacial friction coe ficients in a two-layered stratified flow were stud ied in a closed 15 m long rectangular duct wit fresh water flowing over a quasi-stagnant sa water pool. The average interfacial friction coeff cient over the effective section of closed rectangu lar duct was evaluated from measured quantitie on the basis of a one-dimensional analytical flo model developed along the general Schijf-Schoen feld's line for open channels. The average interfa cial friction coefficient was found to be best corre lated with the number RF sq, in which R and F ar the Reynolds and Froude numbers respectively and with the relative density difference Delta rho rho used as an independent parameter. There i close agreement with re-analyzed data from a earlier study while one data point from the Missis sippi estuary falls on a smooth extrapolation of th appropriate curve. Attempts to correlate the inter facial friction coefficient with the Reynold number, the Froude number, the Keulegan numbe and the relative density difference led to unsatis factory results. The success of the correlation de pends not only on the adequacy of the number o independent flow variables and fluid properties used, but also on the proper dimensionless group ing of these variables. (Moore-IVI)
W85-01502

RRUGATED PIPE FLOW RATE FROM
'E GEOMETRY,
elph Univ. (Ontario). School of Engineering.
W. Irwin.
rnal of Irrigation and Drainage Engineering,
. 110, No. 2, p 237-241, June, 1984. 1 Fig, 1
, 15 Ref.

criptors: *Corrugated pipe, *Pipe flow, *Flow
, Pipes, Hydraulic roughness, Water convey-
e, Mathematical equations, Drainage.

rugated plastic drainage pipe has become the
cipal pipe used for subsurface agricultural lat-
drains and is gaining rapid acceptance for main
ns. One disadvantage is its higher hydraulic
ghness compared to clay or concrete drain tile.
hydraulic roughness of pipe used for water
veyance is of economic importance in the
gn of a drainage system. Data from hydraulic
s of corrugated plastic drainage tubing reported
ne literature were analyzed to develop an equa-
for estimating the flow capacity of corrugated
tic pipe diameters. The flow rate can be calcu-
d from the equation using only physical dimen-
measurements. (Moore-IVI)
5-01514

OSION OF PLUNGE POOLS DOWN-
REAM OF DAMS DUE TO THE ACTION OF
EE-TRAJECTORY JETS,
. Mason.
ceedings of the Institution of Civil Engineers,
1, Vol. 76, p 523-537, May, 1984. 4 Fig, 2 Tab,
ef.

criptors: *Plunge pools, *Scour, *Free-trajec-
jets, Erosion, Spillways, Gates, Mathematical
ations, Energy dissipation, Flood discharge,
k properties, Jets.

discharge of flood waters downstream of
s is always associated with the need to dissi-
the hydraulic energy of the flow. One of the
t common ways of accomplishing this in recent
s has been by the use of free-trajectory jet
ipators such as flip buckets, ski jumps and free
falls. On occasions, however, unforeseen and
gerous erosion of scour holes has occurred
ing to costly remedial works. The case histo-
of scour developments on selected prototypes
reviewed, summarizing features common to
e case histories where scour has been of par-
lar interest. In some cases, the spillways were
l far more than originally intended owing to
ys in power station construction or commis-
ing. Asymmetrical gate operation was a factor
cour in several cases. Unacceptable scour is not
ted to soft rocks. In three cases, problems
ear to be linked with variations of rock
ngth within the plunge pool area. By analyzing
of data from both model and prototype plunge
l developments, formulas were developed for
ulating the probable depths of erosion under
jets, both on models and prototypes. (Moore-
)
5-01517

TURAL CONVECTION IN AN INCLINED
JARE CAVITY IN REGIONS OF DENSITY
'ERSION OF WATER,
ami Inst. of Tech., Hokkaido (Japan).
naba, and T. Fukuda.
rnal of Fluid Mechanics, Vol. 142, p 363-381,
, 1984. 15 Fig, 16 Ref.

criptors: *Convection, *Density inversion,
e-water interfaces, Water temperature, Heat
sfer, Inclination angle.

natural convection occurring from tempera-
variation of water in the neighborhood of the
water interface has an important role in the
nation of ice on a lake or river and the freezing
water pipes, water-storage vessels or fire hy-
nts in cold regions. An ice-water interface such
n these examples is commonly inclined. The
dy laminar natural convection of water in an
ined square cavity is investigated experimental-
nd analytically at temperatures in the neighbor-
d of maximum density near 4 degrees C. One hot wall of the square cavity is maintained at various uniform temperatures from 2 to 20 degrees C and the opposing cold wall is kept at a uniform temperature of 0 degrees C, while the other walls are thermally insulated. Photographs and analytical descriptions of the flow patterns, temperature profiles in the water layer and average heat-transfer coefficients are presented for various surface temperatures of the hot wall and inclination angles of the square cavity from 0 degrees (heated from below) to 180 degrees (heated from above) by 30 degrees intervals. The density inversion of water has a strong effect on the natural convection occurring in the inclined square cavity, and the average heat-transfer coefficient is a peculiar function of the surface temperature of the hot wall. The numerical results agreee well with the experimental ones for some regions of inclination angle and surface temperature of the hot wall. (Moore-IVI)
W85-01519

MODEL STUDY OF JET-INDUCED CIRCULATION AND MIXING IN A RESERVOIR,
Birmingham Univ. (England). Dept. of Civil Engineering.
R. A. Falconer.
Journal of the Institution of Water Engineers and Scientists, Vol. 38, No. 3, p 231-245, June, 1984. 9 Fig, 1 Tab, 16 Ref.

Descriptors: *Model studies, *Mixing, *Water circulation, *Jets, *Shustoke Reservoir, *England, Water quality control, Inlets, Dye releases, Velocity, Pumping, Hydraulic models.

A scaled physical model study of circulation induced in Shustoke reservoir, near Birmingham, was conducted in order to determine the best siting for a relatively high velocity jet inlet along the northern bank. The high velocity jet inlet was intended to improve the mixing characteristics of the reservoir, which has experienced large stagnant regions and poor mixing during the summer months. A comparative study was undertaken of the mean and standard deviations of a conservative dye tracer, released through the jet inlet, for the various jet locations and orientations considered. These statistical parameters were determined by measuring the point concentration of the dye at 12 locations, uniformly distributed across the basin, and at 10 min intervals up to 1 hr after the slug of dye had been initially released from the inlet. Comparisons were also made of the velocity fields for the various jet locations, with the depth mean velocities being determined with the aid of floats made from weighted drinking straws. The results, confirmed by visual observations, showed that the velocity fields and mixing characteristics were noticeably dependent upon the siting of the jet inlet. A 0.6 m diameter jet should be used. It is hydraulically more expedient to pump high-flow rates through the inlet for shorter time period, rather than pumping continuously at a constant rate. (Moore-IVI)
W85-01523

8C. Hydraulic Machinery

ESTIMATION OF THE FATIGUE LIFE OF LOCK-GATE ELEMENTS OF THE MOSCOW CANAL,
V. G. Abrosimov, O. L. Bandin, A. P. Gusenkov, and V. P. Kogaev.
Hydrotechnical Construction, Vol. 17, p 547-551, November, 1983. 3 Fig, 1 Tab, 6 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 8-11, November, 1983.

Descriptors: *Fatigue, *Locks, *Gates, *Moscow Canal, *USSR, Mechanical equipment, Strain, Fatigue failure.

On-site strain-gauge investigations of the stress of the lock gates on the Moscow Canal showed that in the existing design of the gates the level of cyclic stress in individual zones in elements of the leaves in the lower part corresponds in the stress cycle to 0.25 to 0.4% of the linear strain, which confirms the possibility of low cycle or fatigue failure of structural elements of the lock gates. The life of the structural elements is estimated on the basis of the indicated failure criteria. To determine the fatigue life, in addition to the values of the cyclic strains in the maximally stressed sites of the structure an equation must be derived which determines the fatigue strength of the gate elements and must also obtain the required calculated characteristics. The investigation and estimation of the life of lock gate elements shows that for the adopted design and technology of manufacturing lock gates a sufficiently high fatigue life cannot be provided without intermediate repairs. It is necessary to develop design and technological measures to reduce the level of maximum cyclic stresses and strains in the structure and also to use materials, types of welds, and methods of repairing lock gate elements which increase the characteristics of fatigue strength. (Baker-IVI)
W85-01141

IRRIGATION PUMPING WITH WIND ENERGY - ELECTRICAL VS. MECHANICAL,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
R. N. Clark.
Transactions of the ASAE, Vol. 27, No. 2, p 415-418, March-April, 1984. 7 Fig, 1 Tab, 5 Ref.

Descriptors: *Irrigation pumps, *Wind energy, *Wind turbines, *Wind power, Electrical equipment, Electric power production.

During the past few years, researchers have been examining new wind energy systems to pump the large volume of water needed for irrigation. One new system uses a vertical-axis wind turbine to generate electricity that is compatible with utility grid power, and the pump is powered by this electrical system using a conventional electric motor. Another new system uses a vertical-axis wind turbine to produce mechanical power, and the pump is powered directly with this mechanical power or in combination with a diesel engine or electric motor. When the efficiency of converting wind energy to pumped water is compared for the two systems, the mechanical system provides 12% more energy than the electrical system. However, the electrical system is 2.5 times more profitable than the mechanical system because irrigation pumps are used seasonally. With the electrical system, energy generated in the non-irrigating season can be sold to the utility, but the mechanical system is only utilized when water is needed. (Author's abstract)
W85-01186

CHANGING BOUNDARY CONDITIONS FOR THE MANAGEMENT OF HYDROGENERATORS; INFLUENCE ON MAINTENANCE STRATEGIES (GEANDERTE RANDBEDINGUNGEN FUR BETRIEB VON WASSERKRAFTGENERATOREN UND IHR EINFLUSS AUF INSTANDHALTUNGSSTRATEGIEN),
A. v. Planta, and B. Spaargaren.
Wasser, Energie, Luft, Vol. 74, No. 11/12, p 300-303, January, 1982. 2 Fig.

Descriptors: *Maintenance, *Generators, *Boundary conditions, Hydroelectric plants, Diagnostics, Decision making.

A flexible maintenance strategy consisting of on condition maintenance, supplemented by periodic diagnostic checks of various depth, can give a sensible answer to today's changed boundary conditions for the management of hydraulic power plants. This should enable the owner to get the full benefit of his investment in plant and equipment. The diagnostics are an important help to the decision making process in maintenance, as they supply valuable information in addition to the usual trend monitoring, which can help to answer the question whether an overhaul is necessary or not. (Author's abstract)
W85-01257

FITNESS PROGRAMS FOR HYDROELECTRIC POWER PLANTS; PREVENTION OF WEAR AND TEAR ON TURBINES AND GENERA-

TORS (FITNESS-PROGRAMME FUR WASSERKRAFTWERKE; VERSCHLEISS UND SCHADENVERHUTUNG AN TURBINEN UND GENERATOREN),
R. Weber.
Wasser, Energie, Luft, Vol. 75, No. 11/12, p 30-33, 1983. 5 Fig.

Descriptors: *Turbines, *Generators, *Maintenance, Hydroelectric plants, Costs, Erosion, Corrosion, Vibration, Stainless steel, Rustproofing, Insulation.

A conference sponsored by the Swiss and Baden-Wurttemberg water-management organizations was held on 20-21 January 1983 in Rheinfelden, Switzerland to discuss the types of wear to which turbines and generators at hydroelectric plants are subject, what steps operators and manufacturers are taking to combat it, how much energy can be saved by replacing worn parts, and how much this costs. Problems vary according to type of plant (high-pressure reservoir-fed or low-pressure river-fed) and conditions. In Switzerland, the Stalden plant receives water from the Mattmark reservoir in winter and from glacial streams in summer. Significant erosion occurs every summer to the buckets and nozzels of the Pelton turbines due to fine sand, which slips through sand-removal devices. A major overhaul is required every 5 yr, rather than every 10 yr. It is more economical to use stainless steel in such cases; it can also be used to repair old damaged turbines. When tests were conducted to investigate mysterious cracks in bucket root faces, it was discovered that the corrosion vibration resistance of large steel parts is less than that of parts with separately cast components. The long-term vibration resistance of stainless steel is less in water than in air; the Grand Dixence plants have thus decided to paint all at-risk parts with a rustproofing solution. Generator repairs usually consist of renewing brittle shellac or mica insulation on copper casing in old machines. New synthetic resin plastic insulation and magnetic plating can increase generating capacity by 35%. (Gish-IVI)
W85-01259

REGULAR EXAMINATION OF DAMS; HANDLING AND OPERATION CONTROL OF GATES (CONTROLES PERIODIQUES DE L'ETAT DES BARRAGES; MANOEUVRE ET ESSAI DE FONCTIONNEMENT DES ORGANES MOBILES),
Eidgenoessisches Amt fuer Wasserwirtschaft, Bern (Switzerland).
H. Pougatsch.
Wasser, Energie, Luft, Vol. 75, No. 11/12, p 273-275, January, 1983. 2 Fig.

Descriptors: *Gates, *Reservoir operation, *Dams, Snow, Sabotage, Dam safety, Floods.

Two types of gates are considered: surface gates and bottom gates. The first permits the passage of floods, while the second opening are authorized as a part of the partial or complete drainage of the reservoir, and also for use in the case of exceptional floods. Operational procedures are described for gates with one and two vanes. Two particular problems which are important are that posed by the presence of snow, and the prevention of acts of sabotage. (Moore-IVI)
W85-01272

CONCEPTS FOR ENERGY-EFFICIENT IRRIGATION SYSTEM DESIGN,
Iowa State Univ., Ames. Dept. of Civil Engineering.
R. G. Allen, and C. E. Brockway.
Journal of Irrigation and Drainage Engineering, Vol. 110, No. 2, p 99-106, June, 1984. 1 Fig, 37 Ref.

Descriptors: *Irrigation efficiency, *Energy efficiency, *Design criteria, Irrigation requirements, Computers, Pumps, Hydraulic equipment, Furrow irrigation, Border systems, Sprinkler irrigation, Consumptive use, Moisture stress, Soil water, Economic aspects.

Both old and new design and management concepts for increasing irrigation and energy-use efficiencies and net farm profits should be integrated into current and new system designs. Computerized procedures are available for performing economic comparisons and for sizing and selecting system components during periods of price instability. New pump and motor designs coupled with pump and system efficiency testing programs and maintenance schedules can significantly reduce energy consumption at the supply end. Developments in furrow irrigation system equipment and in border system design procedures can greatly increase water application uniformities. Many sprinkler systems can be retrofitted to enable low-pressure operation, and irrigation water requirements can be reduced by improving soil-water management, by changing cropping patterns or by deliberate reduction in consumptive use by initiating moisture stress.
W85-01504

FLOWCAGE - LABORATORY TESTS OF A NOVEL RENEWABLE ENERGY DEVICE FOR FLOWING WATER,
W. R. Dickens.
Proceedings of the Institution of Civil Engineers, Part 2, Vol. 77, p 255-263, June, 1984. 5 Fig, 3 Ref.

Descriptors: *Mechanical equipment, *Energy sources, *Hydropower, *Flowcage, Vibration, Developing countries, Pumps.

The vigorous vibration of an elastically supported circular cylinder perpendicular to the direction of flow (cross-flow vibration) can be used to make more use of the energy available when a number of cylinders are fixed relative to one another in a staggered array. Fifty-five percent of the water power change across the assembly (the Flowcage) can be made available as a vibrating source of energy, driving a flywheel through two sprag clutches or pumping directly. The Flowcage has the essential elements of a run of the river hydropower scheme, damming the flow to a controlled extent while simultaneously generating energy. Application of the Flowcage principle is most likely in developing countries where small local sources of energy are more relevant to the needs of village populations. The flowcage is quiet and pollution free. (Moore-IVI)
W85-01520

PUMPS PROVE VERSATILE AS HYDRAULIC TURBINES,
McGraw-Edison Co., Buffalo, NY. Worthington Group.
D. Spangler.
Power, Vol. 88, No. 7, p 52-54, July, 1984. 6 Fig.

Descriptors: *Pumps, *Hydraulic machinery, *Turbines, Efficiency, Economic aspects, Cost analysis, Electric power production.

Centrifugal pumps, from radial flow to axial flow geometries, can be run in reverse as turbines to drive other rotating equipment with high efficiency and at low cost. Pumps running in reverse as turbines have some attractive advantages. The peak efficiency is essentially the same in both functions, and the high efficiency range can be extended by using multiple pumps of various sizes instead of one single large unit. The cost of a pump/turbine can be as little as half the cost of a small conventional hydraulic turbine. Pumps are also relatively unsophisticated, easy to install and maintain, and simple to operate. A pump's capability of performing efficiently as a turbine is predicted by turbomachinery theory, and a pump has the same affinity relationships in both functions. The greatest potential for pumps used as turbines probably is for simply generating electricity. Project sizes currently in operation vary from a few kilowatts to a few megawatts. (Baker-IVI)
W85-01539

USE AND RE-USE OF ITAIPU'S DIVERSION GATES, PART TWO,
National Power Corp., Manila (Philippines).
J. R. Villalba, R. C. Monteiro, A. E. Raiunec, J. H. Gummer, and J. P. Baroux.
International Water Power and Dam Construct
Vol. 36, No. 7, p 44-49, July, 1984. 8 Fig, 6

Descriptors: *Dam construction, *Gates, *De
criteria, *Itaipu, Diversion gates, Seals, Whe
Diversion gates.

The design details covering the guides and rol
surfaces of the diversion gates are supplemented
a description of related components such as s
and wheels. Solid rubber U-section compress
seals were used at the bottom, and inflatable rub
caisson seals at the top. Side and interpanel s
were of the J-type, with a 50 mm diameter b
With the stipulated flow conditions at divers
closure, the differential head across the divers
gate sluices would be of the order of 3 m. T
would increase rapidly as the reservoir filled,
the tailwater level dropped, the final maxim
differential head being 140 m. A system
needed therefore in which the hydrostatic force
be reacted by the wheels would be limited t
certain design value, consistent with the need
operate the gates under an acceptable differen
head. The pad material and the pad assembl
were subject to an extensive series of tests a
controls including load/deflection test in compr
sion, stability tests, and permanent set tests. (Bak
IVI)
W85-01553

**BEHAVIOUR OF HYDRAULIC MACHIN
UNDER STEADY OSCILLATIONS, PART ON**
Itaipu Binacional, Rio de Janeiro (Brazil).
G. Borciani.
International Water Power and Dam Constructio
Vol. 36, No. 7, p 50-53, July, 1984. 3 Fig.

Descriptors: *Hydraulic machinery, *Oscillato
waves, *Pumping plants, Mathematical mode
Computers, Velocity.

Instability and resonance phenomena in large h
draulic systems, particularly pumping plants, are
growing problem. Although ad hoc solutions a
often found under presssure of commissionir
deadlines, a proper analysis of the dynamic beha
ior of the large hydraulic machine under oscill
tion conditions has still to be developed. A r
search group to coordinate Italian activities in th
field was founded in 1979 to investigate the prol
lem. A mathematical model is presented whic
describes the hydraulic system with linear equa
tions. Each component is characterized by an ad
quate transfer matrix which associates the ampl
tudes of the discharge and pressure variations
one end with those at the other end. Assemblin
the transfer matrices of the different component
gives the global matrix which describes the whol
system and hence its response to excitation. Th
most general diagram was adopted for the gover
nor-machine-generator system. A calculation cod
was devised and checked so that it can be used t
reproduce the various components of the hydrauli
systems which are not machines: penstock section
with constant or varying diameter, or with varyin
celerity, with or without roughness, surge shafts
concentrated resistances, and so cn. Velocity meas
urement in pulsating flows is discussed using laser
doppler velocimeters, acoustic velocimeters, o
electromagnetic flowmeters. (Baker-IVI)
W85-01554

8D. Soil Mechanics

CALCULATION OF THREE-DIMENSIONAL STABILITY OF DEFORMATION-INHOMOGENEOUS EARTH DAMS,
I. M. Vasil'ev.
Hydrotechnical Construction, Vol. 17, p 564-571, November, 1983. 5 Fig, 12 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 19-23, November, 1983.

Descriptors: *Dam stability, *Stability analysis, *Earth dams, Mathematical analysis, Stability, Dam safety, Deformation, Stress, Soil properties, Seismic properties.

connection with the design and construction of
h dams and other structures under complex
ographic and geological conditions, problems
mproving the methods of calculating the stabili-
f these structures remain quite urgent. Methods
known in which conditions of static equilibri-
are completely satisfied, a three dimensional
ing body with a limited contact width is taken
account, forces of internal interaction between
nents of the sliding body are included in the
ulation schemes by means of hypotheses sim-
ying the problems, and methods of taking into
ount seismic loads for three dimensional bodies
e been proposed. Shortcomings of these meth-
which maximally affect the reliability of the
ulations include: disregarding the deformation
mogeneity of the soil mass; adopting inappro-
te stress distribution laws on the slip surface,
the use of inappropriately assigned forms of
failure surfaces. The division of the sliding
y into blocks and consideration of the actual
es of internal interaction permits investigation
he degree of mobilization of the shear strength
rately of each part of the structure. This makes
ssible to uncover unused potentials of stability
to utilize more fully engineering measures for
ing an economical solution of dam design.
ker-IVI)
5-01143

PROVEMENT OF THE CONSTRUCTION
EARTH STRUCTURES,
V. Komarinskii, and G. Ya. Bulyatov.
drotechnical Construction, Vol. 17, p 572-578,
vember, 1983. 3 Fig, 20 Ref. Translated from
rotekhnicheskoe Stroitel'stvo, No. 11, p 24-28,
vember, 1983.

criptors: *Earth dams, *Construction methods,
properties, Design criteria, Construction, Dam
struction.

construction of earth dams with the maximum
of local construction materials has increased
ughout the world in recent years. Placing soil
vater eliminates many shortcomings inherent in
hanical compaction, and even the hydraulic
ng method. This new method makes it possible
ubstantially simplify construction works, espe-
ly in rainy weather, and to obtain at a high rate
orm compaction, the required density and
sture content, and to shorten the construction
od due to year-round construction compared
h the usual methods. As the most effective
sure, placing soils in water is applicable for
ing watertight earth elements in contact zones
h the rock walls of canyons, with the founda-
of an earth structure, and with concrete struc-
l members. Plugging of the porous foundation
eath hydraulic structures under a head is possi-
under certain conditions and is regarded as a
sure making it possible to do away with grout
tains, sheet pile walls, and other measures, and
ce simplifies the works and reduces cost. On
basis of the experience of the dams constructed
his manner for well consolidated soils or in the
e where a thin watertight membrane is placed
h expulsion of water into well drained shoul-
s, the pore pressure should be taken into ac-
nt only for the initial stage of compaction. No
ctures constructed by this method of placing
s in water have thus far experienced dangerous
cking. (Baker-IVI)
5-01144

NERAL METHOD OF CALCULATING STA-
LITY OF EARTH SLOPES WITHIN THE
OPE OF THE TWO-DIMENSIONAL PROB-
M,
N. Bukhartsev.
drotechnical Construction, Vol. 17, p 579-585,
vember, 1983. 1 Fig, 11 Ref. Translated from
drotekhnicheskoe Stroitel'stvo, No. 11 p 28-32,
vember, 1983.

scriptors: *Dam construction, *Stability,
esign criteria, *Earthworks, Slopes, Soil proper-
, Earth dams, Dam safety, Dam foundations.

blems of the stability of earth slopes and bear-
capacity of foundations are of paramount im-
portance when designing structures as they substantially affect the size and cost of the structures. When designing structures the stability is evaluated by engineering methods using the scheme of limit equilibrium of forces preceding loss of stability and occurrence of shear. The methods of evaluating stability can be divided into two groups depending on the scheme of limit equilibrium of forces being used. The first group includes methods based on the assumption of attainment of limit equilibrium at each point of the extensive soil mass of the slope or foundation. Methods of the second group assume the attainment of the ultimate strength of the soil only on the slip surface. In this group the dangerous slip surface, characterized by the most unfavorable relationship of the active shearing forces and maximum resisting reaction forces, is determined by inspection of a rather large number of assigned slip surfaces. In all methods of calculating slope stability with respect to the limit state, in view of the inapplicability of equations of elasticity theory, one or another assumption relative to the stress state of the slope supplementing the equilibrium conditions makes the problem definite. The various assumptions distinguish one method from another. (Baker-IVI)
W85-01145

ROLE OF LARGE-SCALE TURBULENCE AND PROBLEMS OF STABILITY OF EARTH CANALS,
For primary bibliographic entry see Field 8B.
W85-01147

8E. Rock Mechanics and Geology

OVERLAPPING PILES FORM CUTOFF WALL AT THAI DAM,
For primary bibliographic entry see Field 8A.
W85-01543

DESIGN AND CONSTRUCTION OF THE AGUS IV POWER CAVERN. PART ONE: GEOTECHNICAL INVESTIGATIONS,
National Power Corp., Manila (Philippines).
R. A. Almero, C. Kutzner, and K. Schetelig.
International Water Power and Dam Construction, Vol. 36, No. 6, p 21-25, June, 1984. 6 Fig, 2 Tab, 7 Ref.

Descriptors: *Underground powerplants, *Rock excavation, *Mindanao, *Philippines, Design criteria, Construction, Excavation, Geology.

The 150 MW Agus IV hydro scheme under construction in Mindanao, the Philippines, involves the construction of an 80 x 18 x 37 m power cavern in an area of unfavorable geological conditions. The design and construction of the power cavern is considered with emphasis on the geotechnical investigations. The heterogeneity of the volcanic rocks, tectonic faults and the depth of the underground structures required a step by step investigation procedure. Basalt of rock classes 1 to 3 is heterogeneously distributed within and around the power cavern. Homogeneous rock zones accumulate only to a volume of some hundred cubic meters. Rock class 4 is attributed to the tuff layer in the lowest part of the power cavern. Directional and mechanical properties assumed for discontinuities are listed. The effect of the jointing was introduced by assuming reduced shear and tensile strengths of the whole continuum along the main directions of the joint systems, the bedding and the joint families 1 and 2. These were selected as the most characteristic ones for the given situation and for the requirements of computations. A relatively high shear strength along the jointing was assumed on account of the uneven joint planes and the limited extension of the individual discontinuities. Rock improvement prior to and during excavation was necessary. (Baker-IVI)
W85-01544

8F. Concrete

QUANTIFICATION OF VOLATILE SULFUR COMPOUNDS RELATED TO THE CORROSION OF CONCRETE SEWERS,
Hamburg Univ. (Germany, F.R.). Inst. fuer Organische Chemie und Biochemie.
For primary bibliographic entry see Field 5C.
W85-01128

ELECTRON-MICROANALYTICAL INVESTIGATIONS OF THE INTERFACIAL CORROSION IN CONCRETE,
Technische Univ., Vienna (Austria). Inst. fuer Analytische Chemie.
E. Hoke, P. Wilhartitz, M. Grasserbauer, and G. Eder.
Fresenius's Zeitschrift fur Analytische Chemie, Vol. 318, No. 2, p 124-128, 1984. 5 Fig, 1 Tab, 13 Ref.

Descriptors: *Concrete technology, *Concrete testing, *Corrosion, *Cement-aggregate interfaces, Acids, Electron microscopy, Sulfur dioxide, Hydrochloric acid.

Acid corrosion of concrete is important with respect to the binding forces exerted between cement and aggregate. Cement-aggregate interfaces in concrete are usually the sites of least bonding efficiency. Concrete samples of controlled composition were exposed to SO2 and to HCl gases. The interfaces were then separated by freeze-drying or flexion. SEM and microprobe analysis permit the acquisition of morphological information on the nm-scale, but chemical information from X-ray analysis is restricted to the micro m-scale. The characterization of the interface phases responsible for flexural strength is only possible by separation (rupture). The revealed zones can be prepared for TEM(STEM)/EDS-analysis by tear-off replication. Thereby a selection of interfacial layers is performed with respect to their bonding strength. Supplementary SEM or microprobe analysis of larger interface areas can be performed for reasons of representativity; they are, however, unable to characterize quantitatively those thin layers which are of highest importance for concrete strength. (Collier-IVI)
W85-01129

REPAIR WORKS AT THE CONCRETE DAM 'SCHONI' OF THE 'OBERALP' HYDROELECTRIC PLANT (REPARATURARBEITEN AN DER STAUMAUER SCHONI DES KRAFTWERKES OBERALP),
ETH/SIA, Locarno (Switzerland).
W. Diethelm.
Wasser, Energie, Luft, Vol. 75, No. 4, p 97-100, 1983. 13 Fig.

Descriptors: *Oberlap Hydroelectric Plant, *Hydroelectric plants, *Concrete dams, *Maintenance costs, Powerplants, Costs, Construction materials, Concrete construction, Dam construction.

The dam 'Schoni', which belongs to the 'Oberalp' hydroelectric plant, constructed during the years of 1960/61, has been subject to various concrete damages. Those deteriorations were repaired in summer 1982 by the following system: the whole surface was entirely picked and sandblasted; a protective 14 cm thick layer of frost-resistant and waterproof steel-reinforced shot-crete was applied on the whole upstream face (ca. 450 sq m); local repairs were made on the downstream face, and shot-crete was applied on the previously prepared damaged zones. The work took about 8 weeks of time. Total cost for the repairs was approximately 200,000 Swiss francs. (Author's abstract)
W85-01261

TUCURUI, GIGANTIC HYDRO POWER PLANT IN BRAZIL (TUCURUI: GIGANTISCHE WASSERKRAFTANLAGE IM AMAZONAS-URWALD),
Eidgenoessische Technische Hochschule, Zurich (Switzerland).

Field 8—ENGINEERING WORKS

Group 8F—Concrete

For primary bibliographic entry see Field 8A.
W85-01362

8G. Materials

EFFECT OF SOIL MOISTURE ON THE SHORT-TERM CLIMATE AND HYDROLOGY CHANGE - A NUMERICAL EXPERIMENT,
National Oceanic and Atmospheric Administration, Princeton, NJ. Geophysical Fluid Dynamics Lab.
T.-C. Yeh, R. T. Wetherald, and S. Manabe.
Monthly Weather Review, Vol. 12, No. 3, p 474-490, March, 1984. 6 Fig, 4 Tab, 18 Ref, 1 Append.

Descriptors: *Irrigation effects, *Climate, *Soil water, *Mathematical studies, Hydrologic cycle, Evaporation, Precipitation, Latitudinal studies, Simulation, Environmental effects, Tropical regions.

This paper describes a series of numerical experiments simulating the effect of large-scale irrigation on short-term changes of hydrology and climate. This is done through the use of a simple general circulation model with a limited computational domain and idealized geography. The soil at three latitude bands, namely 30 degree N-60 degrees N, 0-30 degrees N, and 15 degrees S-15 degrees N is initially saturated with moisture. The results from these experiments indicate that irrigation affects not only the distribution of evaporation but also that of large-scale precipitation. It is found that the anomalies of soil moisture created by irrigation of these respective latitude zones can persist for at least several months due to increased evaporation and precipitation. Furthermore, if the irrigated region is located under a rainbelt, precipitation in that rainbelt is enhanced. Conversely, if the irrigated region is not located under a rainbelt, much of the additional moisture is transported to a rainbelt outside this area. Thus the moist moisture anomaly for the 30 degrees N-60 degrees N case which is located under the middle latitude rainbelt tends to persist longer than the corresponding anomaly for the 0-30 degrees N case. Although both the 30 degrees N-60 degrees N and 15 degrees S-15 degrees N latitude regions occur under rainbelts, the soil moisture anomaly for the 15 degrees S-15 degrees N case does not persist as long as it does for the 30 degrees N-60 degrees N case. This is because in the 15 degrees S-15 degrees N case, a much greater fraction of the increased precipitation is lost from the hydrologic cycle due to runoff there as compared with the 30 degrees N-60 degrees N case. The above changes of the hydrological processes also cause corresponding changes of the thermal state of the atmosphere such as a cooling of the surface due to increased evaporation. This results in changes of the mean zonal circulation through the thermal wind relationship. It is found that irrigation in the tropical region weakens the upward branch of the Hadley circulation in the vicinity of the tropical rainbelt. (Author's abstract)
W85-01335

BIOLOGICAL PROTECTION OF IMPERMEABLE FLY-ASH LAYERS,
Polish Academy of Sciences, Gdansk. Inst. Budownictwa Wodnego.
For primary bibliographic entry see Field 5G.
W85-01447

8H. Rapid Excavation

EXPERIENCE IN DRILLING AND BLASTI OPERATIONS TO LOOSEN UNDERWAT ROCKS,
V. M Tavrizov.
Hydrotechnical Construction, Vol 17, p 597-6 November, 1983. 4 Fig, 1 Tab Translated fr Gidrotekhnicheskoe Stroitel'stvo, No 11, p 47 November, 1983.

Descriptors: *Blasting, *Drilling, *Underwa Shoals, Navigation, Channels, Construction, Fl ing drilling rig, Limestone, Costs.

Increased navigation conditions made it neces to deepen a river shoal, in a river, the channe which is composed of limestones of aver strength with a compressive strength from 40 140 MPa. Loosening of underwater rocks on large area of 66,000 sq m with a thickness of cm was carried out by means of borehole charg Drilling and blasting operations were carried from the ice cover and, when it was absent, fro floating drilling rig. With the large powder fac needed for good crushing of the rock, the cost drilling and blasting operations increased so what. The high indices obtained with respect labor productivity and cost of drilling and blasti operations can be improved mainly by more p ductive drills, since drilling occupies about 60% the total labor intensity of the operations. T performance of drilling and blasting operatio from the floating drill rig has many advanta compared with the performance of operations the usual means. (Baker-IVI)
W85-01148

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8/4

BOOKSTACKS
DOCUMENTS

PB85-910204

SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 18, NUMBER 4
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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 18, NUMBER 4
APRIL 1985

W85-01632 -- W85-02171

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PREFACE

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
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Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

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AUTHOR INDEX

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SELECTED WATER RESOURCES ABSTRACTS

NATURE OF WATER

A. Properties

'ANSPORT PHENOMENA. - NEW EXPERI-ENTAL RESULTS IN HYDRODYNAMICAL ORCED RAYLEIGH SCATTERING' (PHENO-ENES DE TRANSPORT. - NOUVEAUX RE-LTATS EXPERIMENTAUX EN DIFFUSION AYLEIGH FORCEE' HYDRODYNAMIC),
ntral Lab. of Mekorot (Israel).
Limat.
mptes Rendus de L'Academie die Sciences, rie II, Vol. 299, No. 8, p 391-394, 1984. 2 Fig, 5 f.

scriptors: *Hydrodynamics, *Heat transfer, ayleigh scattering, Turbulent flow, Mathemati- equations, Diffraction.

mporal decrease of intensity diffracted by a ase grating in a flowing liquid was studied for tial periods in the viscoconvective range. Tur-ent transfers cause a relaxation of the mode of rmal fluctuations, which is followed with a laser fracted by the index grating. The temperature odulation causes a modulation of the refractive ex. The intensity is proportional to the tempera-e fluctuation spectrum. The decrease of intensi-is plotted for different Reynolds numbers that aracterize the Plane Poiseuille flow used. The crease of intensity obeys an exponential law. ien the flow is laminar, the time constant is the ie as without flow. The values of p (the period) in the viscoconvective range and the smallest uctures impose their characteristic time on the nvective transport of heat. (Moore-IVI)
35-01745

B. Aqueous Solutions and Suspensions

NETIC FACTORS OF CACO3-PRECIPITA-ON AND THE PARTITIONING OF 12C AND C. STUDIES AT THE WATERFALLS OF GU-RSTEIN AND URACH (SCHWABISCHE B) (KINETISCHE FAKTOREN DER CACO3-SCHEIDUNG UND DER FRAKTIONIER-IG VON 12C UND 13C. UNTERSUCHUNGEN DEN WASSERFALLEN VON GUTERSTEIN D URACH (SCHWABISCHE ALB)),
ettingen Univ. (Germany, F.R.). Sedimentpe-graphisches Inst.
Michaelis, E. Usdowski, and G. Menschel.
itschrift fur Wasser und Abwasser Forchung, l. 17, No. 2, p 31-36, 1984. 8 Fig, 2 Tab, 22 Ref.

scriptors: *Calcite, *Mineral springs, *Guter-n, *Urach, *West Germany, *Carbon radioiso-es, Bicarbonates, Carbon dioxide, Crystal wth, Degassing, Chemical kinetics, Wastewater lution.

asurements along the CaCO3-depositing spring Guterstein demonstrate that calcite is not preci-ited immediately from a Ca-bicarbonate solu-n. In a first step the solution degasses CO2. This ises the supersaturation to increase until crystal-tion begins at a CO3(2-) activity of about 00001 and Delta G about 1 kcal/mole. Due to assing and precipitation the delta C-13 values the dissolved carbonate increase systematically. e precipitated calcite should differ from the olved carbonate by Delta C-13 = 2.3 0/00 if opic equilibrium is attained. But, partitioning of carbon isotopes does not occur because the d is precipitated rapidly from a highly supersa-ated solution. At the nearby spring of Urach the ical a CO3(2-) activity and Delta G-values are ined as well. But in contrast to an earlier period cite does not precipitate at present. This is due, st probably, to inhibitors from waste water de-ited in the recharge area. The delta C-13 values the earlier calcite indicate recrystallization and opic re-equilibration. (Author's abstract)
5-01662

SOLUBILITY OF ORGANIC MIXTURES IN WATER,
Syracuse Research Corp., NY. Life and Environmental Sciences Div.
For primary bibliographic entry see Field 5B.
W85-02109

EULERIAN-LAGRANGIAN SOLUTION OF THE CONVECTION-DISPERSION EQUATION IN NATURAL COORDINATES,
Geological Survey, Menlo Park, CA.
R. T. Cheng, V. Casulli, and S. N. Milford.
Water Resources Research, Vol. 20, No, 7, p 944-952, July, 1984. 7 Fig, 22 Ref.

Descriptors: *Convection, *Dispersion, *Eulerian-Lagrangian Method, Mathematical models, Mathematical equations, Anisotropic dispersion, Solute transport.

Numerical modeling of environmental fluid motions is beset by the conflicting advantages and disadvantages of the Lagrangian and Eulerian viewpoints. While the Lagrangian method follows the natural motions of the water mass, the Eulerian scheme has the major advantage of working in a fixed reference field. An algorithm is proposed for numerical solutions of the convection-disperison equations that combines the best properties of the Eulerian and Lagrangian methods. The Eulerian-Lagrangian Method (ELM) uses the Lagrangian concept in an Eulerian computational grid system. The Lagrangian concept gives a clear description of the conservation principles, the Eulerian concept provides a convenient working frame. The values of the dependent variable off the grid are calculated by interpolation. When a linear interpolation is used, the method is a slight improvement over the upwind difference method. At this level of approximation both the ELM and the upwind difference method suffer from large numerical dispersion. If second-order Lagrangian polynomials are used in the interpolation, the ELM is proven to be free of artificial numerical dispersion for the convection-dispersion equation. The concept of the ELM is extended for treatment of anisotropic dispersion in natural coordinates. The anisotropic properties of dispersion can be conveniently related to the properties of the flow field. the ELM is stable, accurate, and practical for use in the very long term simulation of transport processes in an environmental system. (Moore-IVI)
W85-02162

2. WATER CYCLE

2A. General

NEW ECOLOGICAL APPROACH TO THE WATER CYCLE: TICKET TO THE FUTURE,
Swedish Natural Science Research Council, Stockholm.
For primary bibliographic entry see Field 6A.
W85-01704

RECONNAISSANCE OF SURFACE WATER RESOURCES IN THE TOGIAK RIVER BASIN, SOUTHWESTERN ALASKA, 1980 AND 1982,
Geological Survey, Anchorage, AK. Water Resources Div.
D. R. Kernodle, R. R. Squires, and J. M. Childers.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4170, 1983. 24 p, 10 Fig, 6 Tab, 11 Ref.

Descriptors: *Surface water, Streamflow, Floods, Hydrology, *Water quality, *Benthic invertebrates, *Togiak River basin, *Alaska, Bristol Bay, Maximum evident floods, Environmental indicators.

Data collected during August and September 1980 and March 1982 describe hydrologic characteristics of the Togiak River and its tributaries. Surface waters are generally cold and clear, have significant wilderness recreation values, and provide outstanding salmon habitat. Late summer unit runoff ranged from 2.3 to 8.1 cubic feet per second per square mile. Stream width increased with discharge from about 20 feet on the tributaries to more than 300 feet on the Togiak River near its mouth. Mean depth increased with discharge downstream direction from about 1 to more than 4 feet. Mean velocity ranged between 1 and 4 feet per second and bore little relation to discharge. Late winter unit discharge for sites having little or no upstream lake storage was about 0.5 cubic foot per second per square mile. For the remaining sites, values ranged from 0.8 to 1.4 cubic feet per second per square mile. Unit runoff of maximum evident floods ranged from 12.9 to 50 cubic feet per second per square mile. Field measurements of water temperature, dissolved oxygen, pH, alkalinity and specific conductance indicated that water quality seems much the same throughout the basin and is influenced by the major lakes. Benthic invertebrates indicate a reasonably diverse fauna with midge larvae representing the largest percentage of all organisms found at most sites. (USGS)
W85-01777

IMPROVEMENT OF FLOOD-FREQUENCY ESTIMATES FOR SELECTED SMALL WATERSHEDS IN EASTERN KANSAS USING A RAINFALL-RUNOFF MODEL,
Geological Survey, Lawrence, KS. Water Resources Div.
R. W. Clement.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4110, 1983. 22 p, 2 Fig, 5 Tab, 21 Ref.

Descriptors: Surface water, *Floods, *Small watersheds, *Rainfall-runoff relationships, Precipitation, *Frequency analysis, Streamflow, Gaging stations, Model studies, Annual floods, Antecedent moisture, Surface runoff, Precipitation excess, *Flood frequency, *Kansas, Rainfall-runoff models, Skewness.

The U.S. Geological Survey rainfall-runoff model was used to estimate model parameters for 13 small watersheds in eastern Kansas with drainage areas of less than 11 square miles. Model parameters and rainfall data from three long-term rainfall stations were used in the model to synthesize long-term records of simulated annual peak discharge, which were fitted to a log-Pearson Type III distribution. Final estimates of T-year floods, which were computed by combining weighted estimates of the synthesized and observed T-floods, represent the most reliable estimates based on observed and long-term synthesized records of peak discharges. (USGS)
W85-01786

DROUGHT EFFECT ON HIGH-ALTITUDE FORESTS, RUAHINE RANGE, NORTH ISLAND, NEW ZEALAND,
Ministry of Works and Development, Napier (New Zealand). Water and Soil Div.
P. J. Grant.
New Zealand Journal of Botany, Vol. 22, No. 1, p 15-27, 1984. 7 Fig, 1 Tab, 32 Ref.

Descriptors: *Drought, *Ruahine Range, *New Zealand, *Forests, Rainfall, Deer, Soil erosion, Timberline, Temperature, Tree mortality, High altitude.

Shortly before 1917 abnormally high mortality of canopy trees occurred up to the timberline, c. 1470 m, in the central Ruahine Range. Rainfall records and historical observations indicate that this resulted from intense drought during 1914-15. Despite the drought damage and the impact of deer, the forest regenerated and after 1915 no major source area of coarse sediment developed in Centre Branch of the Waipawa Basin. Forest recovery at the head of the upper Waipawa Basin has produced a timberline which is c. 90 m lower than it was before 1915. On most of the Ruahine Range there is evidence of a recent lowering of timberline which probably also resulted from the 1914-15 drought and which is not associated with decrease of temperature. (Author's abstract)
W85-01886

Group 2A—General

EFFECTS OF CHANNEL EXCAVATION ON WATER-QUALITY CHARACTERISTICS OF THE BLACK RIVER AND ON GROUND-WATER LEVELS NEAR DUNN, NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
C. E. Simmons, and S. A. Watkins.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 82-4083, 1982. 28 p, 15 Fig, 4 Tab, 9 Ref.

Descriptors: *Channel improvement, *Water quality, *Groundwater levels, *North Carolina, Chemical analyses, Bank storage, Suspended sediment, Nutrients, Dissolved solids, Streamflow characteristics, Black River, Channelized streams, Water-table wells, Mean concentrations, Channel alterations.

During 1976-81 data were collected at three sites on the Black River near Dunn, N.C., to define the effects of channel excavation on stream quality and on ground-water levels in nearby areas. One of the data sites was located upstream from the five-mile long excavated reach and served as a background station. Changes in various characteristics of this Coastal Plain stream were determined by comparing data collected before, during, and after the construction period. After deepening of the channel by more than 2 feet, ground-water levels within 100 feet of the stream declined a proportionate amount; however, levels in a well 500 feet from the stream were unchanged. Flow velocities during channel deepening were 100 percent higher than velocities prior to construction. An average increase in water temperatures of about one degree Celsius was observed following removal of trees and brush that provided shading to the stream. After construction, concentrations of dissolved oxygen also increased. The percent of saturation increased 20 to 25 percent in the lower values. Maximum concentrations of suspended sediment increased from about 75 mg/L prior to construction to over 2000 mg/L during construction. Within a year after construction, levels of suspended sediment during stormflow had decreased but remained 5 to 10 times greater than preconstruction levels. Little or no change occurred in pH, total-dissolved solids, nitrogen, phosphorus, and bacteria. (USGS)
W85-01924

FLOOD-FREQUENCY ESTIMATES FOR FIVE GAGED BASINS IN WICHITA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
C. A. Perry, and R. J. Hart.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 84-403, 1984. 23 p, 8 Fig, 6 Tab, 22 Ref.

Descriptors: *Rainfall-runoff relationships, *Model studies, *Frequency analysis, *Flood recurrence interval, *Urban runoff, Wichita, *Kansas, Gaged basins, Calibration.

A study of five basins within the city of Wichita, Kansas, describes the effects of varying degrees of urbanization on flood-frequency relationships. A rainfall-runoff model was calibrated for each basin with an average calibrated model error of 27.5 percent. The calibrated model synthesized 69 water years of peak-discharge record for each basin. Log-Pearson Type III flood-frequency analyses were performed on each synthesized record. Flood frequencies for each basin also were computed using a short-term record of observed annual peak discharges, the modified Soil Conservation Service method, the Oklahoma method, and the National method. The preferred method for computing flood frequency is dependent on the recurrence interval needed and the quantity of available data. Evaluation of all methods revealed the necessity of including a basin area-channel length factor for urban basins. An analysis of the effects of increasing imperviousness on peak discharges indicated an average factor of 6.3 between the 2-year rural and urbanized flood and an average factor of 2.3 between the 100-year rural and urbanized flood. (USGS)
W85-01949

BASIC CONCEPTS OF KINEMATIC-WAVE MODELS,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Miller.
Available from the Distr. Br., USGS, 604 S. Pickett St., Alex., VA 22304. USGS Professional Paper 1302, 1984. 29 p, 10 Fig, 1 Tab, 39 Ref.

Descriptors: *Flow routing, *Kinematic wave models, Dynamic waves, Rivers, Watersheds, *Open channel flow, Unsteady flow, *Model studies.

The kinematic-wave model is one of a number of approximations of the dynamic-wave model. The dynamic-wave model describes one-dimensional shallow-water waves (unsteady, gradually varied, open-channel flow). The report provides a basic reference on the theory and application of kinematic-wave models and describes the limitations of the model in relation to the other approximations of the dynamic-wave model. In the kinematic-wave approximation, a number of the terms in the equation of motion are assumed to be insignificant. The equation of motion is replaced by an equation describing uniform flow. Thus, the kinematic-wave model is described by the continuity equation and a uniform flow equation such as the well-known Chezy or Manning formulas. Kinematic-wave models are applicable to overland flow where lateral inflow is continuously added and is a large part of the total flow. For channel-routing applications, the kinematic-wave model always predicts a steeper wave with less dispersion and attenuation than actually occurs. The effect of the accumulation of errors in the kinematic-wave model shows that the approximations made in the development of the kinematic-wave equations are not generally justified for most channel-routing applications. Modified flow-routing models can be used which help to stop the accumulation of error that occurs when the kinematic-wave model is applied. (USGS)
W85-02035

CALIBRATION AND VERIFICATION OF A RAINFALL-RUNOFF MODEL AND A RUNOFF-QUALITY MODEL FOR SEVERAL URBAN BASINS IN THE DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. B. Linder-Lunsford, and S. R. Ellis.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4286, 1984. 52 p, 6 Fig, 26 Tab, 7 Ref.

Descriptors: *Model studies, *Urban runoff, *Water quality, *Colorado, Denver, Jefferson County, Arapahoe County, Adams County, Denver County.

The U.S. Geological Survey's Distributed Routing Rainfall-Runoff Model--Version II was calibrated and verified for five urban basins in the Denver metropolitan area. Land-use types in the basins were light commerical, multifamily housing, single-family housing, and a shopping center. The overall accuracy of model predictions of peak flows and runoff volumes was about 15 percent for storms with rainfall intensities of less than 1 inch per hour and runoff volume of greater than 0.01 inch. Predictions generally were unsatisfactory for storm having a rainfall intensity of more than 1 inch per hour, or runoff of 0.01 inch or less. The Distributed Routing Rainfall-Runoff Model-Quality, a multievent runoff-quality model developed by the U.S. Geological Survey, was calibrated and verified on four basins. The model was found to be most useful in the prediction of seasonal loads of constituents in the runoff resulting from rainfall. The model was not very accurate in the prediction of runoff loads of individual constituents. (USGS)
W85-02044

NASH MODEL RELATION TO HO ORDER RATIOS,
R. Rosso.
Water Resources Research, Vol. 20, No. 7 920, July, 1984. 11 Fig, 3 Tab, 18 Ref.

Descriptors: *Hydrologic models, *Catc Model studies, Streamflow, Velocity, H runoff relationships, Storms.

The Nash model of the instantaneous unit graph (IUH) is parameterized in terms of order ratios of a catchment on the bas geomorphologic model of catchment re The shape parameter of the Nash model is ent on Horton's numbers R sub-A, R sub-B sub-L, of a catchment. Therefore catchme morphology can provide a synthesis of th of the hydrologic response. The scale paran the Nash model results to be a time varyin acter depending on both geomorphology an age streamflow velocity along the stream ne These two factors are taken separately i count. The assumption of a constant respons tion for a catchment is therefore related assumption of a constant time scale of the I the Nash model of catchment response. Si IUH can be a time-varying characteristic throughout the storm and for different storm variability could be accounted for by the va ty of the time scale of the IUH. Therefore t scale of the IUH could account for the va of the hydrologic response for different stor throughout a storm. When compared with tional regression formulae, these findings c stantially improve the prediction capability Nash model for catchments where no direc fall runoff analysis can be performed. (Bak W85-02158

ESTIMATION OF SKEWNESS OF HY LOGIC VARIABLES,
George Washington Univ., Washington International Water Resources Inst.
V. Yevjevich, and J. T. B. Obeysekera.
Water Resources Research, Vol. 20, No. 7 943, July, 1984. 12 Fig, 3 Tab, 21 Ref. NSF CEE-7916817.

Descriptors: *Skewness, *Hydrology, Probe Mathematical studies, Simulation.

Various methods of estimation of the ske coefficient of hydrologic random variabl compared with respect to bias, variance, square error, and robustness. The underlying lation distributions are limited to gamma (P type 3) and lognormal. The simulation results that a new skewness estimator that uses th mated covariance between the subsample and the subsample variance has a lesser bia the ordinary skewness estimators. It may be as a surrogate when the sample size is sma population skewness large. The superior est of skewness resulting from the maximum hood estimation of parameters of the known lying distribution and robustness studies po the importance of the correct inference on th of underlying probability distribution funct hydrologic applications. (Author's abstract) W85-02161

ADDITIONAL TESTS ON THE EFFEC RAINFALL INTENSITY ON STORM H AND PEAK FLOW FROM WILD-I BASINS,
Georgia Univ., Athens. School of Fores sources.
For primary bibliographic entry see Field 2E
W85-02166

2B. Precipitation

DROUGHT IN SOUTHEASTERN UN STATES,
Florida Univ., Gainesville. Dept. of Geogr
J. A. Henry, and S. E. Dicks.
Florida Scientist, Vol. 47, No. 2, p 114-129, S 1984. 10 Fig, 1 Tab, 17 Ref.

escriptors: *Drought, *Florida, *Georgia, North Carolina, *South Carolina, *Tennesse, Alabama, *Mississippi, Moisture deficiency, eather patterns, Climatology, Eigenvector analy-, Palmer Drought Index.

rought has been a significant, if not dominant, eteorological factor in the southeastern United ates (Florida, Georgia, North Carolina, South arolina, Tennesse, Alabama, and Mississippi) in cent years. Eigenvector analysis of Palmer rought Index values for southeastern United ates for 1931-79 reveals that the 1930s and 1950s perienced the most significant droughts. Gener-y, the dry conditions in the Southeast were less vere than those of the Midwest at the same time. roughout the 1960s, conditions were generally rmal to wet, with significant drought only in ntral and southern Florida. The 1971-79 period as significantly wetter than normal in nearly all the Southeast. Moisture conditions in south-ntral and southern Florida are generally out of ase with the remainder of southeastern United ates. (Collier-IVI)
85-01642

EVIEW OF RAINFALL DATA APPLICATION OR DESIGN AND ANALYSIS,
IAK Consultants, Linkoeping (Sweden).
. Arnell, P. Harremoes, M. Jensen, N. B. hansen, and J. Niemczynowicz.
ater Science and Technology, Vol. 16, No. 8/9, 1-45, 1984. 14 Fig, 4 Tab, 161 Ref.

escriptors: *Rainfall, *Data processing, *Model udies, *Rainfall-runoff relationships, Design orms, Statistical analysis, Computer models, omputer studies, Storms, Floods, Prediction.

he introduction of computer technology has ade it possible to handle quantities of data un-eard just decades ago. Rain data is a good exam-e of such masses of data that have become avail-le for statistical analysis. The state of the art ithin the following areas was reviewed: 1) the atistical characterization of rainfall in time and ace, 2) the development of synthetic design orms and, 3) the application of both synthetic sign storms and historical storms to pipe design, ooding prediction, design of detention basins and lculation of the yearly or extreme pollutional ad on receiving waters from combined sewer verflows. The main conclusion, primarily related item 3, is that more attention in this context ould be put on statistical analysis of flooding and ollution. This analysis is best performed by apply-g historical rain records. Realistic flooding pre-ction is believed only to be possible with a fully ynamic flow model, whereas pollution may be udied by means of simpler models like the time ea approach. The outstanding problem in statisti-l prediction is the distribution in space of the storical rains. (Collier-IVI)
/85-01677

ESIGN STORM FOR A TROPICAL LOCA-ION WITH LIMITED DATA,
ydraulics Research Station, Wallingford (Eng-nd).
. J. Colyer.
Vater Science and Technology, Vol. 16, No. 8/9, 63-68, 1984. 4 Fig, 2 Ref.

escriptors: *Design storms, *Model studies, Urban drainage, *Tropical regions, *Trinidad, Port of Spain, Urban watersheds, Rainfall intensi-, Rainfall-runoff relationships, Rainstorms, Inten-ty-duration-frequency curves.

A computational model was produced of the im-roved urban storm drainage system of Port of pain, Trinidad. Locally appropriate rainfall data ere developed by first producing relationships etween rainfall intensity, duration, and frequency IDF) and then determining design storm profiles. ainfall depths were obtained from an existing DF. Design storm profiles were based on analysis f 100 storms recorded on two raingauges over a wo year period (1980 and 1981). A clear tendency o advanced skewness in the profiles was discov-red; well over 50% of the rainfall depth occured in the first half of the storm. For the purposes of storm drainage analysis, the 100 storms could be divided into three types: a 'Diego Martin' type with very marked skewness and uneven distribution of intensity; a 'San Juan' type with less marked skewness; and a uniform intensity distribution. The computer programs were constructed to use values of the ratio Instantaeous intensity/Mean intensity at 1% time intervals through the storm duration. These ratios were combined with a mean intensity from the IDF relationship to give a dimensional storm profile. The surface runoff model developed for urban conditions in Trinidad was calibrated using observed rainfall and runoff events. The calibrated model was then used within the design storm profiles described above to examine the behavior of the existing drainage system in Port of Spain and to design the necessary improvements. (Collier-IVI)
W85-01678

SYNTHETIC DESIGN STORM AND ITS RELATION TO INTENSITY-DURATION FREQUENCY CURVES,
Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Dept. of Sanitary Engineering.
P. Urcikan, and J. Horvath.
Water Science and Technology, Vol. 16, No. 8/9, p 69-83, 1984. 8 Fig, 3 Tab, 10 Ref.

Descriptors: *Czechoslovakia, *Design storms, *Intensity-duration-frequency Curves, *Model studies, *Rainfall distribution, Rainstorms, Urban hydrology, Rainfall-runoff relationships.

New hydrodynamic deterministic models of rainfall-runoff processes in urban hydrology contributed significantly to development of statistical processing of natural rainfall as synthetic design storms. Design rainfalls have been applied in current hydrodynamic rainfall-runoff models; the course of design rainfalls may be simulated by means of several stochastic-mathematical models. Methods applied in developing design storms with optional time position of intensity maximum with increasing and decreasing intensity course, expressed by means of exponential equations were analyzed. The medium value of the intensity maximum time position tmax/td = 0.317 was identified in eight recording raingauge stations from the set of actual rainfalls of a five-year evaluation period. The design storms will be applied in the future in Czechoslovakia in cases where a more reliable design storm with a variable intensity course, having a character of a stochastic design storm cannot be obtained. (Collier-IVI)
W85-01679

STATISTICAL METHODS OF STORM ANALYSIS,
Agricultural Research Service, Beltsville, MD. Hydrology Lab.
V. D. Vukmirovic, and J. Z. Despotovic.
Water Science and Technology, Vol. 16, No. 8/9, p 85-92, 1984. 8 Fig, 7 Ref.

Descriptors: *Intensity-duration-frequency Curves, *Model studies, *Rainfall distribution, *Rainstorms, Urban hydrology, Storms, Rainfall-runoff relationships, Rainfall intensity, Urban runoff.

Complex information concerning small duration high intensity rainfall is useful for both hydrologist and design engineer and also necessary for urban run-off calculations and drainage system analysis. Return period for a rainfall depth could be determined by an analysis of the annual maxima sample rainfalls for a given duration. That analysis consists of the following three methods: annual maxima method, peaks over threshold method (POT is known as 'partial duration series'), and compound POT. For the defined duration D, relations among D, return period R and rainfall depth X can be evaluated; if there is a need for some more information, it is necessary to analyze the rainfall intensity variations during a rainfall. The storm pattern itself is a random variable that can be defined by a two-dimensional distribution function from which a synthetic storm pattern could be obtained. The distribution function could be interpreted as the probability of a pattern shape appearance. A date in a year when annual maxima Xmax of given duration appears is a random variable d; its distribution function can be defined. The recorded data could be used for the random variable d, transforming the dates into numbers from 1 to 365. This sample could be used for an annual maxima method analysis. An analysis consisting of all three above methods was applied to 57 years of record rainfall data covering the period 1925 to 1981. The annual maxima method was the most simple and the results of this method could be evaluated rapidly. The compound POT method takes more time to get complete information about the storm. (Collier-IVI)
W85-01680

SOME STATISTICAL PROPERTIES OF SHORT-DURATION RAINFALL,
Belgrade Univ. (Yugoslavia). Faculty of Civil Engineering.
D. M. Hershfield.
Water Science and Technology, Vol. 16, No. 8/9, p 93-100, 1984. 10 Fig, 5 Ref.

Descriptors: *Rainfall distribution, *Model studies, *Rainstorms, Urban hydrology, Storms, Rainfall-runoff relationships, Rainfall intensity.

Information on the nature of rainfall characteristics in time and space associated with storms in the mid-latitudes is indispensable for the cost-effective design of various hydraulic structures. Examination of storm data and climatological quantities from both dense raingage networks and individual stations in the United States elucidated some of the important problems in developing drainage design criteria for small areas. Using 5-min increments, for hundreds of storms, the average of the maximum 5-min values was determined to be about 40% of the 60-min amount. The rates of the incoming storm rainfall can vary greatly over a small area but the cumulations during the storm period tend to equalize the storm totals. An 'average' time distribution curve was developed along with relationships between rainfall amounts for durations from 2- to 60-min. A procedure was used for estimating and comparing six quantities from series of annual maximum rainfalls for several short durations. The quantities included a frequency factor, 100-yr value, the probable maximum rainfall, and the observed world maximum rainfalls. (Collier-IVI)
W85-01681

RAINFALL AS THE BASIS FOR URBAN RUNOFF - EXPERIENCE AND PRACTICE IN YUGOSLAVIA,
Split Univ. (Yugoslavia). Faculty of Engineering.
O. Bonacci.
Water Science and Technology, Vol. 16, No. 8/9, p 101-108, 1984. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Rainfall distribution, *Urban runoff, *Yugoslavia, *Rainfall-runoff relationships, Model studies, Rainstorms, Intensity-Duration-Frequency curves, Urban hydrology, Storms, Rainfall intensity, Discharge hydrographs, Hydrographs.

The objective of each study of intensive rainfall and its further application in runoff processes is to define intensity-duration-frequency (IDF) curves. When reading pluviograph records the maximum values of all types of rainfall, regardless of the intervals occuring in intensive rainfall, should be taken into account. In choosing between the partial duration series, annual maxima series, or peaks over a threshold (POT) series, theoreticians prefer the POT series, whereas engineers in practice mostly avoid it. The application of the POT series is more complex than other types of series as it poses certain constraints related to the distribution of occurences of peaks higher the threshold value H sub b. IDF curves should be plotted by defining two families of IDF curves, the first for the period ranging from 5 min to 60 or 120 min and the second for the period from 60 or 120 min up to 24 hours; this method should be used as opposed to plotting for the period ranging from 5 min to 24 hours. In Yugoslavia there are about 250 pluviographs and 3000 rain gauge stations with daily data recordings over an area covering 255,804 sq km.

High variability and significant changes in characteristics of intensive rain in space and time, particularly the direction of storm movement, significantly affect the formation of runoff processes, i.e. outflow hydrograph. The genetic method for computing the runoff process should be used based on the definition of isochrones applied to dynamic programming. (Collier-IVI)
W85-01682

DEPTH-DURATION MODELS OF SHORT TIME INCREMENT RAINFALL,
Purdue Univ., Lafayette, IN. Dept. of Civil Engineering.
A. R. Rao, and B. T. Chenchayya.
Water Science and Technology, Vol. 16, No. 8/9, p 109-130, 1984. 9 Fig, 5 Tab, 10 Ref.

Descriptors: *Depth-area-duration analysis, *Urban runoff, *Rainfall-runoff relationships, Rainfall intensity, Model studies, Rainfall distribution, Rainstorms, Urban hydrology, Storms.

The short increment rainfall depth values corresponding to given frequencies and durations are frequently used in urban storm drainage design. The depth-duration characteristics of short time increment (10 min. and hourly) rainfall sequences, and proposed models of the depths and durations, were investigated as was the effect of different time scales on modelling the process. Regression models of depth and duration data as well as bivariate gamma distribution were used for analysis of hourly and 10-minute rainfall measured at Lafayette, Indiana. Regression models for storm depth-duration relationship are adequate when they are used with appropriately classified storms. Significant differences and some surprising similarities were found in the characteristics of short time increment rainfall processes in different climatic regions. The characteristics of the 10 minute and hourly data are quite similar to each other. (Collier-IVI)
W85-01683

RAINFALL EVENTS AS PATHS OF A STOCHASTIC PROCESS: PROBLEMS OF DESIGN STORM ANALYSIS,
Technische Univ., Munich (Germany, F.R.). Lehrstuhl und Pruefamt fuer Wassergutewirtschaft und Gesundheitsingenieurwesen.
J. Brummer.
Water Science and Technology, Vol 16, No. 8/9, p 131-138, 1984. 1 Fig, 2 Tab, 4 Ref.

Descriptors: *Rainfall, *Stochastic process, *Design storms, Rainfall-runoff relationships, Rainfall intensity, Catchment area, Flood peak.

For questions of temporal and spatial intensity distribution of precipitation events, frequency of precipitation characteristics and for the construction of representative rainstorm events (design storm analysis), a survey of the distribution of completed rainfall events is sufficient. Of interest are the possible variability patterns of rainfall events and their probability distribution (relative frequency of appearance). A concept is introduced for approximating natural peak flow value by means of the distribution of typical rainfall patterns. A comparison demonstrates the quality of this concept and the competency of some well-know design storms for the adequate evaluation of peak flows. The approximation of the natural values by the value resulting from the weighted rainfall patterns, succeeds well for relatively small catchment areas. A slight, continuously increasing underestimation of the natural values begins only in the areas with more than 100 ha of total surface. (Moore-IVI)
W85-01684

UNIVARIATE VERSUS MULTIVARIATE RAINFALL STATISTICS - PROBLEMS AND POTENTIALS,
Hanover Univ. (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
W. Schilling.
Water Science and Technology, Vol. 16, No. 8/9, p 139-146, 1984. 10 Fig, 3 Ref.

Descriptors: *Urban hydrology, *Rainfall, *Statistics, *Multivariate analysis, Mathematical studies, Design storms, Rainfall distribution.

Problems of conventional (univariate) rainfall statistics are discussed. Advanced problems in urban hydrology include design of detention reservoirs, computation of pollution loads and other features. For each of these tasks the conventional statistical treatment of rainfall data causes particular problems since hydrographs rather than peak flows are relevant for the final result. Implications of rainfall probability on probability of reservoir failure or pollution loads are extremely unreliable. Similar problems occur if a design storm is to be defined, because conventional rainfall statistics do not provide any rule how to order a sequence of rainfall intensities. A multivariate approach is presented which treats rainfall as a sequence of independent events, takes care of the temporal structure and eventually also takes care of the spatial structure of rainstorms. (Baker-IVI)
W85-01685

STOCHASTIC CHARACTERIZATION OF TEMPORAL STORM PATTERNS,
Quebec Univ., Chicoutimi. Dept. des Sciences Appliquees.
V. T. V. Nguyen.
Water Science and Technology, Vol. 16, No. 8/9, p 147-153, 1984. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Model studies, *Rainstorms, *Rainfall distribution, Probability distribution, Montreal, Quebec, Storms, Precipitation.

A general stochastic model for characterizing the temporal pattern of storms was developed which can take into account both the persistence in hourly rainfall occurences and the dependence between successive hourly rainfall depths; a storm is defined as a continuous run of non-zero one-hour rainfall depths. The model determines the probability distributions of cumulative storm rainfall amounts at successive time intervals after storm the begins. Hourly rainfall data from Dorval Airport station, on the Island of Montreal, for a total of 2560 summer rainfall events having durations of from 1 to 27 hours were selected from a 32-year record (1943-1974) according to the definition of a storm specified above. The serial correlation coefficient was assumed to be stationary and its computed sample values were used in the estimation of the probability distribution functions for cumulative rainfall amount. By accounting for the correlation structure of consecutive rainfall depths the model gives a good fit to the observations. Use of the model for analytically constructing distributions of cumulative rainfall amounts at successive time intervals seems preferable to the simulation or fitting approaches that have been used in previous investigations. (Collier-IVI)
W85-01686

TIME PATTERNS OF RAINFALL FOR ESTIMATING DESIGN FLOODS ON A FREQUENCY BASIS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
I. Cordery, D. H. Pilgrim, and I. A. Rowbottom.
Water Science and Technology, Vol. 16, No. 8/9, p 155-165, 1984. 3 Fig, 3 Tab, 6 Ref.

Descriptors: *Rainfall, *Design floods, *Rainfall distribution, Frequency distribution, Floods, Urban hydrology, Model studies, Flood peak, Maximum probable floods.

The rainfalls used in the practical estimation of design floods are generally based on frequency-duration relationships derived from recorded intense bursts of rainfall of various durations rather than from complete storms. These recorded intense bursts are therefore used in the derivation of the temporal patterns. The method produces patterns that incorporate the average variation of intensities and the most likely sequence of these varying intensities. Use of these patterns should minimize the introduction of joint probabilities into the design flood model and aid in estimation of a flood with the same frequency as the design rainfall. The method provides patterns with average or typ variations in intensity, in contrast to simple ave ing which is shown to be generally unlikel yield satisfactory patterns. The derived patt are shown to provide peak flood estimates w are higher than those given by constant inter storms but lower than rearrangements of the quency-duration relationships. (Author's abstr W85-01687

TEMPORAL DISTRIBUTION OF DESI STORM RAINFALL,
National Water Research Inst., Burlington (On io).
J. Marsalek.
Water Science and Technology, Vol. 16, No. p 167-175, 1984. 3 Fig, 19 Ref.

Descriptors: *Design storms, *Rainfall distribut *Simulated rainfall, Rainstorms, Rainfall sim tors, Urban hydrology, Rainfall-runoff relati ships, Runoff forcasting.

The temporal distribution of rainfall intensity one of the most important characteristics of design storm. This distribution, and in particular peak intensity and the peak timing, significan affect the runoff peaks simulated for small ur catchments of significant imperviousness. Vari methods for the development of design storm t poral distributions, recommended in the literatu produce widely varying temporal distributio Such differences in design storm hyetographs be noticed for the peak magnitude and timing well as for the overall distribution. Some meth may even produce different rainfall depths identical return periods and durations. As a con quence of differences in design hyetographs, simulated runoff peaks will differ as well. T extent of variations in runoff peaks simulated various design hyetographs will be affected by catchment response and the selected rainfall int val and the computaional time step. Further co parative studies and exchange of experience recommended. (Collier-IVI)
W85-01688

EFFECT OF SPATIAL RAINFALL DISTRIB TION ON SEWER FLOWS,
Hanover Univ. (Germany, F.R.). Inst. fuer Wass wirtschaft, Hydrologie und Landwirtschaftlich Wasserbau.
For primary bibliographic entry see Field 2E.
W85-01689

AREAL REDUCTION FACTORS ON SHO TIME AND SPACE INTERVALS,
Montpellier-2 Univ. (France). Lab. d'Hydrolog Mathematique.
M. Desbordes, P. Raous, and Y. Trevisiol.
Water Science and Technology, Vol. 16, No. 8/ p 189-198, 1984. 3 Fig, 4 Tab, 3 Ref.

Descriptors: *Areal precipitation, *Rainfall-runo relationships, *Rungis, *France, Rainfall intensit Drainage area, Intensity-duration-frequenc curves.

In most research studies on rainfall-runoff proces es, rainfall intensities over the experimental catc ments are measured by means of a few raingage An experimental dense raingage network on t Rungis catchment, France, composed of 9 rai gages, covering approximately 300 to 400 hectare was monitored for three years. Areal reductio factors on short time and space intervals we determined from 51 events ranging from 5 minut to 4 hours. Mean rainfall intensities should not b considered to be uniformly distributed over sma areas ranging from 100 to 400 hectares and fo durations less than one hour. For storm drainag design purposes, one should remember that are reduction factors are random variables; the are distribution of rainfall should be taken into accou be means of Areal Intensity-Duration-Frequenc curves. If these are unknown, one should use mea areal reduction factors defined from point rainfal rather than mean reduction factors which are de fined from maximum point rainfall, observed ove

en area. Rainfall-runoff balances at the catch- outlet have confirmed the influence of rain- network density. The minimum 50 to 100 ires mesh size seems to be suitable. (Collier-

-01690

WEGIAN ACTIVITIES ON COLLECTION RESEARCH ON RAINFALL DATA,
k Inst. for Vannforskning, Oslo.
indholm.
er Science and Technology, Vol. 16, No. 8/9, 9-205, 1984. 4 Fig, 1 Ref.

riptors: *Norway, *Rainfall distribution, nfall intensity, Pluviographs, Rain gages, Data ction, Hydrologic data, Area reduction fac-

y Norwegian communities are located near ntains, valleys, and hills; this topologic diversi- used very big variations in rain intensity from e to place. Due to this condition, a network of itoring stations for monitoring short-time pre- tion is required. There are ca. 50 tipping et pluviographs in Norway recording on mag- tape. These pluviographs (called PLUMA-) are maintained by the Norwegian Meteoro- al Institute (MI) which also process the data- s and distributes information and results from stations. Spatial rainfall distribution was com- d with point measurements based on 5 years of from 6 PLUMATICS in the Oslo area The reduction factor calculated from this data eased rapidly up to 10 sq km and a further ease in this area gives a much slower decrease e reduction factor. (Collier-IVI)
-01691

IGN INFLOW INTENSITY AND DESIGN LOW PROFILES FOR STORM SEWERS,
sdienst voor de Ijsselmeerpolders, Lelystad herlands).
primary bibliographic entry see Field 2E.
-01692

ALUATION OF URBAN DESIGN STORM ISITIVITY,
ois Univ. at Urbana-Champaign. Dept. of Civil ineering.
G. Wenzel, Jr., and M. L. Voorhees.
er Science and Technology, Vol. 16, No. 8/9, 9-236, 1984. 6 Fig, 6 Tab, 20 Ref. Office of er Resources and Technology project A-095-

criptors: *Design storms, *Urban drainage, ainage systems, Design criteria, Rainfall distri- on, Drainage, Urban hydrology, Storm sewers, pth-duration-frequency analysis, Frequency ysis.

ditionally, in the design process for urban nage systems, a precipitation event, either his- cal or artificial, is identified and the system er study is designed to accommodate that nt. This event is usually selected on the basis of rget return period. It is then assumed that the bability of the design capacity being exceeded ne same as the probability of the magnitude of design storm being exceeded. The sensitivity of frequency response of three catchments to gn storm parameters was examined; parameters uded hyetograph shape, antecedent soil mois- condition (AMC), and rainfall duration. A tinuous simulation model was used to compute ulated historical frequency responses for three erent long term rainfall records. Design storms re also developed from depth-duration-frequen- analysis of the rainfall data; comparisons were de on frequency graphs. The hyetograph used the design storm can significantly affect the rn period of the resulting design. AMC can e as much affect on the frequency response of k flows as hyetograph shape. The time of con- tration of the catchment serves as a good guide determine the duration of the design storm to be d. Significant parameter sensitivity exists but an propriate choice of design storm parameters can produce a design which yields peak flows of the desired return period. (Collier-IVI)
W85-01693

STAGED APPROACH TO APPLICATION OF RAINFALL DATA TO URBAN RUNOFF CALCULATIONS,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
For primary bibliographic entry see Field 2E.
W85-01694

RAINFALL DATA FOR THE DESIGN OF DETENTION BASINS,
VIAK Consultants, Linkoeping (Sweden).
For primary bibliographic entry see Field 2E.
W85-01695

RAINFALL ENERGY FROM DROP SIZE DATA,
Pittsburgh Univ., PA. Dept. of Civil Engineering.
R. G. Quimpo, and A.-B. Brohi.
Water Science and Technology, Vol. 16, No. 8/9, p 271-283, 1984. 5 Fig, 2 Tab, 25 Ref.

Descriptors: *Rainfall energy, *Fluid drops, *Kinetic energy, *Erosion rates, Precipitation intensity, Storms, Rainfall intensity.

With the availability of raindrop size distribution data, it is now possible to examine the energy content of storms and approximate more closely their erosion potential. The washoff of pollutants from urban surfaces by storm events depends on the kinetic energy of storms. In order to determine the erosive power of rainfall, data on raindrop size distributions were analyzed and the kinetic energy was expressed as a function of rainfall intensity. Because rainfall intensities vary during the storm, the energy should be calculated from the varying drop size distribution during the storm rather than from the extrapolated distribution from short duration sampling. The regression equation that is currently used to determine storm erosive power from rainfall intensity needs to be revised. (Collier-IVI)
W85-01696

OVERFLOW DATA OF RAINWATER DISCHARGE SYSTEMS DETERMINED FROM RUN OFF SIMULATION OF PLUVIOGRAPH RECORDS,
Lautrich and Pecher, Dusseldorf (Germany, F.R.).
For primary bibliographic entry see Field 2E.
W85-01698

REAL-TIME ESTIMATION AND FORECASTING OF SPATIALLY DISTRIBUTED AREAL RAINFALL,
Hanover Univ. (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
W. Schilling.
Water Science and Technology, Vol. 16, No. 8/9, p 327-348, 1984. 9 Fig, 5 Tab, 30 Ref.

Descriptors: *Rainfall distribution, *Forecasting, *West Germany, *Areal rainfall, Point rainfall, Kalman filter model, Thiessen procedure, Radar, Weather forecasting, Model studies.

A simple multivariate autoregressive model was developed that quantitatively and automatically forecasts spatially distributed point rainfall for short lead times. For calibration and testing of the point model, data of the 'Emschergenossenscchaft' in the Ruhr District, West Germany, were used. The data was assumed to be remotely transmitted; only remotely-transmitted standard raingage data is necessary for model operation. A reliable estimation procedure for areal rainfall should take into account the actual uncertainty of taking the point rainfall as areal rainfall for each specific raingage/subarea. The point model was expanded to forecast and also estimate areal rainfall from point measurements using the Kalman filter technique and the theory of regionalized variables. X-Band-Radar data from the Swist catchment near Bonn was used for verification of the areal rainfall model. In each of 20 measurement periods the Kalman filter estimates outperformed the standard measurements. The Kalman filter model is superior for areal rainfall estimation (compared to the Thiessen procedure) as well as for areal rainfall forecasting compared to trivial forecasts and the point forecasting model mentioned above. (Collier-IVI)
W85-01700

POTENTIAL URBAN RAINFALL PREDICTION MEASUREMENT SYSTEM,
Illinois State Water Survey Div., Champaign.
J. L. Vogel.
Water Science and Technology, Vol. 16, No. 8/9, p 349-362, 1984. 1 Fig, 1 Tab, 33 Ref. NSF grant PFR78-05693.

Descriptors: *Urban rainfall, *Weather forecasting, *Rainfall distribution, *Chicago, *Illinois, Radar, Computers, Rainstorms, Storms, Rain gages, Management planning.

Present raingage systems in many metropolitan regions are capable of monitoring the amount of rain that falls, but unless the raingage network is very dense, extends prohibitively far from the city, and is connected with a computer system to analyze the storm movement, the raingages are not capable of predicting future precipitation patterns and amounts. Continued growth of urban regions and more stringent water quality regulations have resulted in an increased need for more real-time information about past, present, and future patterns and intensities of precipitation. A new prediction/monitoring system for more efficient management of the complex Chicago storm-sewer operational needs consists of five major elements: a 10-cm weather radar incorporating a signal processor; a mini-computer system to analyze the echo data, provide rainfall amounts over the city, and forecast rain which was to occur over the city; telemetered rainfall data from the existing recording raingages of the Sanitary District; meteorologists and standard routine weather facilities; and a communication system connecting the radar and raingages to water control headquarters. The adjunct computer system translates the digital radar data into the rainfall estimates by integrating the raingage-indicated rainfall with the radar signal. It also calculates the motion and rain change fields needed to predict urban rainfall. (Collier-IVI)
W85-01701

STOCHASTIC DESCRIPTION OF TEMPORAL DAILY RAINFALL PATTERNS,
Quebec Univ., Chicoutimi. Dept. des Sciences Appliquees.
V.-T.-V. Nguyen.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 234-238, June, 1984. 4 Fig, 14 Ref.

Descriptors: *Stochastic process, *Model studies, *Rainfall, Montreal Island, Quebec, Temporal distribution, Rainfall amount, Rainfall distribution, Markov chain.

A stochastic approach to characterization of temporal patterns is proposed wherein a rainfall event is defined as an unbroken sequence of consecutive daily rainfalls. A stochastic model is developed to determine the probability distribution of cumulative rainfall amounts at the end of each day within a total rainfall event duration of n days. The model is structured such that the distribution of daily rainfall depths can be approximated by an exponential distribution and the rainfall occurrence process can be described by a first-order stationary Markov chain. An illustrative example was presented, using a 32-year daily rainfall record at Dorval Airport on Montreal Island. The results of this example have demonstrated the adequacy and descriptive capabilities of the model. It can be concluded that the methodology proposed seems to be more general and more flexible than those that have been used in previous investigations. (Author's abstract)
W85-01712

CASE STUDY OF HEAVY RAIN SPELL ON 13TH-25TH DECEMBER 1982 OVER THE EAST COAST OF PENINSULAR MALAYSIA AND SINGAPORE,
Singapore Meteorological Service.
C. Tik.
Journal of the Meteorological Society of Japan, Vol. 62, No.2, p 296-307, April, 1984. 9 Fig, 8 Ref.

Descriptors: *Peninsular Malaysia, *Malaysia, *Singapore, *Rainfall, Hadley cell, Wind, Monsoons, Convergence, Air circulation.

The continuous heavy rain spells over the east coast of Peninsular Malaysia and Singapore are frequently associated with the onset phase (November-December) of the northeast winter monsoon, but the mechanism of the heavy rain spells is not well understood. The Hadley cell over the east coast of Peninsular Malaysia and Singapore was studied by means of meridional wind components and vertical p-velocities for the period of the heavy rain spells from 13th to 25th December 1982. The formation of the heavy rain spells over the east coast of Peninsular Malaysia and Singapore are mainly caused by strong upward motions of moist air in the southern branch of the Hadley cell. Some cases may also be explained by the maximum upward velocities in the mid-troposphere due to the upward branch of the Hadley cell circulation. The maximum upward velocities in mid-troposphere are caused by the combination of strong low-level convergence and the initial appearance of the equatorial cell in the southern branch of the Hadley cell. (Moore-IVI)
W85-02125

AGRICULTURAL DROUGHTS AT PEDDAPURAM, EAST GODAVARI DISTRICT, ANDHRA PRADESH,
Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.
For primary bibliographic entry see Field 2I.
W85-02126

2C. Snow, Ice, and Frost

ICE COVER MELTING IN A SHALLOW RIVER,
Cold Regions Research and Engineering Lab., Hanover, NH.
D. J. Calkins.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 255-265, June, 1984. 11 Fig, 4 Tab, 9 Ref.

Descriptors: *Ice cover, *Melting, *Heat transfer, Water temperature, Diurnal variation, Solar radiation, Frazil ice, River flow, Velocity, Water depth, Air temperature.

The heat transfer coefficients computed from field data on both ice cover melting and water temperature attenuation are higher than the values one would compute based on extrapolation of previous laboratory flume data. The computed heat transfer coefficients were relatively consistent when calculated from the water temperature decay data. Consistent results were also obtained with one set of very detailed ice cover melting data. The diurnal fluctuation in water temperature from the freezing point to values of 0.4-0.6 degrees C was associated with the incoming solar radiation and the open water surface area. The measured water temperature distribution beneath the ice cover at a particular cross section varied from 0.2 to 0.6 degrees C due to the influence of frazil ice and flow distribution. In the open water reaches the water temperature was essentially fully mixed vertically but lateral variation across the river ranged from 0.1 to 0.3 degrees C. The average daily melting of the ice cover often exceeded 5.0 cm and at some locations the rate was as high as 8 cm/d. The melt was not uniform across the section but was highly dependent upon the flow conditions, velocity, and depth. The ice cover melting for this year only occurred during the daylight hours as the air temperatures dropped below 0 degrees C at night and the water temperature likewise decayed to its freezing point. (Author's abstract)
W85-01713

CALCULATION OF MELT-WATER DISCHARGE FROM THE SNOW COVER IN CATCHMENT AREAS IN THE MITTELGEBIRGE MOUNTAINS (BERECHNUNG DER SCHMELZWASSERABGABE AUS DER SCHNEEDECKE IN EINZUGSGEBIETEN DES MITTELGEBIRGES),
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
G. Flemming, and J. Gurtz.
Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 64-66, February, 1983. 4 Fig, 10 Ref.

Descriptors: *Snowmelt, *Mittelgebirge Mountains, *East Germany, *Computer models, Temperature, Snow cover, Precipitation, Catchment area, Mountains, Evaporation.

Computer models for calculating snow melt-water discharge were used to predict discharge patterns in two catchment areas (the Schwarzwasser to the Aue gauge and the Lippersdorfer Bach) in the Mittelgebirge, a mountain range in the German Democratic Republic. The models are based on the daily degree procedure, in which the major factor is temperature, with minor factors of precipitation and snow-cover data. They consist of a frame section and a core section: the former controls program organization and the division of the catchment area into an optional number of levels based upon height above sea-level, which may then be subdivided into bare and forested surfaces; the latter describes snow-cover accumulation, snow melt, and melt-water retention. The SMELT 4 model offers the capability of including not only the mean temperature for each time interval but also the duration of positive (i.e., causing melting) temperatures. Melt intensity, expressed by the so-called degree factor, depends on the amount of water in the snow cover at the beginning of the calculation. SMELT 5 is a physically expanded version of SMELT 4; the melt component is series-connected to components for evaporation and time-dependent accumulation of the snow cover. The models provide a useful base for studying the discharge process in winter and for calculating river flow in general using catchment-area models. (Gish-IVI)
W85-01972

2D. Evaporation and Transpiration

WATER-USE PRODUCTION FUNCTIONS OF SELECTED AGRONOMIC CROPS IN NORTHWESTERN NEW MEXICO, PHASE II,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W85-01817

2E. Streamflow and Runoff

CRITICAL DEPTHS FOR PASSAGE IN BRAIDED RIVERS, CANTERBURY, NEW ZEALAND,
Ministry of Works and Development, Christchurch (New Zealand).
M. P. Mosley.
New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 351-357, 1982. 7 Fig, 4 Ref.

Descriptors: *Canterbury, *New Zealand, *Ashley River, *Hurunui River, *Braided streams, *Rakaia River, Water depth, Stream flow, Minimum flow.

Riffles and points of divergence of branch channels in braided rivers are critical controls upon passage of fish and recreational boats because they are points at which depths are at a minimum. Depths on randomly selected riffles were measured in braided reaches of the Ashley, Hurunui, and Rakaia Rivers and related to discharge; minimum depths encountered in extended reaches of these rivers at a range of flows have also been measured. The data can be used to predict minimum available passage depths at a specified flow, or conversely, to predict the discharge required to maintain a specified minimum passage depth. However, presently available estimates of critical minimum depths required for various instream uses (migration of salmonids, jetboating) appear excess conservative, and minimum depth requires must be more accurately determined befor stream flow needs can be properly assessed. thor's abstract)
W85-01636

FLOOD-PLAIN MANAGEMENT PROGR IN RAPID CITY, SOUTH DAKOTA,
South Dakota School of Mines and Techno Rapid City. Dept. of Geology and Geological gineering.
P. H. Rahn.
Geological Society of America Bulletin, Vol No. 7, p 838-843, July, 1984. 7 Fig, 16 Ref.

Descriptors: *Rapid City, *South Dakota, *F plain management, Floodways, Flood pl Flood damage.

Following the devastating flood of June 9, Rapid City, South Dakota, embarked on a fl plain management program. A 'floodway' wa linated and all homes and motels, as well as commercial establishments, were removed the floodway. Almost the entire area inundate the 1972 flood is now a beautiful park, illustra that man can live in harmony with natural proc es without spending vast sums of money for engineering structures such as dams or lev From a national perspective, it is desirable to serve flood plains for agricultural use. Unfo nately, many flood plains are being urbani which not only take agricultural land out of duction, but also gives impetus to dam const tion that results in the inundation of more l (Author's abstract)
W85-01643

REVIEW OF RAINFALL DATA APPLICATI FOR DESIGN AND ANALYSIS,
VIAK Consultants, Linkoeping (Sweden).
For primary bibliographic entry see Field 2B.
W85-01677

DESIGN STORM FOR A TROPICAL LO TION WITH LIMITED DATA,
Hydraulics Research Station, Wallingford (E land).
For primary bibliographic entry see Field 2B.
W85-01678

SYNTHETIC DESIGN STORM AND ITS RE TION TO INTENSITY-DURATION FREQUE CY CURVES,
Slovenska Vysoka Skola Technicka, Bratisl (Czechoslovakia). Dept. of Sanitary Engineeri
For primary bibliographic entry see Field 2B.
W85-01679

STATISTICAL METHODS OF STORM ANAL SIS,
Agricultural Research Service, Beltsville, M Hydrology Lab.
For primary bibliographic entry see Field 2B.
W85-01680

RAINFALL AS THE BASIS FOR URB RUNOFF - EXPERIENCE AND PRACTICE YUGOSLAVIA,
Split Univ. (Yugoslavia). Faculty of Engineeri
For primary bibliographic entry see Field 2B.
W85-01682

DEPTH-DURATION MODELS OF SHO TIME INCREMENT RAINFALL,
Purdue Univ., Lafayette, IN. Dept. of Civil En neering.
For primary bibliographic entry see Field 2B.
W85-01683

RAINFALL EVENTS AS PATHS OF A ST CHASTIC PROCESS: PROBLEMS OF DESIG STORM ANALYSIS,

hnische Univ., Munich (Germany, F.R.). Lehr- l und Pruefamt fuer Wassergutewirtschaft und undheitsingenieurwesen.
primary bibliographic entry see Field 2B.
5-01684

IE PATTERNS OF RAINFALL FOR ESTI- TING DESIGN FLOODS ON A FREQUEN- BASIS,
v South Wales Univ., Kensington (Australia). ool of Civil Engineering.
primary bibliographic entry see Field 2B.
5-01687

MPORAL DISTRIBUTION OF DESIGN ORM RAINFALL,
ional Water Research Inst., Burlington (Ontar-

primary bibliographic entry see Field 2B.
5-01688

FECT OF SPATIAL RAINFALL DISTRIBU- N ON SEWER FLOWS,
over Univ. (Germany, F.R.). Inst. fuer Wasser- schaft, Hydrologie und Landwirtschaftlichen sserbau.
Schilling.
ter Science and Technology, Vol. 16, No. 8/9, 7-183, 1984. 10 Fig, 8 Ref.

criptors: *Rainfall distribution, *Sewer hydrau- *Rainfall-runoff relationships, Urban hydrolo- Runoff forecasting, Runoff rates, Artificial ms.

en using a runoff model to generate input data statistical computations, e.g. water balance, ur- ization effects, design of dams, etc., the input a and the runoff model should produce flow ures which are correct on the average; the puted probability density function of peak, ume, and time-to-peak should not differ radical- rom the true ones. Errors in computing flows caused by uncertainties about input data as well uncertainties about appropriate models and del parameters. Errors of the input 'rainfall', ecially errors in spatial resolution, propagate by putation of sewer flows. Results of a case ly about a sewer system with a catchment area sq km and ca. 1000 reaches between manholes w - that mean errors in rainfall event depths of ut 20% occur even with five raingages within close to the catchment - that the errors by egarding the spatial distribution are amplified ier than damped by the rainfall-runoff transfor- ion and - that using spatially homogeneous fall input for flow computations cause systemic ors due to the wrong assumption of spatially nogeneous initial losses and due to dominating ections of storm movement. When using artifi- storms, the spatial and temporal rainfall varia- ty should be taken into account. (Collier-IVI)
5-01689

EAL REDUCTION FACTORS ON SHORT ME AND SPACE INTERVALS,
ntpellier-2 Univ. (France). Lab. d'Hydrologie thematique.
primary bibliographic entry see Field 2B.
5-01690

SIGN INFLOW INTENSITY AND DESIGN FLOW PROFILES FOR STORM SEWERS,
ksdienst voor de Ijsselmeerpolders, Lelystad etherlands).
H. M. van de Ven.
ter Science and Technology, Vol. 16, No. 8/9, 07-218, 1984. 5 Fig, 5 Tab, 7 Ref.

scriptors: *Storm sewers, *Design inflow inten- , *Design inflow profiles, *Netherlands, *Le- tad, *Sewer hydraulics, Sewers, Rainfall distri- ion, Discharge frequency, Depth-duration-fre- ency curves.

velve year records of rainfall and of sewer low data in a housing area and in a parking lot in lystad, The Netherlands, were available. These data series contained 5-minute depths of rainfall and sewer inflow. Depth-duration-frequency curves were calculated from the monthly extremes, using Box-Cox transformation and a Gumbel distribution. The differences between the curves for rainfall and for inflow are explained by inertia and rainfall losses. These differences are the reason to use inflow as a sewer design parameter. For the choice of the design discharge (or inflow) intensity the curves are not well suited. Storage-design, discharge-frequency curves proved to be better interpretable. The selected design discharge is 4 or 5 cu m/s/sq km. For non-steady flow calculations in sewer systems an inflow profile has to be provided. The profile should be peaked. The most common location of the peak lies between 20 and 50% of the event duration. The return period of the profile has to be known. A bivariate extreme value distribution is used to estimate this return period. From these distributions synthetic inflow profiles could be calculated. (Author's abstract)
W85-01692

EVALUATION OF URBAN DESIGN STORM SENSITIVITY,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2B.
W85-01693

STAGED APPROACH TO APPLICATION OF RAINFALL DATA TO URBAN RUNOFF CALCULATIONS,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
P. Harremoes, M. Jensen, and N. B. Johansen.
Water Science and Technology, Vol. 16, No. 8/9, p 237-250, 1984. 6 Fig, 15 Ref.

Descriptors: *Urban runoff, *Urban hydrology, *Rainfall distribution, *Denmark, Intensity-duration-frequency curves, Model studies, Mathematical studies, Computer programs.

A coherent staged approach to application of rain data from long rain records to urban storm drainage has been developed in Denmark and is in the process of being implemented at the central computer center of the Danish municipalities. The approach is based on the principal that a spectrum of methods should be made available to the practitioner, from the simplest calculation by hand to the most advanced application of historical rain events as input to the most complicated computer programs. The simplest method is the traditional use of intensity-duration-frequency curves and the rational method. This is equivalent to running a time-area method with a straight time-area curve through all the rain events of a historical rain series. The form factor is used to multiply the flow obtained from the rational method. The use of the rational method with a form factor between 1.0-1.4 is recommended, depending on an estimated shape of the time-area curve. From that basis there are stages of increasing sophistication; the utopian approach is to run all recorded rain events of a rain series through the best available computer programs with very accurate data for the catchment under consideration. The best available programs involve a continuous hydrological simulation model and a model based on the dynamic wave theory for pipe flow. The choice of method depends on the level of ambition and the accuracy of the basic input data for the catchment in question. (Collier-IVI)
W85-01694

RAINFALL DATA FOR THE DESIGN OF DETENTION BASINS,
VIAK Consultants, Linkoeping (Sweden).
V. Arnell.
Water Science and Technology, Vol. 16, No. 8/9, p 255-270, 1984. 7 Fig, 6 Tab, 13 Ref.

Descriptors: *Detention reservoirs, *Urban runoff, *Storm runoff, *Storm water, *Rainfall distribution, *Hydraulic design, Design storms, Storms, Mathematical analysis, Model studies, Rainfall-runoff relationships.

This paper describes the selection of rainfall data for design of detention basins. The use of design storms (the uniform intensity design storm, the Chicago design storm and the Sifalda design storm) was compared with the use of historical storms where the historical storms were assumed to give the most correct result. Historical storms were selected from an 18-year rainfall record; local coefficients were estimated from the same record. Three test catchments were used and detention basins were located at the outlet of each basin. For the runoff simulations, the CTH-Urban Runoff Model was used which also included a detention basin submodel. The results show the importance of design storms having total volumes that correspond to the volumes of historical storms. Use of the uniform intensity design storm and the Chicago design storm resulted in underestimated detention basin volumes. The Sifalda design storm caused overestimated basin volumes which can be reduced after an improvement of the storm. (Author's abstract)
W85-01695

INFLUENCE OF RAINFALL CHARACTERISTICS ON THE POLLUTION EMISSION,
DHV Consulting Engineers, Amersfoort (Netherlands).
K. Bakker, and H. S. J. van Wieringen.
Water Science and Technology, Vol. 16, No. 8/9, p 285-295, 1984. 3 Fig, 3 Tab, 6 Ref.

Descriptors: *Water pollution sources, *Storm wastewater, *Rainfall impact, *Combined sewers, Combined sewer overflows, Storm runoff, Sewers, Storage reservoirs, Runoff coefficient, Overflow, Urban hydrology, Urban runoff, Biological oxygen demand, Chemical oxygen demand, Suspended solids.

An extensive data collection program has been implemented in the Netherlands which provides data on quantities and qualities of stormwater discharges from sewer systems into surface water. To protect the quality of surface waters the combined sewer system is designed to act as a storage reservoir; overflows are restricted by enlarging the storage capacity of individual sewers which is accomplished by overdimensioning of individual sewers. Virtually all sewers in the Netherlands are situated below the level of the overflow weir. Each catchment studied is equipped with continuously recording rain and water level gauges. The measurements started in 1981 at the combined sewer system of Loenen and were later started at other locations. Run-off coefficients were derived from water balances for various storms and show a distinct seasonal influence. In winter time, the coefficients related to impervious area appear to be higher than 1.0. During summer, coefficients considerably below 1.0 have been found. The emission of suspended solids appears to depend on rainfall characteristics. The time of filling of the sewer system reflects these characteristics and appears to be decisive for the concentrations of the suspended solids at the beginning of an overflow. The same holds true for BOD and COD. Long filling times result in much lower concentrations as compared to short filling times. Suspended solids concentrations during an overflow could be predicted by taking into account the washout of the pollutants and the discharge at the overflow weir. (Collier-IVI)
W85-01697

OVERFLOW DATA OF RAINWATER DISCHARGE SYSTEMS DETERMINED FROM RUN OFF SIMULATION OF PLUVIOGRAPH RECORDS,
Lautrich and Pecher, Dusseldorf (Germany, F.R.).
R. Pecher.
Water Science and Technology, Vol. 16, No. 8/9, p 297-309, 1984. 9 Fig, 4 Tab, 8 Ref.

Descriptors: *Urban runoff, *Rainfall-runoff relationships, *Overflow, *Pluviographs, *Runoff simulation, Simulation, Sewer systems, Combined sewers, Statistical analysis.

In the last years, the relieving activity of overflow structures in combined sewer systems was mainly determined by statistical analysis of rainfall data. Due to the rain lost on the surface of a drainage area and to the flow retardation through the sewer network, the resulting runoff variation differs a lot from the rainfall variation. Therefore, the rainfall measurements of 4 rain gaging stations in Hamburg with a total of 67 recorded years and a rain gaging station in Berlin with 22 recorded years were used to carry out runoff simulations. A rainfall statistical analysis was performed with the measured rainfall data in order to determine the annual rainfall durations, depths and frequencies in relation to the average rain intensity. The annual overflow data from overflow structures (overflow weirs and overflow basins) of nonprerelieved drainage areas were computed by means of a simplified runoff model. The so determined overflow data was considerably lower than the data of rainfall analysis. Overflow data from overflow structures in combined sewer systems would not be satisfying if they are derived from only statistical rainfall analysis. Recorded rainfall events should rather be transformed into runoff events and accordingly analyzed. As there were only 5 rain gaging stations available, a generalization of the computed overflow data is still impossible. However, these overflow data seem to be plausible on the whole if compared with rainfall data which were collected in the past only during the summer months. (Author's abstract)
W85-01698

METHODS FOR CALCULATION OF ANNUAL AND EXTREME OVERFLOW EVENTS FROM COMBINED SEWER SYSTEMS,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
N. B. Johansen, P. Harremoes, and M. Jensen.
Water Science and Technology, Vol. 16, No. 8/9, p 311-325, 1984. 9 Fig, 4 Tab, 14 Ref.

Descriptors: *Urban runoff, *Overflow, *Combined sewer systems, *Rainfall-runoff relationships, Water pollution sources, Statistical analysis, Urban hydrology.

Overflow from combined systems constitute an increasing source of pollution of receiving waters, as compared to daily wastewater discharges which undergo treatment to a still higher extent. The receiving water problems from overflows are significant both in a long term scale (mean annual load) and in a short term scale (extreme event load). A method for computation of both annual and extreme load was developed based on historical rain series and the use of a time-area model and simple pollutant mixing model in runoff calculation. Statistical calculations for both mean annual load and extreme events have been applied to the computed overflow series. Based on the computerized method simple manual calculation methods have been developed, resulting in graphs and tables for annual load and extreme load. (Author's abstract)
W85-01699

RECONNAISSANCE OF SURFACE WATER RESOURCES IN THE TOGIAK RIVER BASIN, SOUTHWESTERN ALASKA, 1980 AND 1982,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-01777

STREAMFLOW CHARACTERISTICS OF THE YELLOWSTONE RIVER BASIN, MONTANA, THROUGH SEPTEMBER 1982,
Geological Survey, Helena, MT. Water Resources Div.
R. J. Omang.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 84-4063, 1984. 78 p, 1 Fig, 71 Tab, 6 Ref.

Descriptors: *Low flow, *Flood frequency, *Flow duration, Gaging stations, Streams discharge, Yellowstone River basin, *Montana.

Statistical summaries of streamflow data for selected stream-gaging sites are presented in this report to aid in appraising streamflow in the Yellowstone River basin. Streamflow records are presented for 71 gaging stations for the period of record. Streamflow record collection in the Yellowstone River basin began in 1889. For each gaging station selected for this report, a brief description is given for station location, drainage area, period of record, revisions of previously published records, type and history of gages, regulation and diversions, average discharge, and extremes of discharge. This information is followed by tables of monthly and annual flow statistics, flood-frequency data, low-flow and high-flow frequency data, and flow-duration data. (USGS)
W85-01781

HYDROLOGIC RESPONSES OF STREAM'S TO MINING OF THE MULBERRY COAL RESERVES IN EASTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
H. E. Bevans.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 84-4047, 1984. 30 p, 12 Fig, 6 Tab, 13 Ref.

Descriptors: *Water quality, *Streamflow, *Coal mining, Dissolved solids, Sulfate, Suspended sediment, Flow duration, Storm runoff, Detention reservoirs, *Coal hydrology, *Kansas, Marais des Cygnes River, Little Osage River, Linn County, Miami County, Bourbon County, Mulberry Coal.

The U.S. Geological Survey investigated the hydrologic responses of streams with respect to coal-mining activities in the Mulberry coal reserves of Miami, Linn, and Bourbon Counties, eastern Kansas. Results of a low-flow water-quality reconnaissance showed that small streams draining previously coal-mined areas generally have relatively large concentrations of sulfate. Large streams in the study area have been relatively unaffected by coal mining. A comparison of two small drainage basins showed that the basin affected by an active strip mine had less high flow and more low flow because of the regulating effects of sediment ponds. Effluent pumped from the strip mine increased the load of sulfate by 244 percent, the load of dissolved solids by 41 percent, and occasionally transported relatively large concentrations of iron, lead, manganese, and zinc to the receiving stream. Accelerated erosion caused by the exposure and disturbance of soil during clearing and excavation increased the sediment load of the receiving stream by 25 percent even though sediment ponds were installed. (USGS)
W85-01782

EFFECTS OF THE DROUGHT OF 1980-81 ON STREAMFLOW AND ON GROUND-WATER LEVELS IN GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
R. F. Carter.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4158, 1983. 46 p, 23 Fig, 3 Tab, 8 Ref.

Descriptors: *Low flow, *Flow frequency, *Ground-water levels, Reservoir stages, *Streamflow, *Groundwater, Water resources, *Georgia.

The 1980-81 drought resulted in the lowest rates of streamflow since 1954 in most areas of Georgia, and the lowest since 1925 in some areas. Over most of the State, minimum average streamflows for periods of 1, 7, 30, 60, 90, and 183 consecutive days receded to low levels estimated to be reached at average intervals of 10 to 25 years. Flows in the Flint River from central to southwest Georgia receded to levels estimated to be reached at average intervals of 70 years. Pool levels at four major reservoirs receded to the lowest levels since the reservoirs were first filled. Ground-water levels declined below the lowest levels previously observed in many observation wells. Nearly continuous declines were recorded in some wells for as much as 20 consecutive months, and levels mained below the previous minimum level record for as much as 9 consecutive mont (USGS)
W85-01783

PREDICTION OF PEAK FLOWS FOR CU VERT DESIGN ON SMALL WATERSHEDS OREGON,
Oregon State Univ., Corvallis. School of Forest
For primary bibliographic entry see Field 4A.
W85-01820

DAILY WATER AND SEDIMENT DI CHARGES FROM SELECTED RIVERS O THE EASTERN UNITED STATES: A TIM SERIES MODELING APPROACH,
Geological Survey, Lakewood, CO. Water R sources Div.
For primary bibliographic entry see Field 2J.
W85-01823

WATER RESOURCES DATA, KENTUCK WATER YEAR 1982,
Geological Survey, Louisville, KY. Water R sources Div.
J. M. Bettandorff, J. N. Sullavan, D. W. Leist, an D. V. Whitesides.
Available from the National Technical Informati Service, Springfield, VA 22161 as PB84-16232 USGS Water-Data Report KY-82-1, (May, 198 517 p. Prepared in cooperation with the state Kentucky and with other agencies.

Descriptors: *Kentucky, *Hydrologic data, *Su face waters, *Water quality, *Groundwat Gaging stations, Streamflow, Flow rates, Lak Wells, Chemical analyses, Suspended sedimen Water temperature, Water levels, *Data colle tions.

Water resources data for the 1982 water year f Kentucky consist of records of stage, discharg and water quality of streams; stage and contents lakes; and water levels and water quality of we and springs. This report contains discharge recor from 115 gaging stations; stage and contents for lakes; suspended-sediment data for 38 stations (daily); daily temperature records for 26 station daily specific conductance for 14 stations; groun water level for 75 recording; 99-partial sites; wate quality data from 24 stations sampled at regul intervals and 70 wells; and miscellaneous temper ture and specific conductance from the 115 gagi stations. Also included are data for 118 partia record crest-stage sites. Data collected at vario miscellaneous sites is also published. (USGS)
W85-01923

ANNUAL WATER-RESOURCES REVIEW WHITE SANDS MISSILE RANGE, NEW MEXICO, 1982,
Geological Survey, Albuquerque, NM. Water Re sources Div.
R. R. Cruz.
Available from the OFSS, USGS, Box 25425, Fed Ctr. Denver, CO 80225. USGS Open-File Repo 83-695, 1983. 32 p, 13 Fig, 7 Tab, 5 Ref.

Descriptors: *Hydrologic data, *Groundwate Potentiometric level, *Water quality, *Slope-are measurement, Peak flow, *New Mexico, Militar installation, White Sands Missile Range.

Ground-water data were collected in 1982 a White Sands Missile Range in south-central New Mexico. Depth-to-water measurements in the Pos Headquarters supply wells continued to show sea sonal declines. Test wells east of the Headquarter well field continue to show long-term declines a well as seasonal fluctuations. The total amount o water pumped from White Sands Missile Rang supply wells was 66,226,600 gallons more in 198 than in 1981. The difference in the specific-con ductance values of the water samples collected from the Post Headquarters supply wells in th winter and summer increased in 1982. (USGS
W85-01927

ER RESOURCES DATA, IOWA, WATER
1982,
gical Survey, Iowa City, IA. Water Re-
s Div.
urmeister, V. L. Spiers, P. J. Soenksen, and
Matthes, Jr.
ble from the National Technical Information
e, Springfield, VA 22161 as PB84-137215.
Water-Data Report IA-82-1, 1983. 262 p, 10
Tab. Prepared in cooperation with the State
va and other agencies.

iptors: *Iowa, *Hydrologic data, *Surface
*Groundwater, *Water quality, Flow rates,
nflow, Gaging stations, Lakes, Reservoirs,
ical analyses, Sediments, Water temperature,
ling sites, Water levels, Water analyses,
collections, Water wells.

resources data for the 1982 water year for
consists of records of stage, discharge, and
quality of streams; stage, contents, and water
y of lakes and reservoirs; and water levels in
This report contains discharge records for
aging stations; stage contents for 7 lakes and
oirs; water quality for 17 gaging stations; and
levels for 34 observations wells. Also includ-
125 crest-stage partial-record stations. Addi-
water data were collected at various sites,
rt of the systematic data-collection program,
re published as miscellaneous measurements
nalyses. (USGS)
01931

ER RESOURCES DATA, KANSAS WATER
R 1982,
gical Survey, Lawrence, KS. Water Re-
es Div.
Geiger, D. L. Lacock, L. R. Shelton, M. L.
y, and C. E. Merry.
able from the National Technical Information
e, Springfield, VA 22161 as PB84-84128396.
S Water-Data Report KS-82-1, 1983. 485 p, 8
Tab. Prepared in cooperation with the State
nsas and with other agencies.

riptors: *Kansas, Hydrologic data, Surface
, Groundwater, Water quality, Flow rates,
g stations, Lakes, Reservoirs, Chemical anal-
Sediments, Water temperature, Water level,
r analysis, *Data collections, Sampling sites.

r resources data for the 1982 water year for
as consist of records of stage, discharge, and
quality of streams; stage, contents, and water
y of lakes and reservoirs; and water levels
miscellaneous water quality in wells. This
t contains discharge records for 145 gaging
ns; stage and contents for 24 lakes and reser-
; water quality for 58 gaging stations; and
r levels for 475 observation wells and miscel-
us water quality for 96 wells. Also included
lata for 91 crest-stage partial-record stations.
GS)
-01932

ER RESOURCES DATA, NEW HAMP-
RE AND VERMONT, WATER YEAR 1982,
ogical Survey, Boston, MA. Water Resources

Blackey, J. E. Cotton, and K. W. Toppin.
lable from the National Technical Information
ice, Springfield, VA 22161 as PB84-161868.
S Water-Data Report NH-VT-82-1, 1983. 145
Fig. Prepared in cooperation with the States
ew Hampshire and Vermont and with other
cies.

criptors: *New Hampshire, *Vermont, *Hy-
ogic data, *Surface water, *Groundwater,
ter quality, Flow rate, Gaging stations, Lakes,
rvoirs, Chemical analyses, Sediments, Water
peratures, Sampling sites, Water levels, Water
yses, *Data collections.

er-resources data for the 1982 water year for
Hampshire and Vermont consist of records of
e, discharge, and water quality of streams;
e and contents of lakes and reservoirs; and
nd-water levels. This report contains dis-
ge records for 73 gaging stations, stage records for 4 lakes, month end contents for 25 lakes and reservoirs, water-quality data for 4 gaging stations, and water levels for 30 observation wells. Also included are data for 3 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. Locations of gaging stations, partial-record stations, and observation wells are shown in figure 1. A few pertinent stations (not included above) in bordering States and Province of Quebec are also included in this report. (USGS)
W85-01933

WATER RESOURCES DATA, ARKANSAS, WATER YEAR 1982,
Geological Survey, Little Rock, AR. Water Resources Div.
T. E. Lamb, J. E. Porter, B. F. Lambert, and J. Edds.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-181296. USGS Water-Data Report AR-82-1, 1983. 503 p, 5 Fig, 3 Tab. Prepared in cooperation with the State of Arkansas and with other agencies.

Descriptors: *Arkansas, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water resources data for the 1982 water year for Arkansas consist of records of gage height, discharge, and water quality of streams; elevation, contents, and water quality of lakes; water levels and water quality of observation wells. This report contains discharge records for 55 gaging stations; water quality for 149 stations, 47 partial-record stations, 25 observation wells; and water levels for 95 observation wells. Also included are data for 99 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. (USGS)
W85-01934

WATER RESOURCES DATA, MASSACHUSETTS AND RHODE ISLAND, WATER YEAR 1982,
Geological Survey, Boston, MA. Water Resources Div.
R. A. Gadoury, G. G. Girouard, and D. F. Letty.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-180009. USGS Water-Data Report MA-RI-82-1, 1984. 237 p, 5 Fig, 1 Tab. Prepared in cooperation with the States of Massachusetts and Rhode Island and with other agencies.

Descriptors: *Massachusetts, *Rhode Island, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for Massachusetts and Rhode Island consist of records of stage, discharge, and water quality of streams; contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 97 gaging stations, month end contents for 30 lakes and reservoirs, water quality for 10 gaging stations, and water levels for 107 observation wells. Also included are data for 3 low-flow and 18 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. A few pertinent stations (not included above) in bordering States are also included in this report. (USGS)
W85-01935

WATER RESOURCES DATA, NORTH DAKOTA, WATER YEAR 1982,
Geological Survey, Bismarck, ND. Water Resources Div.
R. E. Harkness, and N. D. Haffield.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-136589. USGS Water-Data Report ND-82-1, 1983. 418 p, 18 Fig, 2 Tab. Prepared in cooperation with the State of North Dakota and with other agencies.

Descriptors: *North Dakota, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water resources data for the 1982 water year for North Dakota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 110 gaging stations; stage only records for 21 gaging stations; stage and contents for 12 lakes and reservoirs; water quality for 114 gaging stations; 8 lakes, 67 wells, and water levels for 31 observation wells. Additional water data were collected at various sites, not involved in the systematic data collection program, and are published as miscellaneous measurements. (USGS)
W85-01936

WATER RESOURCES DATA, SOUTH CAROLINA, WATER YEAR 1982,
Geological Survey, Columbia, SC. Water Resources Div.
C. S. Bennett, R. D. Hayes, J. W. Gissendanner, and H. E. Herlong.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-84162577. USGS Water-Data Report SC-82-1, 1983. 330 p, 5 Fig. Prepared in cooperation with the State of South Carolina and with other agencies.

Descriptors: *South Carolina, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water resources data for the 1982 water year for South Carolina consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 78 gaging stations, stage only at 5 gaging stations, stage and contents at 11 lakes and reservoirs, water quality at 37 gaging stations, and water levels at 57 observation wells. Also included are data for 42 crest-stage partial-record stations. Locations of these sites are shown on figures 3, 4, and 5. Additional water data were collected at various sites not involved in the systematic data-collection program. (USGS)
W85-01937

WATER RESOURCES DATA, GEORGIA, WATER YEAR 1982,
Geological Survey, Doraville, GA. Water Resources Div.
W. R. Stokes, III, T. W. Hale, J. L. Pearman, and G. R. Buell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-128412. USGS Water-Data Report GA-82-1, 1983. 390 p, 8 Fig, 1 Tab. Prepared in cooperation with the State of Georgia and with other Federal agencies.

Descriptors: *Georgia, *Hydrologic data, *Surface water, *Water quality, *Groundwater, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Wells, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water resources data for the 1982 water year for Georgia consists of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains discharge records of 109 gaging stations; stage for 10 gaging stations; stage and contents for 17 lakes and reservoirs; water quality for 17 continuous stations, 115 periodic stations

and miscellaneous sites; peak stage and discharge only for 109 crest-stage partial-record stations and 20 miscellaneous sites; measurements of discharge at 49 low-flow partial-record stations and 15 miscellaneous sites; and water levels of 28 observation wells. (USGS)
W85-01938

WATER RESOURCES DATA, ALABAMA, WATER YEAR 1982,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
H. C. Rollins, F. C. Sedberry, E. G. Ming, and I. A. Giles.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-183250. USGS Water-Data Report AL-82-1, 1983. 467 p, 7 Fig, 1 Tab. Prepared in cooperation with the Geological Survey of Alabama, the Alabama Highway Department, and with other State, Municipal, and Federal agencies.

Descriptors: *Alabama, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water resources for the 1982 water year for Alabama consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 85 gaging stations; stage only for 16 gaging stations, stage and contents for 12 lakes and reservoirs; water quality for 67 gaging stations and 76 wells, and water levels for 52 observation wells. Also included are 10 crest-stage partial-record stations, 8 flood hydrograph partial-record stations and 91 water-quality partial record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. (USGS)
W85-01939

FLOOD-FREQUENCY ESTIMATES FOR FIVE GAGED BASINS IN WICHITA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-01949

INTEGRATED METHODOLOGY FOR IN-STREAM FLOW STRATEGIES,
Duke Univ., Durham, NC. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W85-01951

FORECASTING OF WATER LEVEL AND DISCHARGE OF THE ELBE WITH THE AID OF FUZZY MODELLING (VORHERSAGE VON WASSERSTAND UND DURCHFLUSS FUR DIE ELBE MIT HILFE EINER UNSCHARFEN MODELLIERUNG),
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
N. Hansel, R. Oppermann, and B. Straube.
Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 67-69, February, 1983. 6 Fig, 5 Tab, 8 Ref.

Descriptors: *Flow discharge, *Water level, *Forecasting, *Fuzzy modeling, *Elbe, *East Germany, Model studies, Computers, Hydrologic models.

Fuzzy modelling has proven to be an effective method of forecasting the water level (W) and discharge (Q) of large rivers because it allows a description of the river as a whole, set-up of the model using relatively few data, consideration of new observations, direct utilization of experiences of professionals in the subject field, and inclusion of information gathered after the model has been set in motion. A fuzzy model was used to predict W and Q for the East German portion of the Elbe river together with its main tributaries, Mulde and Saale. Input data were taken from measurements made at three gauges (one on each river) in the 1960s and 70s, and model results were compared with the actual situation. The model consists principally of five fuzzy relationships, R1-5. R1 is a fuzzy classifier representing the relationship between the progress line measured at gauge 1 and a set of hydrologically meaningful patterns. The dynamic situation at gauge 1 is represented by the values X1-3, R2 and R3 are constructed similarly for gauges 2 and 3. R4 classifies the situation at the forecast gauge (X10) at a point in time t1 into 'high' or 'low.' R5 represents the relationship between T1-3, the water-level set H (resulting from R4), and the predicted-value set, Y. The model was found to be highly accurate, and it will be possible to improve it further with practical experience. The model can be expanded at the X1-10 level to include previously measured values or those collected at smaller time intervals. The model is programmed in FORTRAN and was run on an SM4 minicomputer. (Gish-IVI)
W85-01973

FLOOD POTENTIAL OF FORTYMILE WASH AND ITS PRINCIPAL SOUTHWESTERN TRIBUTARIES, NEVADA TEST SITE, SOUTHERN NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
R. R. Squires, and R. L. Young.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4001. 33 p, 23 Fig, 5 Tab, 12 Ref.

Descriptors: *Flood frequency, *Regional floods, Flood channels, *Flood discharge, Flood plains, Flood recurrence interval, Roughness coefficient, Regression analysis, Fortymile Wash, *Nevada, *Nevada Test Site, 100-year flood, 500-year flood, Busted Butte Wash, Drill Hole Wash, Yucca Wash.

Analysis of flood hazards for a 9-mile reach of Fortymile Wash and three of its tributaries was undertaken to aid in determining possible sites for the storage of radioactive wastes. Data from 12 peak-flow gaging stations adjacent to the Test Site were used to develop regression relations that permit an estimation of the magnitude of the 100- and 500-year flood peaks. The regional maximum flood was estimated on the basis of data from extreme floods elsewhere in Nevada and in surrounding states. On Fortymile Wash (drainage area at farthest downstreams cross section, 312 sq mi), the estimated maximum water depth for the three flood magnitudes are 8, 11, and 29 feet, respectively. Mean flow velocities would be as great as 9, 14, and 28 ft/s.
W85-02037

ESTIMATION OF NATURAL STREAMFLOW IN THE JEMEZ RIVER AT THE BOUNDARIES OF INDIAN LANDS, CENTRAL NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
E. E. Fischer, and J. P. Borland.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 82-4113, 1983. 27 p, 3 Fig, 9 Tab, 17 Ref.

Descriptors: Streamflow, Reservoirs, Hydraulic characteristics, Water losses, Streamflow routing, *Indian lands, Surface water, Streamflow records, Trans-basin diversion, Irrigation diversion, Jemez River, *New Mexico, Sandoval County.

Natural streamflow in the Jemez River at the boundaries of Indian lands was estimated from available streamflow records which were adjusted by estimated losses of water due to man-made changes in the hydraulic characteristics of the river basin. The average estimate annual natural streamflow is 53,180 acre-feet at the upstreams boundary of the Jemez Indian Reservation, 53,180 acre-feet at the Jemez--Zia Indian Reservation boundary, 55,440 acre-feet at the Zia--Santa Ana Indian Reservation boundary, and 46,550 acre-feet at the downstream boundary of the Santa A
Reservation. (USGS)
W85-02048

FLOODS OF AUGUST 7-8, 1979, IN CHAUTA QUA COUNTY, NEW YORK, WITH HYDRA LIC ANALYSIS OF CANADAWAY CREEK THE VILLAGE OF FREDONIA,
Geological Survey, Albany, NY. Water Resourc Div.
R. Lumia, and W. H. Johnston.
Available from the OFSS, USGS, Box 25425, Fe Ctr. Denver, CO 80225. USGS Water-Resourc Investigations Report 83-4211, 1984. 16 p, 8 Fig, Tab, 17 Ref.

Descriptors: *Floods, *Flood profiles, *Flo peak, *Water-surface profiles, Rainfall intensi Flood-frequency, Indirect flood measureme *New York, Rainfall frequency, Debris jam, Cha tauqua county, Fredonia.

Extensive flooding of streams in Chautauq County, N.Y., on August 7-8, 1979, after seve thunderstorms, resulted in one death and millio of dollars worth of property damage. Severe floo ing was reported on Canadaway Creek in Fred nia, where the peak discharge was computed to 12,000 cubic feet per second. The recurrence inte val of this discharge is estimated to be greater th 100 years (exceedance probability less than 0.0 A hydraulic analysis of the flood in Fredonia ind cated that a debris jam at the Water Street brid caused the water level (as determined from floo marks) immediately upstream from the bridge to 2.9 feet higher than level computed for unobstruc ed (without debris) flow conditions. The 100-ye flood discharge at the Water Street bridge is co puted to be 5,280 cubic feet per second, and th corresponding water level just upstream from th bridge (under unobstructed flow conditions) is 5 feet lower than the level observed during th August 7-8, 1979 flood. (USGS)
W85-02051

COMPUTATION OF CONTINUOUS STREAM FLOW RECORDS,
Geological Survey, Reston, VA. Water Resourc Div.
E. J. Kennedy.
Available from the Distr. Br., USGS, 604 S. Pick ett St., Alex., VA 22304. USGS Techniques Water-Resources Investigations (Book 3, Chapt A-13), 1983. 53 p, 34 Fig, 5 Ref.

Descriptors: *Hydrometry, *Stream gages, *Hy drologic data collections, Channel flow, Wate measurement, Streamflow.

Records of continuous streamflow, published i the U.S. Geological Survey annual Water Dat Reports for the States and territories, are comput ed from field data, mainly discharge measurement and recorder charts or tapes. This manual de scribes the computation procedures used and som details of related field operations. It was compile mostly from unpublished Water Resource Divisio district manuals edited and supplemented to em phasize digital-recorder and associated compute use. Methods used primarily for graphic-recorde gaging stations and non-recording gages are als included. Reference is made to other publication for some of the more specialized or unusuall complex procedures. (USGS)
W85-02053

DIURNAL VARIATION IN THE OXYGEN UPTAKE OF RIVER SEDIMENTS IN VITRO BY USE OF CONTINUOUS FLOW-THROUGH SYSTEMS,
Copenhagen Univ., Hilleroed (Denmark). De Ferskvands-Biologiske Lab.
E. Jeppesen.
Hydrobiologia, Vol. 91, p 189-195, July, 1982. 4 Fig, 15 Ref. Danish Research Foundation grant 521/28-2.

Descriptors: *Susaa River, *Denmark, *Sediment-water interface, *Oxygen uptake, *Fluvial sedi-

nts, *Measuring instruments, Water temperature, Exchange rate, Aerobic conditions.

ious incubation methods have been used for the surement of oxygen exchange over the sedi-t-water surface in lotic environments. In ish river systems the diurnal variations in gen concentration and the temperature in the mer are often quite high (5-21 mg O2/L and 5-) and the sediment is very heterogenous. These ditions must be considered when designing an bation system. The diurnal exchange of gen, over the sediment-water interface, was sured on 'undisturbed' sediment cores incubat-n the river bank of three reaches in the river aa, Denmark. The incubation chambers were pped with a double pumping system, driving nternal and an external flow, respectively. The rnal flow created a unidirectional flow over the ment surface, with the same velocity as the ral river flow. River water was pumped ugh the incubation chambers (external flow) through a registration chamber equipped with oxygen probe and a temperature transducer. ious methods were used for the numerical solu- of the differential equation which describes rate of exchange of oxygen. On permanently sediment samples, a hysteresis effect between oxygen exchange rate and the oxygen concen-on and temperature appeared. The exchange s were lower in periods with increasing oxygen centration. A minimum in the exchange rate obtained before the minimum in the concen-on of oxygen and temperature was found. This of hysteresis could be explained by equilibra- in connection with the transient state condi-s. The hysteresis was probably enlarged by s in the size of the aerobic layer in the sedi-t. (Collier-IVI)
5-02069

ALYSIS OF TOTAL PHOSPHORUS TRANS-RT IN RIVER SYSTEMS,
t Virginia Univ., Morgantown.
. Verhoff, D. A. Melfi, and S. M. Yaksich.
drobiologia, Vol. 91, p 241-252, July, 1982. 11 8 Ref.

criptors: *Phosphorus, *Solute transport, th of pollutants, Sediment transport, Storm er, Nutrient transport, Nitrogen.

nan activities generate many pollutants from erent land uses. These pollutants include nutri- (e.g., phosphorus and nitrogen), toxic sub-ces (e.g., heavy metals and pesticides), and r substances (e.g., chlorides and salts). These erials often enter a river at some upstream t and are transported downstream by the flow-water. Many substances are transported both ng storms and during normal river flow and n the major portion of the transport occurs ng the storm. This paper considers the quantifi-on of transport primarily during storms. First, characteristics of storm transport are discussed. n, a calculation method for estimating the dis-e of travel for sediment related materials is ented. Third, a technique to estimate the unt of a given chemical passing a point in a am over a specified period of time is presented. last part of this paper contains a technique for ing the movement of substances through a r network. In particular, this procedure yields rmation as to the source of given pollutants r the entire storm period. (Author's abstract)
5-02074

FLUENCE OF WITHIN-STREAM DISTURB-CE ON DISSOLVED NUTRIENT LEVELS RING SPATES,
shwater Biological Association, Wareham gland). River Lab.
Casey, and I. S. Farr.
drobiologia, Vol. 92, p 447-462, July, 1982. 8 , 1 Tab, 31 Ref. Department of the Environ-nt contract DGR 480/309.

criptors: *Dissolved nutrients, *Spates, *Fresh- *Nutrients, Streams, Organic carbon, Phos-tes, Silicates, Nitrates, Potassium, Suspended ds, Bacteria, Organic matter.

In rivers, variations in concentrations of many dissolved nutrients occur during spates. Increases are usually attributed to concentrated point or non-point inputs, and decreases to dilution associated with rainfall. Increased discharge disturbs sediments and benthic communities, but the effects of such disturbance on nutrient levels are difficult to isolate. Measurements of nutrient levels over three artificial spates revealed that substantial variations in dissolved organic carbon, dissolved phosphate, silicate, nitrate, and potassium levels could result from increased discharge in the absence of allochthonous inputs. Variations were closely related to peaks in suspended solids concentration or water height. Increases in biochemical oxygen demand and suspended bacteria also occurred. Variations in phosphate and silicate could be accounted for by a balance between release of 'sediment interstitial water' and exchange processes involving suspended and freshly exposed sediment. An increase in nitrate, during one spate, was due to a reduction in the effect of benthic denitrification. Small peaks in dissolved organic matter concentration were detected over each spate. We propose that within-stream disturbance is a factor which may contribute to variations in dissolved nutrient concentration during the rising hydrograph in natural spates. (Author's abstract)
W85-02089

AVAILABILITY OF DISSOLVED OXYGEN IN INTERSTITIAL WATERS OF A SANDY CREEK,
Indiana Univ. Northwest, Gary.
R. L. Whitman, and W. J. Clark.
Hydrobiologia, Vol. 92, p 651-658, July, 1982. 6 Fig, 1 Tab, 19 Ref.

Descriptors: *Interstitial water, *Dissolved oxygen, *Streams, *Mill Creek, *Texas, Conductivity, Alkalinity, Storm runoff, Convection, Base flow, Mixing, Thermal properties.

The chemical makeup of interstitial water is due to the combined influences of groundwater and surface waters. The possibility is examined of a thermally induced exchange mechanism for mixing of surface and subsurface waters in small, clean, sandy streams which display marked diurnal temperature fluctuations. Dissolved oxygen, pH, conductivity and alkalinity of surface and subsurface interstitial waters were investigated at Mill Creek (a small, rural, predominantly sandy stream in east Texas). Dissolved oxygen concentration tended to decrease with sediment depth, while conductivity and alkalinity did not significantly change with substrate depth. Surface water pH was significantly higher than interstitial water ($p = 0.05$). Chemical analyses of subsurface water from a pre- to post-storm event showed a depression in dissolved oxygen concentration in moderate and deep interstitial waters, immediately following the return of stream base flow, with the deeper strata returning to pre-storm oxygen levels four days later. A thermal convective current mechanism is proposed which would serve to transport surface water downward into these deeper interstices. The convective mechanism could influence the downward transport of organic material by helping to keep it in suspension. (Moore-IVI)
W85-02103

TWO-COMPONENT EXTREME VALUE DISTRIBUTION FOR FLOOD FREQUENCY ANALYSIS,
Naples Univ. (Italy). Dept. of Hydraulic Construction.
F. Rossi, M. Fiorentino, and P. Versace.
Water Resources Research, Vol. 20, No. 7, p 847-856, July, 1984. 7 Fig, 1 Tab, 44 Ref.

Descriptors: *Flood frequency, *Italy, *Two-component extreme value, Statistical analysis, Temporal distribution, Statistical models.

Theoretical considerations, supported by statistical analysis of 39 annual flood series (AFS) of Italian basins, suggest that the two-component extreme value (TCEV) distribution can be assumed as a parent flood distribution, i.e., one closely representative of the real flood experience. This distribution belongs to the family of distributions of the annual maximum of a compound Poisson process, which is a solid theoretical basis for AFS analysis. However, the two-parameter distribution of this family, obtained on the assumption of identically distributed floods, does not account for the high variability of both observed skewness and largest order statistics, so that a significant number of observed floods qualify as outliers under this distribution. The more general TCEV distribution assumes individual floods to arise from a mixture of two exponential components. Its four parameters can be estimated by the maximum likelihood method. A regionalized TCEV distribution, with parameters representative of a set of 39 Italian AFS's, was shown to closely reproduce the observed distribution of skewness and that of the largest order statistic. (Author's abstract)
W85-02151

MAXIMUM LIKELIHOOD ESTIMATES FOR THE PARAMETERS OF MIXTURE DISTRIBUTIONS,
Washington Univ., Seattle. Dept. of Civil Engineering.
K. M. Leytham.
Water Resources Research, Vol. 20, No. 7, p 896-902, July, 1984. 1 Fig, 5 Tab, 17 Ref. OWRT projects A-107-WASH and A-115-WASH.

Descriptors: *Estimating, *Water resources development, Floods, Streamflow, Monte Carlo method, Mathematical studies, Model studies, Mixtures.

Maximum likelihood estimates (MLEs) for the parameters of a mixture of two normal ditributions are presented in terms of an expectation-maximization (EM) algorithm. Small sample properties of the parameter estimates are explored using Monte Carlo simulation. The EM algorithm has a number of attractive features. The algorithm is guaranteed to converge to a local if not a global maximum. Every iteration of the algorithm is guaranteed to increase the log likelihood. The iterative estimates always yield valid parameter values, that is, positive variance and mixing proportion betwen zero and one. Potential problems in the use of MLE's include the following. There may be singularities on the likelihood surface. In some situations the iterative algorithm will converge to parameter values associated with a singularity. Like all other currently available estimation procedures, the EM algorithm does not guarantee convergence to a global maximum. A global maximum can only be ensured by an exhaustive search of the mutidimensional likelihood surface. Little is known about the small-sample properties of the MLE's. Since hydrometeorologic records are generaly less than 50 years in length, the small sample properties of estimators are of concern. Although parameters estimated from unclassified data are inaccurate, quantiles derived from the fitted distributions are only slightly less accurate than quantiles estimated from classified data. This suggests that the ability to classify a sample may not be crucial for the wide range of problems in which quantiles are of principal concern. (Baker-IVI)
W85-02156

OBJECTIVE IDENTIFICATION OF POOLS AND RIFFLES,
State Univ. of New York at Buffalo. Dept. of Geography.
M. P. O'Neill, and A. D. Abrahams.
Water Resources Research, Vol. 20, No. 7, p 921-926, July, 1984. 8 Fig, 18 Ref.

Descriptors: *Pools, *Riffles, *Alluvial streams, Bed forms, Bed elevation, Mathematical studies, Channels, Dunes.

Alternating pools (deeps) and rifles (shallows) have come to be recognized as a fundamental morphological characteristic of alluvial stream channels. A new technique for objectively identifying pools and riffles is termed the bed form differencing technique. It has as its data base bed elevations surveyed at a fixed interval along the channel. Elevations are differenced, and the difference or

elevation change values are used to identify pools and riffles. Where the cumulative elevation change since the last bed form exceeds a certain tolerance value, a new bed form is considered to exist, the type of bed form being determined by the direction of the elevation change. The channel reach studied is located on Mansfield Creek, approximately 65 km south of Buffalo, NY. A well-developed pool-riffle sequence is evident along the full length of the reach. The most realistic pool-riffle sequence is obtained where the tolerance value is 0.75 times the standard deviation of the difference values. The bed form differencing technique can be used to identify bed forms other than pools and riffles, such as ripples and dunes, by simply modifying the surveying interval to reflect the scale of the bed forms. The technique is easy to apply insofar as the requisite data can be collected with a level, survey staff, and measuring tape, and the analysis involves only simple arithmetic. The technique produces results that are reproducible, realistic, and spatially consistent. (Moore-IVI)
W85-02159

ADDITIONAL TESTS ON THE EFFECT OF RAINFALL INTENSITY ON STORM FLOW AND PEAK FLOW FROM WILD-LAND BASINS,
Georgia Univ., Athens. School of Forest Resources.
J. D. Hewlett, J. C. Fortson, and G. B. Cunningham.
Water Resources Research, Vol. 20, No. 7, p 985-989, July, 1984. 5 Tab, 13 Ref.

Descriptors: *Rainfall intensity, *Storm runoff, *Flood peak, Drainage basins, Forest watersheds, Statistical studies, Perennial streams.

Hourly rainfall intensity has been found to have no appreciable effect on storm flows, and only a small effect on peak flows. A statistical analysis was carried out for 4094 storm events on 15 forested drainage basins ranging from 13 to 760 ha in area. The basins were in Kentucky (1), West Virginia (1), South Carolina (1), New Hampshire (1), Pennsylvania (1), Georgia (2), North Carolina (5), Arizona (1), Australia (1), and South Africa (1). The basins range from humid to semiarid climates and from flat to steep topography and contain various covers (forest, brush, grass, and swamp). About half of the basins tested showed significant response (0.05 level) to hourly rainfall intensity for both storm flow and peak flow. The marginal coefficient of determination accounted for by maximum hourly rain intensity averaged about 1% for storm flows and about 10% for peak flows. The dependence of storm flows on rain intensity did not increase in larger storms or on more responsive basins, but rather the opposite. Storm flow from wild-land basins supplying at least first-order perennial streams is little affected by hourly rainfall intensity. In the case of peak flows from such basins, intensity is effective in boosting channel-derived peaks, particularly on low-response basins, but is not a prime determiner of peak discharges on high-response basins. (Moore-IVI)
W85-02166

PHYSICALLY BASED FLOOD FREQUENCY DISTRIBUTION,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
M. A. Diaz-Granados, J. B. Valdes, and R. L. Bras.
Water Resources Research, Vol. 20, No. 7, p 995-1002, July, 1984. 9 Fig, 2 Tab, 19 Ref.

Descriptors: *Flood frequency, *Frequency distribution, Probability distribution, Forecasting, Frequency analysis, Mathematical studies.

The geomorphoclimatic instantaneous unit hydrograph theory, the joint probability density function of storm duration and intensity, and Philip's representation of the infiltration process are used to derive a flood frequency distribution that could be used in regions with no streamflow records. The distribution requires storm, soil, and geomorphologic characteristics which in principle may be evaluated from climatic records, field observations, and/or remote sensing. The model was applied to two basins, one representative of an arid climate and the other of a wet climate, with reasonable results. The resulting flood frequency distribution is in analytical form containing only few climatologic and physiographic parameters of the catchment. (Baker-IVI)
W85-02168

2F. Groundwater

CHANGE IN QUALITY OF THERMAL GROUNDWATER FROM A UNIQUE RESOURCE IN LEBANON,
American Univ., Beirut (Lebanon). Dept. of Environmental Health.
A. Acra, R. Milki, and Y. Karahagopian.
International Journal of Environmental Studies, Vol. 19, No. 1, p 63-68, 1982. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Lebanon, *Summaqiyeh, *Thermal water, *Groundwater, *Physicochemical characteristics, Water temperature, Hardness, Corrosivity.

Thermal groundwaters were not known in Lebanon until 1968, when a 550 m deep artesian well was drilled into the Cenomanian limestone aquifer occuring at a depth of 485 m. The well is located close to Summaqiyeh village in the northern part of Akkar plain. The stored groundwater was initially at a temperature of about 43 C. The physicochemical quality of the water was monitored during a six year period from 1970 to 1975. This groundwater had a mean temperature of 41.35 degrees C, a relatively high mineral content, and a marked corrosive property. It is inferred from these characteristics and the occurrence of the aquifer in a volcanic region that the water is of magmatic origin. Changes in the physico-chemical characteristics of the thermal groundwater over time indicate contamination of the aquifer due to infiltration by groundwater in the region through a corroded well casing and do not indicate infiltration by seawater. (Collier-IVI)
W85-01673

CLASSIFICATION AND DESCRIPTION OF DOLOMITIC FABRICS OF ROCKS FROM THE FLORIDAN AQUIFER, U.S.A.,
Florida Univ., Gainesville. Dept. of Geology.
A. F. Randazzo, and L. G. Zachos.
Sedimentary Geology, Vol. 37, No. 3, p 151-162, 1983/1984. 8 Fig, 1 Tab, 9 Ref.

Descriptors: *Floridan Aquifer, *Florida, *Dolomites, Geologic formations, Mineralogy, Lithology.

Biozones of the Lake City Formation, Avon Park Formation and Ocala Limestone are characterized by interbedded, massive, fossiliferous carbonate rocks (wackestones to grainstones) and thinly bedded, peloidal and carbonaceous rocks (mudstones and wackestones). Several horizons have been partly or completely dolomitized. A wide range of early to late stages of dolomitic fabrics are recognized. The fabrics are classified descriptively as equigranular (unimodal) or inequigranular (multimodal). Fabrics composed of crystals < 0.002 mm in diameter (unresolvable) are termed aphanotopic. Equigranular fabrics include sutured mosaic and sieve mosaic fabrics, and a somewhat problematic fabric. Inequigranular fabrics include porphyrotopic, poikilotopic, fogged mosaic and spotted mosaic fabrics. Two processes of dolomitization are suggested: (a) homogeneous dolomitization resulting in a single-stage development of microtextured (groundmass crystals < 0.016 mm in diameter) aphanotopic, peloidal and mosaic fabrics; and (b) heterogeneous dolomitization resulting in multistage development of porphyrotopic and some mosaic fabrics. It is possible to deduce the original depositional fabric and lithofacies from the dolomitic fabric except where extensive neomorphism has occurred. (Author's abstract)
W85-01733

WATER-LEVEL CHANGES IN THE HIGH PLAINS REGIONAL AQUIFER, NORTHWESTERN OKLAHOMA, PREDEVELOPMENT 1980,
Geological Survey, Oklahoma City, OK. W
Resources Div.
J. S. Havens.
USGS Water-Resources Investigations Report 4073, 1983. 1 Map sheet, 1 Fig, 8 Ref.

Descriptors: *Aquifers, *Water table, *Oklaho
*Maps, *High Plains Regional Aquifer Syst

The High Plains aquifer in Oklahoma is part c
regional aquifer system extending from So
Dakota southward to Texas and New Mexico. T
principal aquifer, the Ogallala Formation of Te
ary age, is hydraulically connected with ot
unconsolidated deposits, principally of Quaterna
age. During 1978, the U.S. Geological Surv
began a 5-year study of the High Plains regio
aquifer system to provide hydrologic informati
for evaluation of the aquifer and to develop pred
tive computer models of it. This report consists
a map showing the water-level changes from p
development to 1980 in the High Plains aquifer
Oklahoma, approximately 40 years after irrigati
began in the Oklahoma Panhandle. Water-le
declines of more than 100 feet have occurr
southeast of Guymon, in Texas County. Less
declines have occurred northeast, northwest, a
southwest of Guymon. These declines reflect t
areas of greatest ground-water withdrawal. Sma
er areas of 100-foot declines have occurred
Woodward and Ellis Counties. An area of 50-fo
water-level rise has occurred east of Boise City
Cimarron County. (USGS)
W85-01771

WATER RESOURCES OF THE FORT UNIO COAL REGION, EAST-CENTRAL MONTAN
Geological Survey, Helena, MT. Water Resourc
Div.
S. E. Slagle.
Available from the OFSS, USGS, Box 25425, Fe
Ctr. Denver, CO 80225. USGS Water-Resourc
Investigations Report 83-4151, December 1983.
p, 9 Fig, 4 Tab, 82 Ref.

Descriptors: Groundwater, *Groundwater avai
ability, Surface water, Water quality, *Montan
Williston Basin, Fort Union Formation.

The shallow ground-water system in the Fo
Union coal region overlies the Upper Cretaceou
Bearpaw Shale. It includes the Upper Cretaceou
Fox Hills Sandstone and the overlying Hell Cree
Formation, Paleocene Fort Union Formation, an
Pleistocene and Holocene glacial deposits, terrac
deposits, and alluvium. Two general flow pattern
are present in aquifers above the Hell Creek Fo
mation and a third may occur in the Fox Hills
lower Hell Creek aquifer. Recharge to the shallo
ground-water system from direct infiltration c
snowmelt and rainfall is about 50,000 acre-ft/yr
Discharge from the system is to perennial stream
(about 5,000 acre-ft/yr to the Redwater River)
withdrawal by wells (about 2,000 acre-ft/yr fo
livestock use and 2,500 acre-ft/yr for domesti
use), and 34 to 45 in./yr to evapotranspiration
Primary constituents in water above the Hel
Creek Formation are sodium, bicarbonate, and sul
fate, and dissolved-solids concentrations are abou
1,800 mg/L; water below a depth of about 200 fee
contains more sodium and bicarbonate. Water i
the Fox Hills-lower Hell Creek aquifer has a
average dissolved-solids concentration of 1,18
mg/L. Flows in most streams have large seasona
variations, with the largest flows occurring in th
spring as a result of snowmelt and rainfall. Dis
solved-solids concentrations of streams generally
are largest during low flow and smallest during
high flow. Concentrations ranged from 160 t
6,960 mg/L in small streams and from 400 to 60
mg/L in the Missouri and Yellowstone Rivers
(USGS)
W85-01772

GEOHYDROLOGY OF THE MEADOWBROOK ARTIFICIAL-RECHARGE PROJECT SITE IN EAST MEADOW, NASSAU COUNTY, NEW YORK,

ological Survey, Albany, NY. Water Resources
v.
A. Aronson, J. B. Lindner, and B. G. Katz.
ailable from the OFSS, USGS, Box 25425, Fed.
. Denver, CO 80225. USGS Water-Resources
estigations Report, 1983. 44 p, 19 Fig, 8 Tab, 34
f.

scriptors: *Groundwater recharge, *Induced in-
ration, *Groundwater movement, *Reclaimed
ter, Water quality, Recharge basins, Injection
lls, Computer models, *Long Island, Recharge
ilities, Index materials, *New York.

Nassau and Suffolk Counties, where the quality
l quantity of potable ground water has declined
he result of urbanization, the use of reclaimed
stewater to replenish the ground-water reser-
r is technically feasible. A system of 11 re-
rge basins and 5 shallow injection wells will
urn 4 million gallons per day of reclaimed
stewater to the ground-water reservoir. Results
a two-dimensional flow analysis of pump-test
a were incorporated into a finite-difference re-
nal flow model to predict changes in head from
ficial recharge in and around the recharge site.
naximum water-table rise of 17 feet is predicted
eath the recharge basins under 'worst-case'
ditions; buildups will be somewhat higher near
injection wells. The predicted maximum in-
ase in streamflow at East Meadow Brook is 3.5
ic feet per second. The projected chemical
lity of the treated effluent to be used for aquifer
harge will be superior to that of water already
sent in the upper part of the ground-water
ervoir at the recharge site. Therefore, the re-
rge effort should improve both the quantity and
lity aspects of the ground-water in the vicinity
he recharge site. (USGS)
5-01774

**NERALIZED ALTITUDE AND CONFIGU-
TION OF THE WATER TABLE IN PARTS
LARIMER, LOGAN, SEDGWICK, AND
LD COUNTIES, COLORADO,**
ological Survey, Lakewood, CO. Water Re-
rces Div.
G. Borman, and N. G. Gaggiani.
GS Water-Resources Investigations Report 82-
5, 1983. 1 Map sheet, 2 Fig, 8 Ref.

scriptors: *Groundwater, *Water table, Uncon-
d aquifers, Geologic formations, *Colorado,
llala Formation, White River Formation.

e water table in parts of Larimer, Logan, Sedg-
k, and Weld Counties, Colorado ranges from
ut 7,000 feet above the National Geodetic Ver-
l Datum of 1929 (formerly called mean sea
el) in eastern Larimer County to about 3,450
in northeastern Sedgwick County. Water is
ving to the south and southeast in much of the
dy area. (USGS)
5-01775

**PLORATORY DRILLING AND AQUIFER
STING AT THE KIPAHULU DISTRICT HA-
AKALA NATIONAL PARK, MAUI, HAWAII,**
ological Survey, Honolulu, HI. Water Re-
rces Div.
R. Souza.
ilable from the OFSS, USGS, Box 25425, Fed.
Denver, CO 80225. USGS Water-Resources
estigations Report 83-4066, 1983. 21 p, 6 Fig, 3
, 3 Ref.

criptors: Drilling, *Aquifer testing, Confined
undwater, Perched groundwater, Groundwater
harge, *Well hydrograph, *Discharge hydro-
ph, *Hawii, Maui.

exploratory well, located at 388 feet above sea
el in Kipahulu Valley on Maui, Hawaii, was
pleted and tested in October 1980. The 410-
well penetrates a series of very dense basaltic
flows of the Hana Formation. At an elevation
0 feet above mean sea level, the well penetrat-
a water-bearing zone of permeable basaltic
c. Water from this zone had a head of about 76
above sea level. In October of 1980, the well
pump tested for 9 hours at various discharge rates up to 350 gallons per minute with a maximum drawdown of about 12 feet. Based on the test data, the well should produce water at a rate of 200 gallons per minute with a drawdown of less than 3 feet. The water level in the well was continuously monitored from October 1980 to mid-November 1981, during which period a maximum decline of 20 feet was recorded. Water level fluctuations in the well can be correlated to the flow in nearby Palikea Stream. The long-term water level in the well should stabilize at about 75 feet above sea level. Water quality was excellent. The total dissolved-solids content was 49 milligrams per liter and the chloride content was 4.2 milligrams per liter. (USGS)
W85-01776

GROUND WATER IN THE TWENTY-NINE PALMS INDIAN RESERVATION AND VICINITY, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
J. R. Freckleton.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, Price: $7.50 in paper copy, $4.00 in microfiche. USGS Water Resources Investigations Report 82-4060, October 1982. 46 p, 2 Fig, 6 Tab, 10 Ref.

Descriptors: *Groundwater, Hydrology, Geology, Drillers logs, Chemical analysis, Yield, Well, Precipitation, *California, Twenty-Nine Palms Indian Reservation, San Bernardino County.

The Twenty-Nine Palms Indian Reservation is in San Bernardino County, California. Movement of ground water in the area is impeded locally by faults which act as ground-water barriers. There are indications that a fault probably crosses the reservation in an east-west direction; such a fault may interfere with ground-water pumping. The water-table altitude near the northern boundary of the reservation is estimated to be 120 to 130 feet below land surface datum; the aquifer thickness in the area is unknown. Pumping-test results for wells near the reservation show specific capacities ranging from 9.2 to 70.0 gallons per minute per foot of drawdown. Wells drilled on the reservation would probably fall within this range. Sodium concentrations, which may pose a hazard to those who must restrict its intake, and excessive fluoride are present in water samples from wells near the reservation. High sodium and fluoride concentrations are probably present in water in the saturated material underlying the reservation. (USGS)
W85-01779

TRUE LOCATION AND ORIENTATION OF FRACTURES LOGGED WITH THE ACOUSTIC TELEVIEWER (INCLUDING PROGRAMS TO CORRECT FRACTURE ORIENTATION),
Geological Survey, Denver, CO. Water Resources Div.
R. A. Kierstein.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water Resources Investigations Report 83-4275, 1984. 73 p, 14 Fig, 7 Tab, 8 Ref.

Descriptors: *Computor programs, Geologic fractures, Well logs, Logging, Televiewer, *Magnetometer, Hole deviation, *Fracture attitude.

The attitude of fractures measured on acoustic-televiewer logs may be misorientated by as much as 180 degrees in a drill hole that is deviated significantly from vertical, because of the effect of the vertical component of the magnetic field on the tilted magnetometer that is used to orient the log. A method has been developed to correct for the misorientation by analyzing the orientation of the magnetometer with respect to the magnetic-field vector acting at the magnetometer's center. Computer programs were written to correct the attitude of fractures for both magnetic effects and hole deviation. For the reorientation of a single fracture, a stereographic solution is illustrated. Test results suggest that the fracture orientation can be corrected to plus or minus five degrees of true orientation, provided there are no other magnetic effects, such as magnetite in the rocks. (USGS)
W85-01780

EFFECTS OF THE DROUGHT OF 1980-81 ON STREAMFLOW AND ON GROUND-WATER LEVELS IN GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01783

GROUND-WATER QUALITY IN THE WESTERN SNAKE RIVER BASIN, SWAN FALLS TO GLENNS FERRY, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
D. J. Parliman.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4062, 1983. 85 p, 19 Fig, 11 Tab, 40 Ref.

Descriptors: *Water quality, Water quality standards, *Groundwater, *Baseline studies, *Aquifers, Chemical analysis, *Hydrogeology, Water wells, Elmore County, *Idaho, Owyhee County, Bruneau River, Mountain Home, Western Snake River basin, Snake River valley.

Water-quality data were collected from 92 wells in the western Snake River basin, Swan Falls to Glenns Ferry, Idaho. Current data were compiled with pre-1980 data from 116 wells to define water-quality conditions in major aquifers. Factors affecting water quality are composition of aquifer materials, water temperature, and source of recharge. Mixing of water by interaquifer flow, from confined, hot water aquifers (40 degrees Celsius or greater) with water from cold water aquifers (less than 20 degrees Celsius) occurs along regional complex fault systems, and through partially cased boreholes. Cold water generally contains calcium, magnesium, and bicarbonate plus carbonate ions; hot water generally contains sodium, potassium, and bicarbonate plus carbonate ions. Warm water (between 20 degrees and 40 degrees Celsius) has an intermediate chemical composition resulting from mixing. Ground-water quality is acceptable for most uses, although it locally contains chemical constituents or physical properties that may restrict its use. Effects of thermal water used for irrigation on quality of shallow ground water are inconclusive. Long-term increase in concentrations of several constituents in parts of the study area may be due to effects of land- and water-use activities, such as infiltration of septic-tank effluent. (USGS)
W85-01784

REGIONAL GEOHYDROLOGY OF THE NORTHERN LOUISIANA SALT-DOME BASIN, PART III, POTENTIOMETRIC LEVELS OF THE WILCOX-CARRIZO AND SPARTA AQUIFERS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
G. N. Ryals.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS WRI Report 83-4131, 1983. 10 p, 5 Fig, 1 Tab, 10 Ref.

Descriptors: *Maps, *Potentiometric level, Aquifers, Contours, Water-level fluctuations, Well hydrographs, *Louisiana, Wilcox-Carrizo aquifer, Sparta aquifer.

The potentiometric surface of the Wilcox-Carrizo aquifer in northwestern Louisiana is shown by contours using data collected from 1960-80. The aquifer is not affected by regional water-level declines, as no large pumping centers have been developed. Seasonal water-level fluctuations shown by the hydrographs of seven wells are generally less than 10 feet annually. The spring 1980 potentiometric surface of the Sparta aquifer in northern Louisiana and southern Arkansas is shown by contours. Water-level measurements in Arkansas were made March 18-21, 1980, and in

Louisiana, May 19-21, 1980. Intensive pumping of the aquifers throughout northern Louisiana and southern Arkansas has caused a regional lowering of water levels. This regional water-level decline is shown by the hydrographs of six wells. (USGS)
W85-01785

COMPUTER PROGRAM AND DATA LISTING FOR TWO-DIMENSIONAL GROUND-WATER MODEL FOR LARAMIE COUNTY, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01787

MACHINE-READABLE DATA FILES FROM THE MADISON LIMESTONE AND NORTHERN GREAT PLAINS REGIONAL AQUIFER SYSTEM ANALYSIS PROJECTS, MONTANA, NEBRASKA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01790

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE BLOOMFIELD COAL TRACT, DAWSON COUNTY, EASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
M. R. Cannon.
Available from OFSS, USGS, Box 25425, Fed, Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4229, December 1983. 33 p, 6 Fig, 3 Tab, 29 Ref.

Descriptors: *Coal mines, Hydrology, Fort Union coal region, *Montana, *Mining impacts.

The Bloomfield coal tract in Dawson County, Montana, contains about 420 million tons of recoverable coal reserves within the Pust coal bed. About 136 million tons of coal within the tract is Federally owned, of which 98 million tons has been identified for potential lease sale. A hydrologic study has been conducted in the potential lease area to describe existing hydrologic systems and to assess potential impacts of surface coal mining on local water resources. Shallow ground-water resources in the tract are limited to sandstone and coal aquifers in the Tongue River Member of the Fort Union Formation (Paleocene age). These shallow aquifers have small values of hydraulic conductivity; yields to wells generally range from 1 to 10 gallons per minute. Water from shallow sandstone and coal aquifers is used primarily for livestock watering and domestic supply. Chemical analyses indicate that water from most shallow aquifers is dominated by calcium and magnesium cations and sulfate and bicarbonate anions. Surface-water resources in the tract consist primarily of small reservoirs used for livestock watering. All streams in the tract are ephemeral, making them unreliable as a source of livestock water. Mining of the Pust coal bed would cause certain impacts on local water resources. About 15 stock and domestic wells and 13 small stock reservoirs would be destroyed by mining. Shallow coal and sandstone aquifers would be permanently removed from parts of the tract. Leaching of soluble salts from mine spoils may cause a long-term degradation of the quality of water in shallow aquifers in or near the coal tract. Impacts on the local water resources could be mitigated by development of alternative ground-water supplies from deeper aquifers in the Fort Union and in the Upper Cretaceous Hell Creek and Fox Hills Formations. Reservoirs destroyed by mining could be reconstructed during mine reclamation. (USGS)
W85-01791

MAJOR INSTITUTIONAL ARRANGEMENTS AFFECTING GROUND WATER IN NEW YORK STATE,
Cornell Univ., Ithaca, NY. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 6E.
W85-01802

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN CHAMBERS, LIBERTY, AND MONTGOMERY COUNTIES, TEXAS, 1975-79,
Geological Survey, Austin, TX. Water Resources Div.
K. W. Ratzlaff, W. B. Lind, and C. E. Ranzau.
Texas Department of Water Resources Report 280, Austin, September 1983. 37 p, 3 Fig, 11 Tab, 5 Ref.

Descriptors: *Groundwater, Drillers' logs, *Water levels, *Chemical analyses, *Texas, Chambers County, Liberty County, Montgomery County.

Information on major new water wells in Chambers, Liberty, and Montgomery Counties was compiled by the U.S. Geological Survey from 1975 to 1979. This report presents the results of the hydrologic data collection on new large-capacity and other selected wells, including well location and completion data, drillers' logs of the strata penetrated, water levels, and chemical quality of the produced water. These water-well data are supplementary to similar data on older wells in these countries and descriptive evaluations of the ground-water resources which have been published previously. (USGS)
W85-01818

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN BRAZORIA, FORT BEND, AND WALLER COUNTIES, TEXAS, 1975-79,
Geological Survey, Austin, TX. Water Resources Div.
K. W. Ratzlaff, C. E. Ranzau, and W. B. Lind.
Texas Department of Water Resources, Austin, Report 277, July 1983. 55 p, 3 Fig, 12 Tab, 5 Ref.

Descriptors: *Ground water, Drillers' logs, Water levels, *Chemical analyses, *Texas, Brazoria County, Fort Bend County, Waller County.

Information on major new water wells in Brazoria, Fort Bend, and Waller Counties was compiled by the U.S. Geological Survey from 1975 to 1979. This report presents the results of the hydrologic data collection on new large-capacity and other selected wells, including well location and completion data, drillers' logs of the strata penetrated, water levels, and chemical quality of the produced water. These water-well data are supplementary to similar data on older wells in these counties and descriptive evaluations of the ground-water resources which have been published previously. (USGS)
W85-01819

GUIDE TO NORTH DAKOTA'S GROUND-WATER RESOURCES,
Geological Survey, Bismarck, ND. Water Resources Div.
Q. F. Paulson.
Available from the Distr. Br., USGS, 604 S. Pickett St., Alex., VA 22304. USGS Water-Supply Paper 2236, 1983. 25 p, 30 Fig, 6 Tab, 18 Ref.

Descriptors: *Groundwater availability, *Groundwater quality, *Groundwater contamination, *Groundwater management, Groundwater hydrology, Surface-groundwater relations, Water use, Water law, *North Dakota.

More than 60 percent of North Dakota's population uses ground water for one purpose or another. The State has a good potential for further groundwater development based on information collected in county ground-water studies during the past 25 years. However, the development will involve difficult problems because of salinity, uneven distribution of aquifers, and insufficient aquifer recharge (replenishment). The solution to these and other complex geohydrologic problems will require sound management practices using modern technology including computer modeling of aquifers. The most productive aquifers consist of l shaped bodies of sand and gravel that were d ited from melting glaciers some tens of thou of years ago. Yields from these aquifers, occur mostly north and east of the Missouri R are commonly between 50 and 500 gall minute, and, in places, exceed 500 gallons a m Ground water also is obtainable from sand lignite, and limestone aquifers in the bedrock ground water generally is bacterially safe an not been affected by toxic wastes. Howeve some parts of North Dakota the ground water mineralized or saline that is only of limited (USGS)
W85-01824

INSTRUMENTATION USED FOR HYDI LIC TESTING OF POTENTIAL WATER-BI ING FORMATIONS AT THE WASTE ISO TION PILOT PLANT SITE IN SOUTHE ERN, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water sources Div.
For primary bibliographic entry see Field 7B.
W85-01827

FLUORIDE, NITRATE, AND DISSOLV SOLIDS CONCENTRATIONS IN GROU WATERS OF WASHINGTON,
Geological Survey, Tacoma, WA. Water sources Div.
W. E. Lum, II, and G. L. Turney.
Available from the OFSS, USGS, Box 25425, Ctr. Denver, CO 80225. USGS Open-File Re 82-508, 1981. 4 Map Sheets, 4 Fig, 8 Ref.

Descriptors: *Groundwater, *Nitrate, *Disso solids, *Fluoride, Geochemistry, Chemical qua Water quality, *Maps, *Washington, Groundw region designations, Groundwater contamina

This study provides basic data on ground-w quality throughout the State. It is intended for in planning and management by agencies and i viduals who have responsibility for or interes public health and welfare. It also provides a b for directing future studies of ground-water qu toward areas where ground-water quality p lems may already exist. The information prese is a compilation of existing data from numer sources including: the Washington Department Ecology and Social and Health Services, the E ronmental Protection Agency, as well as m other local, county, state and federal agencies private corporations. Only data on fluoride, trate, and dissolved-solids concentrations ground water are presented, as these constitu are among those commonly used to determine suitability of water for drinking or other purpo They also reflect both natural and man-impo effects on water quality and are the most rea available water-quality data for the State of W ington. The percentage of wells with fluoride, trate, or dissolved-solids concentrations exceed U.S. Environmental Protection Agency Prim and Secondary Drinking Water Regulations w about 1, about 3, and about 3, respectively. M high concentrations occurred in widely separa wells. Two exceptions were: high concentrati of nitrate and dissolved solids in wells on Hanford Department of Energy Facility and h concentrations of nitrate in the lower Yaki River basin. (USGS)
W85-01828

DEVELOPING THE RESOURCE POTENTI OF A SHALLOW WATER TABLE,
California Univ., Davis. Dept. of Land, Air a Water Resources.
For primary bibliographic entry see Field 3B.
W85-01832

WATER RESOURCES DATA, KENTUCK WATER YEAR 1982,
Geological Survey, Louisville, KY. Water R sources Div.
For primary bibliographic entry see Field 2E.
W85-01923

EE-DIMENSIONAL DIGITAL-COMPUT-MODEL OF THE PRINCIPAL GROUND-ER RESERVOIR OF THE SEVIER ERT, UTAH,
ogical Survey, Salt Lake City, UT. Water urces Div.
primary bibliographic entry see Field 7C.
-01925

ER-LEVEL MAPS OF THE ALLUVIAL IFER, NORTHWESTERN MISSISSIPPI, IL, 1982,
ogical Survey, Jackson, MS. Water Resources

primary bibliographic entry see Field 7C.
-01926

UAL WATER-RESOURCES REVIEW, TE SANDS MISSILE RANGE, NEW ICO, 1982,
ogical Survey, Albuquerque, NM. Water Re-es Div.
primary bibliographic entry see Field 2E.
-01927

A FOR GROUND-WATER TEST HOLE R NICOLAUS, CENTRAL VALLEY AQUI-PROJECT, CALIFORNIA,
ogical Survey, Menlo Park, CA. Water Re-es Div.
primary bibliographic entry see Field 7C.
-01929

ROLOGIC MAPS OF THE HIGH PLAINS IFER, JANUARY 1981, SOUTHWESTERN SAS,
ogical Survey, Lawrence, KS. Water Re-es Div.
primary bibliographic entry see Field 7C.
-01930

ER RESOURCES DATA, IOWA, WATER R 1982,
ogical Survey, Iowa City, IA. Water Re-es Div.
primary bibliographic entry see Field 2E.
-01931

ER RESOURCES DATA, KANSAS WATER R 1982,
ogical Survey, Lawrence, KS. Water Re-es Div.
primary bibliographic entry see Field 2E.
-01932

ER RESOURCES DATA, NEW HAMP-RE AND VERMONT, WATER YEAR 1982,
ogical Survey, Boston, MA. Water Resources

primary bibliographic entry see Field 2E.
-01933

ER RESOURCES DATA, ARKANSAS, ER YEAR 1982,
ogical Survey, Little Rock, AR. Water Re-es Div.
primary bibliographic entry see Field 2E.
-01934

ER RESOURCES DATA, MASSACHU-TS AND RHODE ISLAND, WATER YEAR
ogical Survey, Boston, MA. Water Resources

primary bibliographic entry see Field 2E.
-01935

ER RESOURCES DATA, NORTH OTA, WATER YEAR 1982,
ogical Survey, Bismarck, ND. Water Re-es Div.
primary bibliographic entry see Field 2E.
-01936

WATER RESOURCES DATA, SOUTH CAROLINA, WATER YEAR 1982,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01937

WATER RESOURCES DATA, GEORGIA, WATER YEAR 1982,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01938

WATER RESOURCES DATA, ALABAMA, WATER YEAR 1982,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01939

TRENDS AND FLUCTUATIONS IN THE POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, WEST-CENTRAL FLORIDA, 1961-80,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01940

DATA FOR GROUND-WATER TEST HOLE NEAR BUTTE CITY, CENTRAL VALLEY AQUIFER PROJECT, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01941

WATER-LEVEL MAPS OF THE ALLUVIAL AQUIFER IN NORTHWESTERN MISSISSIPPI, APRIL 1983,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01944

SHALLOW GROUND-WATER FLOW AND DRAINAGE CHARACTERISTICS OF THE BROWN DITCH BASIN NEAR THE EAST UNIT, INDIANA DUNES NATIONAL LAKESHORE, INDIANA, 1982,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 4A.
W85-01948

MAJOR AQUIFERS IN MINER COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
S. D. McGarvie.
South Dakota, Dept. of Water and National Resources, (Vermillion), Information Pamphlet No. 20, 1983. 10 p, 3 Fig, 1 Tab.

Descriptors: *Aquifers, Hydrogeology, *Groundwater, Water quality, *South Dakota, Miner County.

Outwash sand and gravel occurs throughout Miner County, S.D., at depths ranging from 0 to 500 feet below land surface. In places, the deposits are hydrologically connected and form major glacial aquifers. The Floyd aquifer underlies about 180 square miles of Miner County at depths ranging from 25 to 150 feet below land surface. Thickness ranges from 10 to 100 feet and wells may yield as much as 1,200 gallons per minute. Other outwash aquifers under lie an additional 195 square miles of Miner County. The Niobrara Formation is the uppermost bedrock aquifer in the county and underlies all but its southwest corner. The Niobrara is found at depths ranging from 60 to 600 feet below land surface. Thickness of the formation ranges from 10 to 120 feet. The Codell Sandstone Member of the Carlile Shale underlies the Niobrara Formation throughout the county at depths ranging from 120 to 720 feet below land surface. Thickness of the Codell ranges from 10 to 100 feet. The Dakota Sandstone underlies most of the northwest half of Miner County. Depth to the Dakota ranges from 350 to 1,000 feet below land surface and thickness ranges from 10 to 400 feet. The Dakota Sandstone is underlain by the Sioux Quartzite which contains relatively large amounts of water in joints and fractures. Each of the aquifers in Miner County provides adequate supplies of water for domestic and stock use. The Floyd aquifer offers the greatest potential for irrigation or other large-yield development. (USGS)
W85-01950

FEASIBILITY STUDY OF DEVELOPING VALLEY-FILL AQUIFERS FOR VILLAGE WATER SUPPLIES IN SOUTHERN GUAM,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
J. F. Ayers, and R. N. Clayshulte.
Technical Report No. 41, September, 1983. 96 p, 6 Fig, 8 Tab, 10 Ref. Project No. OWRT A-027-GUAM(1), Contract/Grant No. 13-34-0001-2112.

Descriptors: *Alluvial aquifers, *Water supply development, *Groundwater potential, *Rural areas, Alluvium, Marine sediments, Aquifers, Irrigation wells, Groundwater irrigation, Geophysics, Seismology, Resistivity, *Guam.

Villages located in southern Guam occasionally experience domestic water supply shortages that affect both the home dweller and the farmer. Municipal water supplies are provided by the islandwide distribution system. Water is obtained from well fields which tap the complex Ghyben-Herzberg lens beneath the northern limestone plateau and is transported south at considerable cost. If alternative sources of freshwater can be located near the centers of high demand, the energy costs of pumping water long distances would be lowered, the reliability of the distribution system would be improved, the quantity of water extracted from the northern lens would be reduced, and lastly the village communities would become more self-sufficient in terms of water supply. Potential sources of groundwater sources of groundwater for domestic use have been identified near the outflow of the Inarajan River. Two water-bearing units of alluvium and shallow-water marine sediments overlie a partially weathered volcanic basement. From the results of the study it appears feasible to develop the groundwater resource, at least initially, on a limited scale. The quality of the product water is such that it could be used directly for agriculture purposes.
W85-02026

DIAGENESIS AND PORE-SPACE EVOLUTION WITHIN RECENT AND PLEISTOCENE CARBONATE UNITS OF OROTE PENINSULA, GUAM,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
R. N. Clayshulte, and J. F. Ayers.
Technical Report No. 47, December, 1983. 119 p, 7 Fig, 11 Tab, 35 Ref, 2 Append. Project No. OWRT A-025-GUAM(1), Contract/Grant No. 14-34-0001-2112.

Descriptors: *Carbonates, *Diagenesis, Porosity, Limestone, Reefs, Carbonate rocks, Lithification, Sedimentation, Groundwater, Vadose water, Marine geology, Aquifers, Porous media, *Guam, Orote Peninsula.

The Mariana limestone on Orote Peninsula has undergone diagenetic modification under marine phreatic, freshwater and freshwater vadose conditions. Marine diagenetic modification from internal sediment fill, submarine cementation and borings have produced partial to complete occlusion of primary interparticle porosity. Marine sediments are lithified by cements similar to those found in the modern reef complex. Within the freshwater phreatic environment, nearly all interparticle porosity is occluded with some secondary porosity generation. There has also been preferential disso-

lution of, primarily, aragonitic clasts, which creates distinctive moldic porosity. There is only minor diagenetic alternation within the freshwater vadose environment.
W85-02027

HYDROGEOLOGIC INVESTIGATION OF AGANA SWAMP NORTHERN GUAM,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
J. F. Ayers, and R. N. Clayshulte.
Technical Report No. 40, September, 1983. 30 p, 6 Fig, 1 Tab, 10 Ref. Project No. OWRT A-026-GUAM(1), Contract/Grant No. 14-34-0001-2112.

Descriptors: *Geohydrology, *Swamps, *Carbonates, *Groundwater movement, Groundwater, Groundwater basins, Aquifers, Groundwater potential, Geophysics, Seismology, Limestone, Carbonate rocks, *Guam, Agana Swamp.

An attempt was made to investigate the hydraulic relationship between Agana Swamp, located near the village of Agana, and the freshwater lens beneath the limestone plateau of northern Guam. A number of problems developed during the course of the study which prompted a change in the project objectives. The main problems were access to the study area and artificial features which prevented the full application of geophysical surveys and the installation of an observation-well network. The study, however, points out a number of aspects such as the general geology and physiography of the swamp area, its drainage characteristics, and the occurrence of groundwater. In addition, the results of the investigation have been useful in constructing a set of guidelines for further study.
W85-02029

ALTITUDE OF THE TOP OF THE MATAWAN GROUP-MAGOTHY FORMATION, SUFFOLK COUNTRY, LONG ISLAND, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7B.
W85-02030

GEOHYDROLOGIC DATA FOR TEST WELL USW G-4, YUCCA MOUNTAIN AREA, NYE COUNTY, NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-02031

DATA FOR GROUND-WATER STUDIES OF THE SAN JUAN BASIN, NEW MEXICO (1982-83),
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-02034

APPRAISAL OF WATER FROM SURFICIAL-OUTWASH AQUIFERS IN TODD COUNTY AND PARTS OF CASS AND MORRISON COUNTIES, CENTRAL MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 4B.
W85-02038

AQUIFER TESTS IN THE STRATIFIED DRIFT, CHIPUXET RIVER BASIN, RHODE ISLAND,
Geological Survey, Providence, RI.
D. C. Dickerman.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4321, 1984. 39 p, 16 Fig, 7 Tab, 24 Ref.

Descriptors: *Aquifer, Aquifer test, *Transmissivity, *Hydraulic conductinity, *Storage coefficient, *Specific yield, Chipuxet River groundwater reservoir, *Stratified drift, *Rhode Island.

Analyses of 18 aquifer tests in the Chipuxet River basin in southern Rhode Island indicate that the stratified-drift this aquifer is generally highly transmissive and would yield large quantities of water to properly constructed wells. The aquifer is an irregularly shaped body of coarse sand and gravel deposited by glacial streams during the last Pleistoicene ice advance. This heterogenous, anisotropic water-table aquifer is composed of stratified drift consisting of complexly interbedded lenses of sand and gravel and subordinate amounts of silt and silty sand. The tests were made in the thick, permeable parts of the stratified drift, which forms a major ground-water reservoir in the lower reaches of the Chipuxet River basin. The analytical method most often used, and whose assumptions closely approximate field conditions, was a method by R. W. Stallman intended for vertical movement in an unconfined, anisotropic aquifer. The transmissivity of the stratified-drift aquifer ranged from 5,000 to 39,100 square feet per day. The horizontal hydraulic conductivity ranged from 90 to 595 feet per day, and the vertical hydraulic conductivity ranged from 3 to 52 feet per day. The ratio of vertical to horizontal hydraulic conductivity of the stratified-drift aquifer ranged from 1:5 to 1:80. (USGS)
W85-02039

RECHARGE AND DISCHARGE AREAS OF THE FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-02049

ALTITUDE AND GENERALIZED CONFIGURATION OF THE TOP OF THE FLORIDAN AQUIFER, ST. JOHNS COUNTY, FLORIDA,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-02050

HYDROGEOLOGY OF WELL-FIELD AREAS NEAR TAMPA, FLORIDA, PHASE 2--DEVELOPMENT AND DOCUMENTATION OF A QUASI-THREE-DIMENSIONAL FINITE-DIFFERENCE MODEL FOR SIMULATION OF STEADY-STATE GROUND-WATER FLOW,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. B. Hutchinson.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. Water-Resources Investigations Report 84-4002, 1984. 174 p, 40 Fig, 9 Tab, 29 Ref.

Descriptors: *Computer models, *Groundwater movement, *Hydrogeology, *Water management (applied), Pumping, *Evapotranspiration, Tampa, Hillsborough County, *Florida.

This report describes a quasi-three-dimensional finite-difference model for simulation of steady-state ground-water flow in the Floridan aquifer over a 932-square-mile area that contains 10 municipal well fields. The over-lying surficial aquifer contains a water table and is coupled to the Floridan aquifer by leakage term that represents flow through a confining layer separating the two aquifers. Under the steady-state condition, all storage terms are set to zero. Use of the head-controlled flux condition allows simulated head and flow changes to occur in the Floridan aquifer at the model boundaries. Procedures used to calibrate the model, test its sensitivity to input-parameter errors, and validate its accuracy for predictive purposes are described. Also included are attachments that describe setting up and running the model. Example model-interrogation runs show anticipated drawdowns under high, average, and low recharge conditions with 10 well fields pumping simultaneously at the maximum annual permitted rates totaling 186.9 million gallons per day. (USGS)
W85-02052

INFLUENCE OF SIMULATED GROUND ER-MOVEMENT ON THE PHOSPHORU LEASE FROM SEDIMENTS, AS MEASU IN A CONTINUOUS FLOW SYSTEM,
Amsterdam Univ (Netherlands). Lab. voor N biologie.
L. van Liere, and L. R. Mur.
Hydrobiologia, Vol. 92, p 511-518, July, 19 Fig, 9 Ref.

Descriptors: *Groundwater movement, *Pho rus, *Sediments, Flow, Interstitial water.

An experimental system based on a conti flow reactor is presented in which undist sediment cores can be investigated with rega the release of phosphorus to the overlying and the characteristics of the interstitial wat this system the effect of simulated vertical gr water movement was also studied. The resu three preliminary experiments are shown: t turbed core, core in which downward migr was stimulated, and core in which upward m tion was stimulated. In all experiments the an of released phosphorus rose very rapidly to values, due probably in part to the effec freeze/thaw on the cores, although no measu shift in the interstitial profile was observed d thawing. The latter two experiments show rapid loss of phosphorus from the system in trast to the first experiment. This process reflected in the phosphorus concentration o interstitial water. Restoration in regions downward migration of sediment water is like be most rapid. In other regions the hydraulic r tion time may become very important. (Baker-
W85-02094

THREE-DIMENSIONAL STREAMLINES DUPUIT-FORCHHEIMER MODELS,
Minnesota Univ., Minneapolis. Dept. of Civil Mineral Engineering.
O. D. L. Strack.
Water Resources Research, Vol. 20, No. 7, p 822, July, 1984. 14 Fig, 16 Ref, 1 Append.

Descriptors: *Streamlines, *Dupuit-Forchhei models, *Groundwater movement, Comp models, Flow resistance, Infiltration, Permeabi Model studies.

The modeling of steady regional aquifer flo generally done by the use of two-dimensional merical or analytical models that are based up Dupuit-Forchheimer approximation. An appr mate method is presented for determining stre lines in three dimensions using two-dimensio Dupuit-Forchheimer models. This approach based upon the interpretation of the Dupuit-For heimer assumption that the resistance to flow the vertical direction is neglected. This assumpt does not preclude the occurrence of flow in vertical direction; vertical components of flow determined in an approximate fashion by requir continuity of flow. Its accuracy appears to dep primarily upon the variation with position of rate of infiltration through the upper and lo boundaries of the aquifer considered. The proach may be used in computer models based either numerical or analytical techniques. It is plicable to aquifers with layers of different perm bilities and will be particularly useful in determ ing flow paths in systems of stacked aquifers. many problems of practical importance, the proximate method of determining streamlines three dimensions may make it unnecessary resort to three-dimensional models. (Moore-I
W85-02148

DOUBLE-POROSITY MODELS FOR A F SURED GROUNDWATER RESERVOIR WI FRACTURE SKIN,
Geological Survey, Menlo Park, CA.
A. F. Moench.
Water Resources Research, Vol. 20, No. 7, p 8 846, July, 1984. 14 Fig, 4 Tab, 45 Ref, 3 Apper

Descriptors: *Porosity, *Groundwater movemen *Geologic fractures, Model studies, Permeabili

icient, Hydraulic head, Flow resistance,
s.

ries of flow to a well in a double-porosity
ndwater reservoir are modified to incorporate
s of a thin layer of low-permeability material
acture skin that may be present at fracture-
interfaces as a result of mineral deposition or
tion. The commonly used theory for flow in
le-porosity formations that is based upon the
ption of pseudo-steady state block-to-fissure
is shown to be a special case of the theory
nted in this paper. The latter is based on the
ption of transient block-to-fissure flow with
ire skin. Under conditions where fracture skin
hydraulic conductivity that is less than that
e matrix rock, it may be assumed to impede
nterchange of fluid between the fissures and
s. Resistance to flow at fracture-block inter-
tends to reduce spatial variation of hydraulic
gradients within the blocks. This provides
etical justification for neglecting the diver-
e of flow in the blocks as required by the
lo-steady state flow model. Coupled boundary
problems for flow to a well discharging at a
ant rate were solved in the Laplace domain.
slab-shaped and sphere-shaped blocks were
dered, as were effects of well bore storage
well bore skin. Results obtained by numerical
sion were used to construct dimensionless-
curves that were applied to well test data, for
nped well and for an observation dimension-
ype curves that were applied to well test data,
pumped well and for an observation well,
the fractured volcanic rock terrane of the
da Test Site. (Author's abstract)
-02150

**X-AVERAGED AND VOLUME-AVER-
D CONCENTRATIONS IN CONTINUUM
ROACHES TO SOLUTE TRANSPORT,**
nia Polytechnic Inst. and State Univ., Blacks-

Parker, and M. Th. Van Genuchten.
r Resources Research, Vol. 20, No. 7, p 866-
July, 1984. 2 Fig, 1 Tab, 23 Ref.

riptors: *Solute transport, *Convection, *Dis-
on, *Flux-averaged concentrations, *Volume-
ged concentrations, Mathematical equations,
dary conditions, Porous media, Interstitial
r.

sformations between volume-averaged pore
concentrations and flux-averaged concentra-
are presented which show that both modes of
entration obey convective-dispersive transport
tions of identical mathematical form for non-
ive solutes. The pertinent boundary condi-
for the two modes, however, do not trans-
identically. Solutions of the convection-dis-
on equation for a semi-infinite system during
y flow subject to a first-type inlet boundary
ition is shown to yield flux concentrations,
e solutions subject to a third-type boundary
ition yield volume-averaged concentrations.
e solutions may be applied with reasonable
nity to finite as well as semi-infinite media if
mixing at the exit is precluded. Implications
ie distinction between resident and flux con-
rations to laboratory and field studies of solute
port are discussed. It is suggested that per-
d limitations of the convection-dispersion
el for media with large variations in pore
r velocities may in certain cases be attributa-
to a failure to distinguish between volume-
aged and flux-averaged concentrations.
-02153

**TION OF TWO COMPRESSIBLE FLUIDS
H INTERFACE IN A POROUS RESER-
R,**
artment of Scientific and Industrial Research,
lington (New Zealand). Applied Mathematics

.. Wooding, and G. J. Weir.
er Resources Research, Vol. 20, No. 7, p 873-
July, 1984. 14 Fig, 2 Tab, 22 Ref.

criptors: *Groundwater movement, *Porous
ia, Groundwater reservoirs, Model studies, Pressure, Gas-water interface, Leaky aquifers, Porosity, Permeability, Mathematical equations.

This paper describes the development of a physical model of a reservoir involving two compressible fluids, typically gas over water. The reservoir is assumed to be of constant thickness, but its height varies with position, leading to an undulating topography. Withdrawal of the upper fluid begins and proceeds at a constant rate. Topics of interest are the distribution of fluxes throughout the reservoir, the pressure field as a function of time and space, and the movement of the interface between the fluids. The problem is formulated using a version of the two-fluid layer concept. One of the space variables is eliminated by vertical integration, assuming that the fluid velocity vector is almost parallel to the upper and lower confining boundaries (Boussinesq reservoir). The resulting equation of motion for the horizontal components of the flow resembles that for a horizontal reservoir, but terms involving the gradient of the undulating reservoir modify the vertical pressure gradient. The problem is solved in two space dimensions and time. The difficulty presented by intersections of the fluid-fluid interface with one or other of the confining boundaries is resolved by introducing a mathematical continuation of the fluids and their interface through and past the boundary. This is particularly appropriate for 'leaky' aquifers; in the case of impermeable boundaries, a concern of the present paper, approximate solutions may be obtained by assuming a virtual porosity and permeability which are extremely small. The method resembles that of Wilson and Sa da Costa (Water Resour. Res., 18, 1069-1080, 1982) Some useful results have been obtained for Boussinesq reservoirs of fairly arbitrary geometry. Approximate numerical solutions are presented for two-dimesional flow in a rectangular reservoir, the outer part of which is completely submerged, and for axisymmetric and three-dimensional flows in a circular quadrant. A constriction upon the gas flow due to a 'dip' in the reservoir is found to produce enhanced horizontal water flow due to the increase in horizontal pressure gradient. Downstream of the dip the interface develops an elevation, while a depression appears upstream. The establishment of stable flow of gas through a 'neck' between two gas reservoirs is demonstrated, and it is proposed that a similar type of flow can be developed as a result of gas fingering through an initially submerged neck. Further applications of the technique could be to reservoirs containing steam over water (geothermal) or to the coastal saltwater intrusion problem, but these are not considered in the present paper. (Author's abstract)
W85-02154

GROUNDWATER RESPONSE UNDER AN ELECTRONUCLEAR PLANT TO A RIVER FLOOD WAVE ANALYZED BY A NONLINEAR FINITE ELEMENT MODEL,
Padua Univ. (Italy). Inst. of Applied Mathematics.
G. Gambolati, F. Toffolo, and F. Uliana.
Water Resources Research, Vol. 20, No. 7, p 903-913, July, 1984. 12 Fig, 1 Tab, 36 Ref.

Descriptors: *Groundwater level, *Flood waves, *Mathematical models, *Trino Vercellese, *Italy Nuclear powerplants, Water table, Finite element models, Permeability coefficient, Specific yield.

In the foundation design of electronuclear plants, conservative stability criteria with respect to earthquakes are usually assumed, where the maximum water table level beneath the nuclear reactor in response to possible flood waves occurring in the nearby river is taken to coincide with the ground surface elevation. This approach may dictate heavier structural constraints; hence additional costs that could be minimized if a realistic prediction of the aquifer behavior and of the actual largest pressure head below the plant is provided by appropriate mathematical tools. A nonlinear finite element model based on the Dupuit-Boussinesq equation of flow in an unconfined aquifer has been developed and applied to simulate the water table fluctuation under the electronuclear plant of the test site of Trino Vercellese (nothwestern Italy) in response to the flood event that occurred in the Po River from March 30 to April 4, 1981. The nonlinearity has been overcome by the aid of an efficient iterative linearization technique wherein the model equations are solved by symbolic factorization, numerical factorization, and backward-forward subsitution after an optimal preliminary recording. The model was run for uniform values of aquifer permeability and specific yield within the typ range evidenced for the Trino sands by the early data in our possession. The results show that the maximum water level elevation below the reactor is almost 3 m lower than the corresponding river flood peak even in the most unfavorable conditions, i.e., with the hydraulic conductivity in the upper range, and is rather insensitive to the specific yield values within the plausible interval. The model allowed for an easy evaluation of the effectiveness of the impermeable protection walls and of a possible secondary aquifer recharger from a minor channel. The modeling approach for the analysis of the water behavior appears to be a very promising tool to help in the structural design of future electronuclear plants. (Author's abstract)
W85-02157

PRESSURE TRANSIENT ANALYSIS FOR TWO-PHASE GEOTHERMAL WELLS: SOME NUMERICAL RESULTS,
S-Cubed, La Jolla, CA.
S. K. Garg, and J. W. Pritchett.
Water Resources Research, Vol. 20, No. 7, p 963-970, July, 1984. 26 Fig, 6 Tab, 12 Ref.

Descriptors: *Geothermal wells, *Pressure transient analysis, Geothermal reservoirs, Simulation, Mathematical models, Two-phase reservoirs, Flashing, Permeability, Kinematic mobility.

A numerical geothermal reservoir simulator is used in a series of calculations to help devise interpretation techniques for analyzing pressure transient data from two phase geothermal reservoirs. The investigations include (1) the drawdown/buildup behavior of initially two-phase (liquid water/stream) reservoirs, (2) the drawdown/buildup response of initially single-phase reservoirs which undergo flashing as a result of fluid production, and (3) the effects of cold water injection into hot two-phase reservoirs. Production (drawdown/buildup) data from two-phase (either initially or due to production-induced boiling) reservoirs may be analyzed in the usual manner to yield kinematic mobility; buildup data from reservoirs which undergo flashing on production also offer the possibility of determining absolute formation permeability. Injection data can be interpreted in a straightforward manner to yield absolute formation permeability; the corresponding falloff data appear, however, to be of little value. (Author's abstract)
W85-02163

PARAMETER IDENTIFICATION OF GROUNDWATER AQUIFER MODELS: A GENERALIZED LEAST SQUARES APPROACH,
California Univ., Los Angeles. School of Engineering and Applied Science.
J. Sadeghipour, and W. W.-G. Yeh.
Water Resources Research, Vol. 20, No. 7, p 971-979, July, 1984. 8 Fig, 4 Tab, 18 Ref. NSF grant CEE 81-13500.

Descriptors: *Transmissivity, *Least squares method, *Aquifers, Mathematical models, Groundwater, Hydraulic head, Parameter identification.

This paper concerns the methods of estimating aquifer transmissivities on the basis of unsteady state hydraulic head data. Traditionally, the criterion of minimizing the sum of the squares of errors has been used to match the observed data with the model response. The data used for optimization usually contain noise that is not necessarily uncorrelated. It is well understood that the results of identification methods are very sensitive to measurement errors in data. In this study, the ordinary least squares (OLS) technique is carried out along with a generalized least squares (GLS) technique specifically designed to reduce the effect of correlated errors. The trace of the covariance matrix is used as a measure of overall accuracy and reliability of the estimated parameters. The effectiveness

of the OSL and GLS techniques in dealing with noisy data is demonstrated by using a hypothetical example. The results of numerical experiments suggest that GLS offers a promising approach in efficiently improving the reliability of the estimated parameters. (Author's abstract)
W85-02164

DARCY'S FLOW WITH VARIABLE PERMEABILITY: A BOUNDARY INTEGRAL SOLUTION,
Columbia Univ., New York. Dept. of Civil Engineering.
A. H.-D. Cheng.
Water Resources Research, Vol. 20, No. 7, p 980-984, July, 1984. 8 Fig, 1 Tab, 11 Ref. NSF grant CEE-8307069.

Descriptors: *Permeability, *Mathematical equations, *Darcy's law, *Groundwater movement, Boundaries.

A boundary integral equation method (BIEM) for Darcy's flow with spatially varied permeability is developed. The numerical solution is efficient if a closed-form Green's function is available. The Green's functions are derived for a few permeability functions in one and two dimensions. The permeabilities can be used for simple fit of field permeability data. (Baker-IVI)
W85-02165

TRAVEL TIMES FROM BURIED AND SURFACE INFILTRATION POINT SOURCES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
For primary bibliographic entry see Field 2G.
W85-02167

APPLICATION OF THE GEOSTATISTICAL APPROACH TO THE INVERSE PROBLEM IN TWO-DIMENSIONAL GROUNDWATER MODELING,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
R. J. Hoeksema, and P. K. Kitanidis.
Water Resources Research, Vol. 20, No. 7, p 1003-1020, July, 1984. 21 Fig, 4 Tab, 20 Ref, 2 Append. Iowa Water Resources Research Institute project CT 381702, NSF grant CME-8106577.

Descriptors: *Transmissivity, *Groundwater, *Geostatistical approach, *Jordan aquifer, *Iowa, Mathematical models, Hydraulic head, Covariance.

A methodology is presented for the estimation of transmissivity from head and transmissivity measurements in the two-dimensional steady flow case following the geostatistical approach to inverse modeling. The field of the logarithm of transmissivity (log-transmissivity) is represented as a zero-order intrinsic random field; its spatial structure is described in this application through a two-term covariance function that is linear in the parameter 01 and 02. Linearization of the discretized flow equations allows the construction of the joint covariance matrix of the head and log transmissivity measurements as a linear function of 01 and 02. The coefficient matrices are calculated numerically in a noniterative fashion. Maximum likelihood estimation is employed to estimate 01 and 02 as well as additional parameters from measurements. Linear estimation theory (cokriging) then yields point or block-averaged estimates of transmissivity. The application of the methodology gives good estimates of transmissivities. When the transmissivities are used in a numerical model they reproduce the head measurements quite well. The developed methodology was applied for the estimation of transmissivities of the Jordon aquifer in Iowa. This case study illustrated that the geostatistical approach can be a useful tool in the iterative process of model development. Model validation serves to diagnose possible conflicts between modeling assumptions and available data and to suggest ways in which these conflicts can be resolved. In the case of the Jordan aquifer, accounting for leakage into the aquifer and removal of two outliers appeared to improve the consistency among modeling assumptions and measurements. (Moore-IVI)
W85-02169

CONTAMINANT TRANSPORT IN FRACTURED POROUS MEDIA: ANALYTICAL SOLUTION FOR A TWO-MEMBER DECAY CHAIN IN A SINGLE FRACTURE,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 5B.
W85-02170

2G. Water In Soils

USE OF FIXED-BED ADSORBER MODELS TO PREDICT THE FLUXES OF TOXIC SUBSTANCES IN GROUNDWATERS AND SOIL ENVIRONMENTS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W85-01793

NEW MATERIALS IN PIPE NETWORKS - SPECIAL CONSIDERATION OF INTERNAL COATINGS,
Zurich Water Supply (Switzerland).
A. Naf.
Aqua, No. 5, p 221-224, 1983. 14 Fig, 1 Tab.

Descriptors: *Corrosion, *Pipelines, *Linings, Pipes, Water conveyance, Water distribution, Cement, Mortar, Linings.

Reliable corrosion protection of metallic pipelines is an important factor in determining the quality of ground installed facilities. Besides the choice of material and insulation, attention must be given to the installation which must be performed in a clean and expert manner. The lining of water pipelines with bitumen is rarely used today. Theoretical perceptions show that the carcinogenic compounds contained in the tar are transferred to the water. Cement mortar lining is not completely impermeable. Water penetrates through the mortar to the pipe wall. The formation of ferric hydroxide, however, results in an essentially increased bondage. As an alternative solution to the cement mortar lining a Swiss Pipeline product using a synthetic material lining has been developed. Results of tests of pipe strength and resistance to corrosion are discussed along with the manufacture of fittings and accessories and tension-proof connections. (Baker-IVI)
W85-01997

MICROWAVE MEASUREMENTS OF MOISTURE DISTRIBUTIONS IN THE UPPER SOIL PROFILE,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
A. M. Sadeghi, G. D. Hancock, W. P. Waite, H. D. Scott, and J. A. Rand.
Water Resources Research, Vol. 20. No. 7, p 927-934, July, 1984. 10 Fig, 3 Tab, 23 Ref. NASA grant NAG-5-20.

Descriptors: *Soil water, *Microwaves, *Remote sensing, Reflectivity, Tillage, Evaporation, Drying, Soil properties.

Laboratory and field experiments were conducted to investigate the ability of microwave remote sensing systems to detect the moisture status of a silt loam soil exhibiting abrupt changes in moisture content near the surface. Laboratory soil profiles were prepared with a discontinuous moisture boundary in the subsurface. Reflectivity measurements of these profiles were made with a bistatic reflectometer operating over the frequency ranges of 1-2 and 4-8 GHz (wavelength ranges of 30-15 and 7.5-3.75 cm, respectively). These measurements exhibited a well-developed coherent interference pattern in good agreement with a simple two-layer reflectivity model. Field measurements of bare soil surfaces were conducted for initially saturated profiles and continued for extended periods of drying. During drying, coherent interference patterns similar to those observed in the laboratory were detected. These appear to be d
steep moisture gradients occurring between d
layers near the surface. The field results
modeled by a five-segment linear moisture p
with one or two steep segments and a multi
reflectivity program. Agreement between n
and field response over the frequency range
used to estimate the depth of drying layers w
the soil. These depths were monitored ove
second and third drying cycles. Formation o
drying layers under field conditions appears
influenced by drying time, tillage, and evapor
demand. In any case, it appears that the coh
effects caused by nonuniform moisture pr
may substantially affect the reflectivity of
rough soil surfaces. (Author's abstract)
W85-02160

**TRAVEL TIMES FROM BURIED AND S
FACE INFILTRATION POINT SOURCES,**
Commonwealth Scientific and Industrial Rese
Organization, Canberra (Australia). Div. of E
ronmental Mechanics.
J. R. Philip.
Water Resources Research, Vol. 20, No. 7, p
994, July, 1984. 3 Fig, 13 Ref.

Descriptors: *Solute transport, *Mathema
equations, *Infiltration, Water pollution sou
Leaching, Soil water, Convection, Diffusion.

A primary element in the analysis of solute t
port and leaching during steady saturated and
saturated two- and three-dimensional soil w
flows is the time of travel of marked water p
cles from their source to all downstream poin
the flow field. Exact travel time solutions for f
of physical interest are clearly of significance.
exact solutions are presented for travel times
three-dimensional steady infiltration into a ho
geneous soil from buried and surface point sou
While the study was developed specifically
terms of the quasi-linear analysis of water m
ment in unsaturated soils, it will be understood
the mathematical results apply to any steady
vection-diffusion process described by an equa
of a specified form, together with appropr
boundary conditions. In this sense, the exact s
tions for travel times are presented from cont
ous point sources for all linear convection-diffu
processes in the appropriate infinite and semi-
nite regions. The results are presented graphica
In the soil water context a limitation is that tr
velocities are based on a mean volumetric mois
content. (Baker-IVI)
W85-02167

2H. Lakes

**WATER TEMPERATURE AND TURBIDITY
GLACIALLY FED LAKE TEKAPO,**
Department of Scientific and Industrial Resea
Wellington (New Zealand). Oceanographic I
J. Irwin, and R. A. Pickrill.
New Zealand Journal of Marine and Freshw
Research, Vol. 16, No. 2, p 189-200, 1982. 5 Fig
Ref.

Descriptors: *Lake Tekapo, *New Zeala
*Water temperature, *Turbidity, *Glacial la
Glacial streams, Godley River, Thermal stratif
tion, Coriolis force, Isotherms.

Inflow into Lake Tekapo (New Zealand) is do
nated by the glacially-fed headwater God
River. Measurements of water temperature
transmissivity at periods of seasonal maxima
minima provide data on dispersion of river w
entering the lake. During spring, lake wa
warming from isothermal winter conditions
ceive turbid cold meltwater which interflows
underflows downslope to the deepest basin to p
against the rising lake floor. Waters stratify wea
in summer, and turbid inflowing water interflo
In winter, near isothermal lake water receives c
clear water underflowing to the deepest basin.
all seasons inflowing water is deflected towa
the eastern side of the lake by Coriolis fo
Diurnal changes in inflow across the Godley d
in spring are complex, with interflow and overfl

nced by heating of waters flowing over wide, d river channels. In winter, underflows are est in early morning when inflows are cold- nd they weaken through the day as river s warm. (Author's abstract)
01637

OMINANT HEADWATER INFLOW AND CONTROL OF LAKE-RIVER INTERAC- S IN LAKE WAKATIPU,
rtment of Scientific and Industrial Research, ngton (New Zealand). Oceanographic Inst.
Pickrill, and J. Irwin.
Zealand Journal of Marine and Freshwater rch, Vol. 16, No. 2, p 201-213, 1982. 5 Fig, 23

iptors: *Lake Wakatipu, *New Zealand, w, Temperature, Suspended solids, Particu- atter, Water temperature, Under flow.

erature and suspended particulate matter ntrations were used to identify lake-river ctions in Lake Wakatipu (New Zealand). Re- rom sampling at seasonal maxima and minima ter temperature and inflow, in conjunction density estimates, suggest that both annual iurnal cycles from inflow from the predomi- eadwaters are generated. From mid autumn l spring, underflows predominate; in summer, water may warm sufficiently to allow inflow- ater to interflow or overflow. In summer the diurnal temperature range in the rivers sets diurnal cycle of inflows, with underflow in rly morning, progressing through to inter- and finally overflows again at night. In , when river temperatures remain low ghout the day, inflowing water underflows uously. Floods normally enter as turbid un- ws, disrupting the diurnal summer cycle and thening the underflows of winter. Flood un- ws reach speeds of over 20 cm/s and carry ulate material over 60 km downslope into the st basin. (Author's abstract)
01638

ONAL MEROMIXIS IN THREE HYPER- NE LAKES ON ROTTNEST ISLAND, TERN AUSTRALIA,
rn Australia Univ., Nederlands. Dept. of Zo-

Bunn, and D. H. D. Edward.
alian Journal of Marine and Freshwater Re- , Vol. 35, No. 2, p 261-265, 1984. 2 Fig, 1 3 Ref.

iptors: *Western Australia, *Australia, nest Island, *Meromictic lakes, *Saline lakes, ication, Water temperature, Salinity.

ottnest Island, approximately 19 km west of antle, Western Australia, there are six perma- ypersaline lakes; three of the lakes become nictic 'hot lakes' during winter and spring. are the first such lakes recorded in Australia. ly temperature profiles were taken from 1980 to January 1981 and from April to nber 1982 in Serpentine Lake. Profiles were aken in Government House, Herschell, and d Lakes. An important factor contributing to ansient stratification is a surface input of fresh from seepages around the lakes, which over- ie existing hypersaline layer. Heat penetrates monimolimnion of these clear-water lakes trapped by the insulating effect of the over- less-saline water. The disappearance of the ication at the onset of summer is thought to e to reduced freshwater input and evapora- of the less-saline mixolimnion. Stratification ever observed in either of the two shallow kes, Bagdad and Garden; since these lakes eceive freshwater from seepages it is likely the shallow conditions permit complete g throughout the year. (Collier-IVI)
01645

OMPOSITION OF WILD RICE (ZIZANIA ATICA) STRAW IN TWO NATURAL ES OF NORTHWESTERN ONTARIO,
Ontario Ministry of Natural Resources, Kenora. Nortwestern Region.
P. Sain.
Canadian Journal of Botany, Vol. 62, No. 7, p 1352-1356, July, 1984. 5 Fig, 1 Tab, 25 Ref.

Descriptors: *Ontario, *Rice, *Decomposition, *West Bay, *Lulu Lake, *Nutrients, Nitrogen, Phosphorus, Potassium, Calcium, Sulfur, Magnesium, Carbon.

Decomposition of wild rice (Zizania aquatica L.) straw was studied by placing 20 g of air-dried straw into 25 X 15 cm size nylon bags. Each set of five straw bags was covered in a fine aluminum screen to avoid damage from aquatic animals. The screens were placed on October 17, 1979, in West Bay representing a river system and in Lulu Lake, a typical shallow wild rice lake. After 350 days the total decomposition by weight of straw was 94 and 72% in West Bay and Lulu Lake, respectively. Release of nutrients from the straw was studied by calculating the percent loss of nutrients in each sampling period. A rapid release of nutrients was observed during the first 3 wk followed by a slow release of nutrients thereafter. Total amounts of nutrients released after 350 days were about 98% potassium, 82% calcium, 81% phosphorus, 79% sulfur, 72% magnesium, and 57% nitrogen. The amount of nitrogen released and the carbon:nitrogen ratio of straw at the jointing stage of wild rice suggest that a major portion of the total nitrogen remains tied up in straw and may not become available for the next wild rice crop. (Author's abstract)
W85-01647

VEGETATION AND WATER CHEMISTRY OF FOUR OLIGOTROPHIC BASIN MIRES IN NORTHWESTERN ONTARIO,
Alberta Univ., Edmonton. Dept. of Botany.
D. H. Vitt, and S. Bayley.
Canadian Journal of Botany, Vol. 62, No. 7, p 1485-1500, July, 1984. 28 Fig, 5 Tab, 45 Ref.

Descriptors: *Ontario, *Vegetable crops, *Oligotrophic lakes, *Peat bogs, *Mires, Precambrian Shield, Calcium, Conductivity, Hydrogen ion concentration, Mosses, Magnesium, Sulfates, Nitrates, Alkalinity.

Four small oligotrophic basin mires on the Precambrian Shield were quantitatively analyzed for vegetation patterns and surface water and groundwater chemistry. Mean concentrations of ions in the surface waters of all vegetation stands indicate these mires to be characterized by low calcium content (0.6-1.9 mg Ca/L), low corrected conductivity (12-31 micro mho/cm (1 mho = 1 S)), and relatively high pH (4.0-5.7). Mire 224 is dominated by Chamaedaphne calyculata, Scheuchzeria palustris, and Carex oligosperma. The surface water mean determinations are Ca, 1.10 +/- 0.51 mg/L; Mg, 0.57 +/- 0.2 mg/L; corrected conductivity, 16.7 +/- 4.2 micro mho/cm; and pH 4.37. Abundance patterns of the dominant Carex species can be correlated with pH of the surface water of the mire. Mire 239 is characterized by Smilacina trifolia, Ledum groenlandicum, and Carex trisperma. The mean surface water determinations are Ca, 1.53 +/- 0.36 mg/L; Mg, 0.59 mg/L; corrected conductivity, 21.2 +/- 2.0 micro mho/cm; and pH 4.0. Significant differences in pH, Ca, and Mg occur between the interior and edge portions of this bog. Water chemistry from portions burned in 1974 showed no differences from unburned portions. The vegetation of mire 661 contains a sequence of communities positioned relative to the inflow streams, with a Myrica gale - Alnus rugosa community followed by a zone dominated by Picea mariana then a Larix laricina zone and then by an open Sphagnum papillosum - Menyanthes trifoliata lake edge zone. More ombrotrophic areas are dominated by Sphagnum fuscum. Ca, Mg, and Fe concentrations, pH, and corrected conductivity were reduced through this sequence. Comparison of weekly samples of water entering and leaving this mire in 1981 showed a reduction of Ca, Mg, SO4, NO3 N, alkalinity, and pH. (Author's abstract)
W85-01648

VERTICAL TEMPERATURE DISTRIBUTION IN LAKES,
National Bureau of Standards (NEL), Boulder, CO. Center for Chemical Engineering.
R. D. Noble, N. J. Kemp, and R. G. Buschman.
Journal of Environmental Systems, Vol. 14, No. 1, p 63-75, 1984-85. 2 Fig, 15 Ref, 1 Append.

Descriptors: *Water temperature, *Vertical distribution, *Lakes, *Solar radiation, Heat transfer, Model studies, Air-water interface, Thermal stratification.

Analytical expressions for the vertical temperature distribution in large lakes and other large water bodies are not available for the general case. This is due in large measure to two problems: there are non-linearities in the heat exchange term at the air-water interface and the actual absorbed radiation at the air-water interface has been difficult to express analytically. Analytical solutions were developed for the vertical temperature distribution in lakes. The solutions are good for large water bodies where inflows and outflows are negligible. The solution is based on a linearization of the surface heat exchange term. Solutions were developed for both zero-order and first order linearizations. An analytical expression was used to describe the actual daily absorbed radiation at the air-water interface. Since the model can account for variations in incoming solar radiation over time, the model could be very useful for estimating the vertical temperature distribution over extended periods. It would also be useful as a check on numerical solutions and a check on limiting cases of surface heat exchange. The model contains no adjustable parameters. Based on comparisons with experimental data, the model predictions become better as one approaches the end of the averaging period for the surface heat loss values. (Collier-IVI)
W85-01651

INFLUENCE OF PHYSICO-CHEMICAL FACTORS ON THE COLIFORM BACTERIA IN A CLOSED-LAKE WATER SYSTEM,
Jawaharlal Nehru Univ., New Delhi (India). Microbiological Lab.
U. S. Bagde, A. M. Khan, and A. K. Varma.
International Journal of Environmental Studies, Vol. 18, No. 3/4, p 237-241, 1982. 7 Fig, 16 Ref.

Descriptors: *Physicochemical properties, *Coliforms, *New Delhi, *India, Nutrient requirements, Bacteria, Nitrogen, Phosphates, Hydrogen ion concentration, Conductivity, Water temperature, Hardness, Sulfates, Ammonia, Nitrates, Nitrites.

Correlation of physical and chemical factors with biological factors has not been included in most research on heterotrophic pathogenic coliform bacteria. During the hot and humid period of May to August, epidemic diseases caused by coliform organisms are commonly reported in northern India. The coliform group of micro-organisms responsible for causing pollution in drinking waters was examined in a lake on the East-North of New Campus of Jawaharlal Nehru University, New Delhi. Bacterial counts (MPN) were correlated with certain physical and chemical factors, viz. electrical conductivity, pH, temperature, Ca-Mg hardness, inorganic nitrogen substances, inorganic sulfate and phosphate contents of the water. The coliform counts (MPN) varied with seasonal variations and changes in the properties of the water bodies. An inverse correlation of bacterial counts was noted with the dissolved inorganic nitrogenous compounds like ammonia, nitrite and nitrate. Similar observations were made when compared with dissolved salts of phosphate and sulfate. (Collier-IVI)
W85-01672

OXYGEN DEPLETION IN CENTRAL AND EASTERN LAKE ERIE: RELATIONSHIP WITH BACTERIA, CHLOROPHYLL, POC, AND MORPHOMETRY,
National Water Research Inst., Burlington (Ontario).
M. N. Charlton, and S. S. Rao.

Journal of Great Lakes Research, Vol. 9, No. 1, p 3-8, 1983. 2 Fig, 3 Tab, 16 Ref.

Descriptors: *Lake Erie, *Oxygen depletion, *Bacteria, *Chlorophyll, *Organic carbon, Lake morphology, Hypolimnion, Particulates, Metabolism, Lake sediments.

Hypolimnion oxygen depletion in central and eastern Lake Erie was related to bacteria, particulate organic carbon, and chlorophyll concentrations during 1979. The central basin had the higher oxygen depletion rate and this was associated with more microbiota and particulate organic carbon. After compensation for temperature differences, the rate of oxygen depletion per unit bacteria, chlorophyll, and particulate organic carbon was found to be similar in each basin. These observations are consistent with hypothesis that lake morphometry affects oxygen depletion through the control of hypolimnion particle concentrations. The implication that most of the hypolimnion oxygen metabolism occurs in the water column means that the role of sediments as a site of oxygen consumption should be reassessed. (Author's abstract)
W85-01752

ROLE OF SEDIMENTS IN THE NITROGEN BUDGET OF LOWER GREEN BAY, LAKE MICHIGAN,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5B.
W85-01754

ASSOCIATION BETWEEN NET BASIN SUPPLIES TO LAKE SUPERIOR AND SUPPLIES TO THE LOWER GREAT LAKES,
Wisconsin Univ.-Madison. Dept. of Geography.
W. A. R. Brinkmann.
Journal of Great Lakes Research, Vol. 9, No. 1, p 32-39, 1983. 5 Fig, 4 Tab, 13 Ref.

Descriptors: *Great Lakes, *Lake Superior, *Water level, *Hydrologic budget, Eigenvector analysis, Precipitation, Water supply.

Eigenvector analysis was carried out on monthly net basin supplies for the Great Lakes for the period of 1900-1973. Net basin supply anomalies for Lake Superior are to a large degree uncorrelated with those for the lower three lakes. There is a certain degree of opposition in the sign of the anomalies, particularly in the moderate range of net basin supplies. Extreme magnitudes (exceeding one standard deviation for at least part of the system) are almost always of the same sign. This suggests that the use of Lake Superior as a storage reservoir, in the absence of reliable long range weather predictions, is of some benefit during periods of moderate net basin supplies only, because periods of prolonged severe events tend to be basin-wide. Variations in the time series of the eigenvector coefficients suggest that, in general, supplies tended to be above average for the low lakes until about the 1930s and again since the mid 1960s, and that supplies tended to be above average for Lake Superior during the 1940s and 1950s. These times of change are in agreement with the timing of shifts in large scale circulation patterns for the Northern Hemisphere as well as for eastern North America and with the times of change in temperature and precipitation patterns over the Great Lakes region. (Baker-IVI)
W85-01755

INFLUENCE OF THE ST. MARYS RIVER PLUME ON NORTHERN LAKE HURON PHYTOPLANKTON ASSEMBLAGES,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
R. G. Kreis, Jr., T. B. Ladewski, and E. F. Stoermer.
Journal of Great Lakes Research, Vol. 9, No. 1, p 40-51, 1983. 6 Fig, 2 Tab, 34 Ref.

Descriptors: *St. Marys River, *Lake Huron, *Phytoplankton, Diatoms, Entrainment, Plumes, Water circulation, Suspended sediments, Sinking, Chlorophyll a, Benthic flora.

Analysis of phytoplankton samples from the Straits of Mackinac region yielded high species diversity and species richness values at the outfall of the St. Marys River due to entrained benthic diatoms. Epilithic, psammonic, epipelic, and epiphytic diatoms originating in the St. Marys River and Detour Passage area were removed from their primary habitats and transported into northern Lake Huron. Southward movement of the St. Marys River plume, as determined from suspended benthic diatom distribution and abundance, was strongly indicated for 3 km. Moderate influence of the plume was noted at 6 km and weaker association with the plume was detected for as far as 32 km. Apparently, loss of suspended riverine species from the upper water column in this area was primarily due to sinking. Sinking, calculated from residence times based on river discharge data, was estimated to range between 0.76 and 5.99 m/day. Total phytoplankton abundance and chlorophyll a values were lower near the rivermouth. Conversely, C-14 uptake was significantly greater near the river. Benthic populations comprised as much as 40% of the assemblage and an additional amount of dead and fragmentary diatoms was also observed. Viable benthic diatoms may contribute as much as 25% of the algal assemblage on a cell volume basis. Upon death and decomposition, they may constitute an important source of carbon and nutrients in the immediate vicinity. (Author's abstract)
W85-01756

SPECTRAL ATTENUATION AND IRRADIANCE IN THE LAURENTIAN GREAT LAKES,
National Water Research Inst., Burlington (Ontario). Aquatic Physics and Systems Div.
J. H. Jerome, R. P. Bukata, and J. E. Bruton.
Journal of Great Lakes Research, Vol. 9, No. 1, p 60-68, 1983. 7 Fig, 1 Tab, 9 Ref.

Descriptors: *Great Lakes, *Optical properties, *Spectral attenuation, *Irradiance, Lake Superior, Lake Huron, Lake Erie, Lake Ontario, Productivity.

The optical characteristics of the Laurentian Great Lakes range from the clearest waters of the upper lakes (Lake Superior, Lake Huron/Georgian Bay) to the turbid waters of the lower lakes (Lake Erie and Lake Ontario). It is these optical characteristics that determine the quantity and quality of radiation that is available for photosynthesis at a giver depth. Optical data collected between 1973 and 1979 are utilized to study spectral attenuation and irradiance in the midlake waters of the four Great Lakes. Particular attentuation is given to the photosynthetic available radiation (PAR), its incident spectral distribution, its spectral attenuation, and its qualitative change with depth. Curves are shown illustrating these spectral properties as well as the relationships between PAR and the photosynthetic usable radiation (PUR) for each of the lakes. These curves, along with the included mathematical relationships, enable quantitative estimates to be obtained of incident PAR, subsurface PAR, and subsurface PUR, and qualitative information to be obtained on subsurface irradiance levels for the Laurentian Great Lakes. Lake Superior and Lake Huron/Georgian Bay, in general, display similar and comparable optical characteristics, as do Lakes Erie and Ontario. The optical characteristics of the upper Great Lakes, however, are quite distinct form those of the lower Great Lakes. These similarities and differences between the Laurentian Great Lakes are a direct consequence of the levels of productivity, with the upper Great Lakes being characterized by low productivity and the lower Great Lakes being characterized by higher productivity. (Moore-IVI)
W85-01757

PREDICTING VARIABILITY IN A LAKE ONTARIO PHOSPHOROUS MODEL,
Michigan State Univ., East Lansing. Dept. of Resource Development.
R. H. Montgomery, V. D. Lee, and K. H. Reckhow.
Journal of Great Lakes Research, Vol. 9, No. 1, p 74-82, 1983. 5 Fig, 2 Tab, 25 Ref. NOAA grant 03-78-B01-109.

Descriptors: *Lake Ontario, *Phosphorus, *M studies, Variability, Prediction, Error an Monte Carlo method, Uncertainty

The prediction of a model always has a deg uncertainty. Because the level of uncertain inversely related to the value of information tained in the prediction, there is a need to qu the uncertainty. One approach to estimate p tion uncertainty is first-order error analysis. I method, the error in a characteristic (variab parameter) is defined by its first nonzero mo (the variance). Errors are propagated throug model using first-order terms in the Taylor s and the variances are then combined to yiel total prediction uncertainty. An alternativ proach to model prediction error analysis is M Carlo simulation. In this technique, proba density functions are assigned to each charac tic (variable or parameter), reflecting the u tainty in that characteristic. Then, values are domly selected from the distribution for each and inserted into the model, to calculate a pr tion. Repeating this process a number of produces a distribution of predicted values, w reflects the combined uncertainties. These tw proaches (first-order error analysis and M Carlo simulation) are applied to Lake Ontario using a steady state mass balance phosph model. Comparisons are made which su guidelines for the use of each. (Author's abs
W85-01758

NET ATMOSPHERIC INPUTS OF PCBS THE ICE COVER ON LAKE HURON,
De Paul Univ., Chicago, IL.
For primary bibliographic entry see Field 5B.
W85-01759

SATELLITE-TRACKED CURRENT DRIFT IN LAKE MICHIGAN,
National Oceanic and Atmospheric Admin tion, Ann Arbor, MI. Great Lakes Environm Research Lab.
For primary bibliographic entry see Field 7B.
W85-01760

RELEASE OF SEDIMENT-PHOSPHO AND THE INFLUENCE OF ALGAL GRO ON THIS PROCESS,
Amsterdam Univ. (Netherlands). Lab. voor M biologie.
L. Van Liere, J. Peters, A. Montijn, and L. R. Mur.
Hydrobiological Bulletin, Vol. 26, No. 2-3, p 200, December, 1982. 5 Fig, 3 Tab, 22 Ref.

Descriptors: *Phosphorus, *Lakes, *Netherla *Algal growth, *Sediments, Polders, Eutrop tion, Lake sediments.

A Continuous Phosphorus Release Reactor used to measure the rate of phosphorus re from undisturbed sediment cores taken from se al lakes and polders in the province of N Holland. Findings from various lakes and po ditches were compared with each other. P lakes exchanged their particulate phosphorus idly with the overlying water as compared other sediment types. This makes them suitable phosphorus load reduction measures. There found to be no simple direct relation betw chemically extracted phosphorus fractions and phosphorus released during the experiment. A growth in the overlying water stimulated the lease of phosphorus. (Baker-IVI)
W85-01761

WIND INDUCED DIFFUSION IN A SHALL LAKE, A CASE STUDY,
Agricultural Univ., Wageningen (Netherlan Dept. of Hydraulics and Catchment Hydrol
J. D. Leenen.
Hydrobiological Bulletin, Vol. 16, No. 2-3, p 240, December, 1982. 5 Fig, 6 Ref.

iptors: *Shallow water, *Wind, *Diffusion, , Limnology, Mixing, Mathematical equa- Tracers.

ongitudinal mixing process in a shallow lake the influence of wind has been studied. This ss may be described with the classical con- n-diffusion equation. A time scale for verti- ixing of about 6 hours was found, which is compared to the time scale for horizontal g of several weeks. This is the reason that al mixing is negligible compared to the hori- transport. A formula is given for estimating ngitudinal diffusion coefficient. The formula more differentiation than a previously de- ed empirical formula. Using a numerical to describe the transport of chloride (a ly available tracer in this lake) the diffusion cient has been calibrated. Results agree fa- ly with the dimensional estimate and the mentioned empirical formula. The hypothe- stated that the macrocirculation pattern de- on the wind direction, and that the length- in the horizontal, wind induced diffusion s should be associated with the size of the -eddies and not with the size of the lake. -IVI)
1763

OLOGY IN RESERVOIRS ON THE COL- O RIVER,
a Univ., Las Vegas. Lake Mead Limnologi- search Center.
aulson, and J. R. Baker.
ble from the National Technical Information e, Springfield, VA 22161 as PB84-190164, codes: A13 in paper copy, A01 in microfiche. ical Report No. 11, September 1983. 269 p, g, 3 Tab, 65 Ref, 1 Append. Project No. T B-121-NEV(1), Contract/Grant No. 14-34- 243.

ptors: Water quality management, Water , *Limnology, *Nitrogen, *Phosphorus, ophyll, *Productivity, *Nutrients, *Colora- er, Lake Powell, Lake Mead, Lake Mohave, Havasu, Nevada, Arizona, Utah, California.

ost prevalent limnological characteristic of olorado River reservoirs during 1981 and as the low phosphorus concentrations that in most of the systems. A large percentage phosphorus inputs to the reservoirs from the ries and main stem was bound to suspended nts. This was especially evident in Lake where over 90% of the total and biologi- vailable phosphorus inputs were sedimented ed) in the reservoir. Total nitrogen concen- in the reservoirs decreased downstream he headwaters of Lake Powell. This de- was caused by nitrogen retention in each ir and by the lack of significant nitrogen from downstream tributaries. The reservoirs ll phosphorus limited on the basis of area- ed, annual average total nitrogen/total orus (TN/TP) ratios. The ratio does de- downstream reflecting the slight increase in orus and decrease in nitrogen; however, the e annual TN/TP ratios never approached where nitrogen would be considered limit-

1812

OLOGY OF LAKE PADGETT, SAXON AND ADJACENT AREA, PASCO TY, FLORIDA,
gical Survey, Lakewood, CO. Water Re- Div.
mary bibliographic entry see Field 7C.
1826

HIC ECOLOGY OF FISH REARING S,
State Univ., Columbus. Dept. of Zoology. Vaga, and D. A. Culver.
ble from the National Technical Information e, Springfield, VA 22161 as PB84-207331, odes: A05 in paper copy, A01 in microfiche. Resources Center Completion Report, 1984. 81 p, 21 Fig, 5 Tab, 47 Ref. Project WRT A-065-OHIO(1).

Descriptors: *Plankton, *Zooplankton grazing, Phytoplankton, Algae, *Bosmina, *Daphnia, Larval fish, Productivity, Bacteria, Nutrients, Population dynamics, *Ohio, Hebron National Fish Hatchery, *Trophic dynamics, *Fish yield, *Trophic levels, Ecology.

A three year study of the trophic dynamics of fish rearing ponds was conducted at the Hebron National Fish Hatchery, Hebron, Ohio to investigate questions concerning the interaction of various trophic levels in the plankton and to better understand the factors most responsible in determining fish yield. Investigation of the effects of zooplankton grazing on the size structure of the phytoplankton indicated that above certain threshold levels of zooplankton biomass, zooplankton grazing can radically change the size structure of the phytoplankton community. Small flagellates were susceptible to both Daphnia and Bosmina grazing whereas small cryptomanads were removed only by Daphnia. The dynamics of resistant algal forms to grazing was not possible to predict at the species level. The presence of filament concentrations in excess of 20% of total phytoplankton volume inhibited the egg production of Daphnia more than that of Bosmina. However, total seasonal reproductive output of both species was due to factors other than filament concentration and the effects of filaments on succession in the zooplankton is questioned. Fish predation was found to affect the per capita production of Daphnia and to have a large influence on the species composition of the zooplankton community. High levels of fish predation resulted in Bosmina becoming the dominant grazer but at the same time increased the reproductive rate in Daphnia, regardless of species.
W85-01833

STUDY OF HABITAT CONDITIONS OF THE MACROPHYTIC VEGETATION IN SELECTED RIVER SYSTEMS IN WESTERN LOWER SAXONY (FEDERAL REPUBLIC OF GERMANY),
Oldenburg Univ. (Germany, F.R.). Dept. of Biology.
G. Wiegleb.
Aquatic Botany, Vol. 18, No. 4, p 313-352, June, 1984. 3 Fig, 8 Tab, 99 Ref.

Descriptors: *Macrophytes, *Aquatic habitats, *Rivers, *Lower Saxony, *West Germany, Ecological distribution, Marshes, Vegetation, Analysis of variance, Cluster analysis, Aquatic plants, Dissolved oxygen, Turbidity, Velocity, Acidity, Calcium.

In Lower Saxony, ecological investigations were carried out in selected river systems. The vegetation of the 43 sampling sites was classified by means of cluster analysis into 7 groups, 3 of which occurred on the diluvial plains and 2 in the coastal marsh area only. Forty-one parameters were measured 3-7 times covering 2 vegetation periods. The structure of the data was carefully studied by bivariate correlation analysis and factor analysis. A high number of significant correlations was detected, which indicates difficulties in ecological interpretation. Temporal variation of the parameters measured was classified into 3 groups according to stability. For a study of the relationships between the vegetation and the ecological parameters, the data set was split into 5 subsets (physical data, water chemical data, interstitial water chemical data, sediment characteristics, and a mixed set of simple field data). The relationship of each subset to the vegetation was studied separately using cluster analysis. The mixed data set FIELD showed the highest degree of similarity to the vegetation clustering. The best vegetation type differentiation qualities were shown by some physical and water chemical parameters (oxygen content, turbidity, current velocity, acidity, calcium). The ecological behavior of some species of medium frequency was also studied in detail by means of analysis of variance. The means of all parameters for occurrence and non-occurrence were compared. For Ranunculus peltatus, Myriophyllum alterniflorum and Elodea canadensis, several differentiation variables could be detected. The zonation of two rivers was studied in detail by comparing the vegetation sequence with important physical and chemical parameters. The interaction between these parameter groups is clearly shown. Physical parameters like current velocity are responsible for the basic zonation, while chemical parameters can modify the zones to a large extent. (Moore-IVI)
W85-01887

FACTORS STRUCTURING FISH ASSEMBLAGES ALONG A BOG LAKE SUCCESSIONAL GRADIENT,
Wisconsin Univ.-Madison. Center for Limnology.
F. J. Rahel.
Ecology, Vol. 65, No. 4, p 1276-1289, August, 1984. 3 Fig, 8 Tab, 71 Ref.

Descriptors: *Fish, *Bog lakes, *Succession, *Wisconsin, Oligotrophic lakes, Multivariate analysis, Hydrogen ion concentration, Dissolved oxygen, Minnows, Perch, Acid lakes.

Three alternate and distinct fish assemblages were identified in 43 northern Wisconsin lakes encompassing a gradient from bog ponds to small, oligotrophic lakes having little bog character. Multivariate analysis of physical/chemical variables identified three general environmental factors that influence community type and species richness. These factors are: (1) habitat size and heterogeneity; (2) lake productivity-pH; and (3) winter oxygen concentrations. Ordination of lake fish assemblages along these environmental radients revealed that two factors, lake pH and winter anoxia, were especially crucial in determining assemblage type. Maintenance of these discrete assemblages is also the result of biotic interactions (exclusion of cyprinids due to predation or competition from centrarchids). A centrarchid assemblage dominates lakes across a wide range of habitat types and pH, providing winter anoxia does not occur. Lakes with low winter oxygen concentrations harbor a cyprinid assemblage if the pH is above 5.2-5.4. Lakes that are acidic and also have low winter oxygen contain only two physiologically hardy species comprising the Umbra-Perca assemblage: central mudminnow (Umbra limi) and yellow perch (Perca flavescens). Five fishless lakes had physical and chemical characteristics similar to lakes with an Umbra-Perca assemblage. Within the fish assemblages, no subgroups of closely associated species were evident. For Umbra-Perca lakes, few environmental differences were evident between lakes having (1) no fish, (2) central mudminnows only or, (3) yellow perch and central mudminnows. The sequential loss of species along a gradient from oligotrophic seepage lakes to bog ponds reflected the increased harshness of the chemical environment and the loss of near-shore habitat zones. Species that are specialized zooplanktivores, that utilize hard-bottom substrates for spawning or feeding activities, or that are intolerant of low pH were limited to lakes with little bog character. Lakes in intermediate stages of succession contained acid-tolerant species that are food and habitat generalists. Lakes near the final stages of senescence contained only yellow perch and central mudminnows. The location of bog lakes at the lower end of several environmental gradients makes them valuable sites for studying the influence of environmental factors and biotic interactions on the structure of aquatic communities. (Author's abstract)
W85-01891

PHYTOPLANKTON POPULATION DYNAMICS OF A SMALL RESERVOIR: EFFECT OF INTERMITTENT MIXING ON PHYTOPLANKTON SUCCESSION AND THE GROWTH OF BLUE-GREEN ALGAE,
McMaster Univ., Hamilton (Ontario). Dept. of Biology.
A. M. Trimbee, and G. P. Harris.
Journal of Plankton Research, Vol. 6, No. 4, p 699-713, 1984. 7 Fig, 2 Tab, 26 Ref.

Descriptors: *Phytoplankton, *Population dynamics, *Succession, *Algal growth, *Guelph Lake, *Ontario, Reservoirs, Cyanophyta, Diatoms, Seasonal variation, Anoxic conditions, Seasonal succession.

The seasonal succession of the phytoplankton of a small reservoir (Guelph Lake, Ontario) in the spring-summer of 1982 was compared to that in 1981. Mixing of the deeper waters occurred several times throughout the summer in 1982 but not in 1981. The water at 10 m became anoxic for only 2 weeks in late July in 1982. In contrast, in 1981, the water at 10 m became anoxic at the beginning of July and remained so until mid-September. The phytoplankton dynamics observed in 1982 did not follow the typical progession from spring diatoms to summer species adapted to survive under stratified conditions, as in 1981. Diatoms were present throughout the summer in higher amounts in 1982 than in 1981. The most obvious difference in the two summers was the much greater abundance of Aphanizomenon flos-aquae in 1982. Other blue-green algae including Microcystis aeruginosa, Gomphosphaeria lacustris, and Lyngbya birgei appeared earlier on in 1982, but did not immediately increase in abundance as in 1981. In 1982, rates of phytoplankton community change were low in May and June and increases were observed in mid-July, early August, late August and late September. In contrast, in 1981, the rate community change increased in late May, mid-June, early July and late July and remained low throughout August and September. (Author's abstract)
W85-01916

WATER QUALITY OF LAKE ARLINGTON ON VILLAGE CREEK, NORTH-CENTRAL TEXAS, 1973 TO 1981,
Geological Survey, Austin, TX. Water Resources Div.
F. L. Andrews, and W. J. Gibbons.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigation Report 83-4196, 1983. 126 p, 18 Fig, 28 Tab, 14 Ref.

Descriptors: *Water quality, *Dissolved oxygen, Iron, Manganese, Nitrogen, Phosphorus, *Dissolved solids, Chloride, Sulfate, Hardness, Phytoplankton, *Texas, Lake Arlington, Village Creek, Thermal stratification.

Water in Lake Arlington on Village Creek in north-central Texas had volume-weighted average concentrations well below secondary maximum contaminant levels for drinking water for dissolved solids, dissolved chloride, and dissolved sulfate. The water was moderately hard. Thermal stratification in Lake Arlington usually begins during March or April and persists until October. Thermal stratification has resulted in significant seasonal and areal variations in the concentration of dissolved oxygen, dissolved iron, dissolved manganese, total inorganic nitrogen, and total phosphorus. Even through heated effluent from an electrical generating plant is returned to the reservoir at site C sub C and cause an elevation of water temperature, average dissolved oxygen levels at this site are not significantly different from levels at other sites. Dissolved iron and dissolved manganese were maximum during summer stagnation at site A sub C, a deep site near Arlington Dam. The concentrations of dissolved iron and dissolved manganese in water throughout the reservoir during winter circulation and in water near the reservoir surface during summer stagnation were quite low (less than 50 micrograms per liter). (USGS)
W85-02042

BOTTOM DYNAMICS IN LAKES,
National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab.
For primary bibliographic entry see Field 2J.
W85-02054

ENTRAINMENT, DEPOSITION, AND TRANSPORT OF FINE-GRAINED SEDIMENTS IN LAKES,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
For primary bibliographic entry see Field 2J.
W85-02055

PHYSICAL AND GEOCHEMICAL CHARACTERISTICS OF SUSPENDED SOLIDS, WILTON CREEK, ONTARIO,
National Water Research Inst., Winnipeg (Manitoba).
E. D. Ongley, M. C. Bynoe, and J. B. Percival.
Hydrobiologia, Vol. 91, p 41-57, July, 1982. 9 Fig, 1 Tab, 64 Ref.

Descriptors: *Wilton Creek, *Ontario, *Suspended solids, *Physicochemical properties, *Geochemistry, Storm runoff, Seasonal variation, Particle size, Calcium, Phosphorus, Magnesium, Aluminum, Titanium, Iron, Pottasium, Algae, Bioaccumulation.

To understand the nature of sediment-associated nutrient and contaminant transport dynamics in fluvial systems, a stormflow sampling program of suspended solids is reported for one water year in a representative rural diffuse source catchment of southeastern Ontario. Bulk samples of subsieve suspended solids were obtained using field-portable continuous-flow centrifuge apparatus. The physical and geochemical properties of suspended solids show no significant intersite differences over reaches of 1,500-2,000 m, yet display distinctive seasonal trends. Systematic seasonal changes in particle size, organic content, and Ca, P, Mn, Al, Ti, Fe, and K appear to reflect the changing role of partial area hydrology. Ca, P, and Mn are bioaccumulated by stream algae. Mineral signature is relatively constant over the year. (Author's abstract)
W85-02056

COMPARISON OF SEDIMENT ENERGY-TEXTURE RELATIONSHIPS IN MARINE AND LACUSTRINE ENVIRONMENTS,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2J.
W85-02058

GEOCHEMISTRY OF THE RHINE AND THE RHONE AND HUMAN IMPACT (LA GEOCHIMIE DU RHIN ET DU RHONE ET L'IMPACT HUMAIN),
Centre d'Ecologie de Camargue (France).
H. L. Golterman.
Hydrobiologia, Vol. 91, p 85-91, July, 1982. 2 Fig, 2 Tab, 7 Ref.

Descriptors: *Rhine River, *Rhone River, *Switzerland, *Geochemistry, Stream pollution, Water pollution, Environmental effects, Water quality.

The Rhine and the Rhone are two rivers very similar in their geological, hydrological and (geo)chemical characteristics. They originate from adjacent glaciers (in Switzerland); both pass through a limestone area and then through a deep lake, which collects most of the glacial silt. Both flow for a further 1 000 km while acquiring, more and more, the character of a lowland river. The chemistry of the water and the suspended matter was originally identical. On each, however, the influence of cultural development has been quite different. It is suggested that a detailed chemical desription of both river systems will be helpful to understand and reduce present-day pollution; very probably, to some extent, both rivers can serve as each other's baseline data. (Author's abstract)
W85-02059

WHOLE-LAKE LEAD BURDENS IN SEDIMENTS OF LAKES IN SOUTHERN ONTARIO, CANADA,
Ontario Ministry of the Environment, Rexdale
For primary bibliographic entry see Field 5B.
W85-02062

HISTORICAL CHANGES IN ANTHROPOGENIC LEAD FALLOUT IN SOUTHERN ONTARIO, CANADA,
Trent Univ., Peterborough (Ontario).
For primary bibliographic entry see Field 5B.
W85-02063

BASIC CONCEPTS AND ASSOCIATED TISTICAL METHODOLOGY IN THE CHEMICAL STUDY OF LAKE SEDIM
Geneva Univ. (Switzerland). Inst. F.-A. For
For primary bibliographic entry see Field 2J
W85-02064

ZINC IN WATER AND SEDIMENTS OF FINNISH LAKES,
Tampere Univ. of Technology (Finland).
For primary bibliographic entry see Field 5B
W85-02065

CARBON FLOW ACROSS THE SEDI WATER INTERFACE IN LAKE VEC THE NETHERLANDS,
Limnologisch Inst., Nieuwersluis (Netherlan
T. E. Cappenberg, K. A. Hordijk, G. J. Jonk and J. P. M. Lauwen.
Hydrobiologia, Vol. 91, p 161-168, July, 1 Fig, 2 Tab, 20 Ref.

Descriptors: *Lake Vechten, *Nethe *Carbon, *Sediment-water interface, *Cycli trients, Organic matter, Chlorella, Algae, C phyta, Isotope studies, Lakes.

The turnover and exchange rates, as well diffusion processes, concerning the inpu output of carbon compounds at the mud interface, were studied. The carbon inpu were derived from the annual sedimentatio of particulate organic matter (about 1,100 yr). The nature of the sedimented POC, breakdown pathways and turnover rates t important metabolic intermediates in methan sis, were examined. The breakdown kine Chlorella cell walls, a dominant green alga i Vechten, was studied using U and C-14 l cell walls. The breakdown of the cell walls a to be the rate-limiting step in anaerobic mine tion. Using first order kinetic equations, and and GLC and radio-chemical methods, tu rate constants (k-values) of between 0.18 an day and pool sizes of algal cell walls of 37 ug/g wet mud were found, giving turnove of 7.7 to 25.6 ug/g/day of cell wall materia turnover rates (k-values between 0.07 and 0 of acetate, the most important breakdown pr and its concentration gradients (between 5 micromol) and diffusion coefficient (L 0.0000022 sq cm/s) just in and above mud interface, was quantified. The diffusion of a within the sediments, could not account f turnover rates observed. Finally, from aceta data and from those on the rates of format carbon dioxide and methane, the output of c and its cycling in Lake Vechten are disc (Author's abstract)
W85-02066

LOADING CONCENTRATION MODELS PHOSPHATE IN SHALLOW LAKES,
Centre d'Ecologie de Camargue (France).
H. L. Golterman.
Hydrobiologia, Vol. 91, p 169-174, July, 1 Fig, 3 Tab, 9 Ref.

Descriptors: *Phosphate, *Load distrib *Loading concentration models, *Lakes, *Sh water, Model studies, Calcium, Apatite, Iron, sediments, Eutrophic lakes, Algal growth.

In shallow lakes, the quantitative influence o ments on the phosphorous loading is different that in deep lakes because through resuspe the sediments are repeatedly brought into c with the water. A theoretical mathematical f la was developed which describes the phos concentration in water and sediments of sh lakes as a function of loading. In vitro experi agreed, in principle, with the expected shape relationship curve. The curve shows that the phate concentration rises slowly during the stages of eutrophication and that, later, a more rapid increase can be expected. In the stitial waters of shallow lake sediments low values may occur than in the overlying wate iron may control the phosphate concentr

e. As algal growth takes place in the water, in t eutrophic shallow lakes, the Ca(2+) concen- on and the pH will control the solubility of the sphate surrounding these algae. The apatite em is just as important as Fe as a eutrophic- -water phosphate controlling mechanism. lier-IVI)
-02067

DEL FOR INSTREAM REGULATION OF DIOISOTOPES AND HEAVY METALS IN ERINE WATERS SUBJECTED TO A URA- M MILL DISCHARGE,
: Consultants Ltd., Mississauga (Ontario).
primary bibliographic entry see Field 5B.
-02068

ERIMENTAL MEASUREMENT OF SEDI- NT NITRIFICATION AND DENITRIFICA- N IN HAMILTON HARBOUR, CANADA,
Master Univ., Hamilton (Ontario).
lapwijk, and W. J. Snodgrass.
robiologia, Vol. 91, p 207-216, July, 1982. 6 8 Tab, 6 Ref.

criptors: *Hamilton Harbour, *Ontario, *Sedi- s, *Nitrification, Nitrogen cycle, Effluents, nonia, Carbon, Sediment-water interface, Arr- us activation energy, Lakes.

research examines the role of sediment nitrifi- n and denitrification in the nitrogen cycle of ilton Harbour. The Harbour is subject to large onia and carbon loadings from a waste-water ment plant and from steel industries. Spring onia concentrations rapidly decrease from 4.5 5 mg/L, while spring nitrate concentrations ase from 1 to 2 mg/L, by mid-summer. A e-layer sediment model was developed. The layer is aerobic; in it, oxidation of organics nitrification occurs. The second layer is for rification, and the third layer is for anaerobic esses. Ammonia sources for nitrification in- e diffusion from the water column, sources iated with oxidation of organics, sources from rification and from anaerobic processes. Dif- n of oxygen, ammonia and nitrate across the ment-water interface occurs. Temperature ef- are modelled using the Arrhenius concept. A bination of zero-order kinetics for nitrate or onia consumption with diffusion results in a order reaction, with the respect to the water mn loss rate of sediments. From experimental urement, the rate of nitrification is 200 mg N/ diment per day, while that of denitrification is g N/L sediment per day at 20 degrees C. The enius activation energy is estimated as 15 000 nole-K and 17 000 cal/mole-K for nitrification denitrification, respectively between 10 de- C and 20 degrees C. Calculations of the flux nmonia with the sediments, using the biofilm, pare favorably with experimental observa- . The ammonia flux from the water column is ated to account for 20% of the observed eased in water column stocks of ammonia, e the nitrate flux from the water column is ated to account for 25% of the total nitrogen uced by the sediments. (Author's abstract)
-02070

S BALANCE MODELS OF PHOSPHORUS EDIMENTS AND WATER,
da Centre for Inland Waters, Burlington (On-).
primary bibliographic entry see Field 2J.
-02071

AMIC PHOSPHATE BUDGET MODEL A EUTROPHIC LAKE,
nische Hogeschool Twente, Enschede (Neth- ds).
jklema, and A. H. M. Hieltjes.
robiologia, Vol. 91, p 227-233, July, 1982. 10 5 Ref.

criptors: *Lake Brielle, *Netherlands, *Phos- e budget, *Eutrophic lakes, *Model studies, ulation, Sediments, Primary production, Min- zation, Sedimentation, Adsorption, Cycling ents, Lakes.

The relations between the external nutrient loading of lakes, recycling through sediments and the resulting productivity are complicated by feed-back mechanisms, seasonal variations and trends. Simulation is a useful tool for the identification of controlling factors and the assessment of the effects of management measures, supplementary to experimental research. The model variables in our dynamic phosphate budget model include inorganic and organic particulate phosphate and dissolved o-phosphate, in both sediments and overlying water. Sediments may be aerobic or anaerobic, depending on topography, temperature and composition. The major processes described are primary production, mineralization, sedimentation, adsorption and diffusion. Several model parameters have been estimated directly for Lake Brielle (Netherlands). The sediment dilution rate, the extent of anaerobic conditions and the number and character of adsorption sites are important controlling factors. (Author's abstract)
W85-02072

SPATIAL HETEROGENEITY IN WHOLE LAKE SEDIMENTS - TOWARDS A LOADING ESTIMATE,
Alberta Environment, Edmonton. Water Resources Mangement Div.
T. B. Reynoldson, Jr., and H. R. Hamilton.
Hydrobiologia, Vol. 91, p 235-240, July, 1982. 4 Fig, 4 Tab, 11 Ref.

Descriptors: *Lake Wabamum, *Alberta, *Lake sediments, *Nutrient loadings, Eutrophic lakes, Phosphorus, Isotope studies, Organic matter, Lakes.

Studies of nutrient loadings, to shallow culturally eutrophied Alberta lakes, suggest internal inputs are significant. In this regard, estimation of bottom sediment P loads to Lake Wabamun (80 sq km, 5.5 m mean depth) were examined. Initially we determined the spatial variability in Total Organic Content (% loss on ignition) and Total Phosphorus, as indicators. Phosphorus fractions and biologically available phosphorus (BAP) were measured at specific stations. These data showed a very uniform distribution in sediment type with a Total Organic Content of 40.6 +/- 3.3 (95% C.L.) at the west end, gradually declining to 26.3 +/- 0.9 at the east end. Transects performed at routine monitoring stations indicate the representativeness of each station, e.g., station 2, 40.8 +/- 1.3 (10 sites). One explanation of this uniformity is provided from Pb-210 analysis of shallow cores which indicate mixing to a depth of 16 cm. This is also thought to explain the mechanics of P loading to the water phase. Finally, Total Organic Content relates well to BAP (r(2) = 0.80). It is hoped that this simple technique may well permit more precise extrapolation to whole lake BAP estimates at least on this lake. (Author's abstract)
W85-02073

PARTITIONING OF PHOSPHORUS BETWEEN PARTICLES AND WATER IN A RIVER OUTFLOW,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Ecology and Systematics Section.
J. P. Barlow, and M. S. Glase.
Hydrobiologia, Vol. 91, p 253-260, July, 1982. 7 Fig, 1 Tab, 14 Ref.

Descriptors: *Cayuga lake, *New York, *Salmon Creek, *Phosphorus, *Particulate matter, Mixing zone, Adsorption, Chemical precipitation, Sedimentation, Nutrients.

The mixing zone between Cayuga Lake, N.Y. and one of its tributaries, Salmon Creek, was studied to determine effects of physical processes such as adsorption, precipitation or sedimentation on phosphorus discharge by the Creek. A high sodium concentration in the lake served as a natural tracer, by which proportions of Creek and Lake water were determined at any point in the mixing zone. Proportions of Creek and Lake water were used to predict amounts of P that would be expected on the basis of mixing alone. Differences between predicted and observed concentrations were attributed to local physical processes. In several of the six plumes surveyed, there was substantial loss of P due to sedimentation. The P-distribution in all plumes showed evidence of exchanges between particles and the medium, as a result of which soluble reactive-P usually decreased and soluble unreactive-P usually increased. The nature and magnitude of these local processes were such that they could have significant effects on the fate of stream-P discharged into the lake. (Author's abstract)
W85-02075

MICROBIAL METABOLISM IN SURFACE SEDIMENTS AND ITS ROLE IN THE IMMOBILIZATION OF PHOSPHORUS IN OLIGOTROPHIC LAKE SEDIMENTS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 2J.
W85-02076

ACCUMULATIVE PHASES FOR HEAVY METALS IN LIMNIC SEDIMENTS,
Technische Univ., Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik.
For primary bibliographic entry see Field 5B.
W85-02077

PHOSPHATE ADSORPTION KINETICS OF RESUSPENDED SEDIMENTS IN A SHALLOW LAKE, NEUSIEDLERSEE, AUSTRIA,
Vienna Univ. (Austria). Limnologische Lehrkanzel.
A. Gunatilaka.
Hydrobiologia, Vol. 91, p 293-298, July, 1982. 3 Fig, 1 Tab, 26 Ref.

Descriptors: *Neusiedlersee, *Austria, *Seston, *Suspended sediments, *Shallow water, *Phosphates, *Adsorption, Calcium, Langmuir isotherm, Isotherms, Lake sediments, Nutrients, Illite, Chlorite, Lakes.

Previous evaluations of phosphorus adsorption kinetics of lake sediments have used methods developed for soil science; most of the extraction procedures used in these investigations are from soil chemistry which involve the use of strong acids and alkalis that destroy some of the physical properties of natural samples. The phosphate adsorption capacity of suspended sediments from Neusiedlersee, (a 300 sq km, very shallow, highly turbid lake), was evaluated using a silicone oil-filter-centrifugation technique with P-32 and Tritium H2O labelling. This technique is quick, convenient and allows uptake processes to be followed during the first few seconds. The time dependent phosphate uptake was tested for concentration and pH dependency; the highest uptake was recorded at pH 9.00. The high calcite proportion in the sestonic material seems to influence the adsorption process; there is a high percentage of calcium bound phosphate in the seston sample. The other clay minerals present in the sample, such as illite and chlorite, have a high affinity for phosphates only at an acid pH. The kinetics of adsorption (at lake orthophosphate level and pH) could be explained by a biphasic Langmuir isotherm. The phosphate forms a monolayer when adsorbed on seston; adsorption taking place in various sites on the particle surface, or subsequent adsorption taking place in layers, may explain the two slopes in the isotherm. Adsorption may occur simultaneously on all sites, with higher energy sites being filled preferentially during the initial stages of adsorption. When the results are corrected for initial bound phosphate (assumed to be calcium bound phosphate 70.6%), the maximum phosphate adsorbed is equivalent to 588 micrograms/g seston (dry weight). (Collier-IVI)
W85-02079

DYNAMICS AND MECHANISMS OF ARSENITE OXIDATION BY FRESHWATER LAKE SEDIMENTS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.

For primary bibliographic entry see Field 5B.
W85-02080

MANGANESE CYCLE IN LAC LEMAN, SWITZERLAND: THE ROLE OF METALLOGENIUM,
Geneva Univ. (Switzerland). Inst. F.-A. Forel.
J.-M. Jaquet, G. Nembrini, J. Garcia, and J. P. Vernet.
Hydrobiologia, Vol. 91, p 323-340, July, 1982. 11 Fig, 4 Tab, 37 Ref. Swiss National Research Foundation projects 2.606-0.76 and 2.314-0.79.

Descriptors: *Manganese, *Lac Leman, *Switzerland, *Metallogenium, *Bacteria, Lake sediments, Sediments, Interstitial water, Suspended solids, Scanning electron microscopy, Transmission electron microscopy, Sediment-water interface, Cycling nutrients, Zinc, Cadmium, Iron.

The manganese pathways in Lac Leman have been investigated on the basis of chemical analyses undertaken on water, suspended solids, bottom sediments and interstitial water samples. The various modes of occurrence of Mn have been determined by means of visual examination using SEM and TEM (scanning and transmission electron microscopy), by microanalysis (EDAX) of various sediment fractions, by chemical analysis of the dissolved phase, and by chemical speciation and XRD of bottom sediments. Fluxes to and from the sediment have also been computed. The time-depth variations of Mn in the water column are characterized by (a) a very steep gradient of Mn sol. from the sediment interstitial water (15 mg/L) to the overlying water, 2 m above the bottom (500 micro g/L), (b) an accumulation of Mn part. between 280 m and the interface at 310 m, consisting of mineralized colonies of Metallogenium. The abundance of Metallogenium colonies is inversely related to O2 concentration; the optimal value for the bacterium Mn fixation is around 1 mg/L. Because of the quasi-anoxic state of the bottom sediments and overlying water, Mn diffuses from a 'source layer', 2-5 cm below the interface (a) upwards across the interface, before being taken up by Metallogenium, and (b) downwards to a 'sink layer', in which large amounts of Mn-carbonate precipitate. Particulate Mn sedimentation rates measured in traps show that downwards Mn flux due to Metallogenium settling approximately balances the upwards soluble flux due to diffusion. Quantitatively, the process of Mn cycling in Lac Leman is, therefore, limited to the lowermost part of the hypolimnion. Although Zn and Cd seem to follow the same cycle as Mn, Fe behaves in a different manner; it was not taken up by Metallogenium at the time of our study. (Author's abstract)
W85-02081

PARTICLE SIZE DISTRIBUTION AND CHEMICAL PARAMETERS OF THE SEDIMENTS OF A SHALLOW TURBID IMPOUNDMENT,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Botany.
P. C. Keulder.
Hydrobiologia, Vol. 91, p 341-353, July, 1982. 15 Fig, 20 Ref.

Descriptors: *Wuras Dam, *South Africa, *Particle size, *Chemical properties, *Sediments, Sodium, Potassium, Calcium, Magnesium, Phosphorus, Phosphates, Passega classification.

As part of an ecosystem study of Wuras Dam, a small mesotrophic turbid impoundment in the semi-arid part of South Africa, an investigation was made of the particle size distribution, organic content and inorganic chemical composition of the sediment. Nine transects 50 m apart were made during February 1980. Sediments were sampled with an Eckman grab. The following analyses were made: size fractionation by wet sieving, cation exchange capacity, exchangeable Na, K, Ca, Mg and PO4, total P, and loss on ignition. From the results it was clear that the finer particles, in or near the original river bed, had higher cation exchange capacity, total P, exchangeable phosphorus and organic content. Littoral areas with avian habitat and extensive macrophyte vegetation, contained coarser sediments. Organic detritus apparently migrated to the deeper part of the impoundment. Sediments of lacustrine and fluvial origin were identified by means of the Passega classification. (Author's abstract)
W85-02082

INTERACTION BETWEEN INTERSTITIAL WATER AND SEDIMENT IN TWO CORES OF LAC LEMAN, SWITZERLAND,
Geneva Univ. (Switzerland). Dept. of Inorganic, Analytical and Applied Chemistry.
G. Nembrini, J. A. Capobianco, J. Garcia, and J.-M. Jacquet.
Hydrobiologia, Vol. 92, p 363-375, July, 1982. 7 Fig, 2 Tab, 35 Ref. Swiss National Research Foundation projects 2.606-0.76 and 2.314-0.79.

Descriptors: *Lac Leman, *Switzerland, *Interstitial water, *Iron, Vivianite, Siderite, Sulfides, Iron sulfides, Manganese, Trace metals, Lake sediments, Lakes.

The pore fluids of the sediments collected at the deepest point of Lac Leman (Switzerland) are supersaturated with respect to vivianite and siderite. In the presence of sulfide, the iron solubility is controlled entirely by the amorphous iron sulfides. As the iron (II) becomes dominant, the formation of siderite occurs and evidence of this, in the solid phase, can be obtained by the use of Mossbauer spectroscopy and some sequential chemical extractions. The amount of 'siderite iron' decreases from about 10% near the sediment surface to a few percent in the lower levels of the sediment (< 10 cm). Evidence for vivianite formation could not be obtained even in the lower layers, despite the precautions taken to avoid oxidation. Although the trace metal behavior in the solid phase is well correlated with the iron and manganese, availability in the pore fluid is dependent on the adsorption on, or co-precipitation with, finely dispersed colloids, which pass through a 0.45 micro m filter. Trace metal concentrations in pore fluid were directly related to total elemental concentrations in the solid phase, and did not reflect cumulative trends associated with anthropogenic enrichment. (Author's abstract)
W85-02084

RATES OF SEDIMENT-WATER EXCHANGE OF OXYGEN AND SEDIMENT BIOTURBATION IN LOUGH NEAGH, NORTHERN IRELAND,
New Univ. of Ulster, Coleraine (Northern Ireland). Limnology Lab.
B. Rippey, and D. H. Jewson.
Hydrobiologia, Vol. 92, p 377-382, July, 1982. 4 Fig, 28 Ref.

Descriptors: *Lough Neagh, *Northern Ireland, *Bioturbation, *Sediment-water interface, *Oxygen, *Lake sediments, Eutrophic lakes, Benthos, Chlorophyll a, Redox potential, Interstitial water, Advection.

Oxygen is transported 30 mm into the sediment at an 8 m depth site in eutrophic Lough Neagh by the irrigational activities of the benthic fauna. Faunal activity also mixes the upper 20 mm of sediment. Sediment oxygen uptake rate, redox potential-depth profile and the chlorophyll a concentration were measured in the upper sediment layers from February to November 1979. Chlorophyll a input to the sediment, following the Spring phytoplankton maximum, remained in the 0-1 cm sediment layer but did cause the redox potential profile to change from one with potentials around 400 mV in the upper 50 mm to one with a strong gradient over the 0-30 mm region. The start of benthic faunal activity in May caused the chlorophyll a to be mixed into the 1-2 cm layer and also caused oxygen to be transported into the sediment at a rate sufficient to change the redox potential back to its initial state. The biodiffusion coefficient for solids in the upper 20 mm was estimated to be (6 x 10 to the minus 8th power) sq cm/s. Oxygen transport in the pore waters of the upper sediment layers was considered to be best described as advection, caused by the irrigational activities of the benthic fauna. (Author's abstract)
W85-02085

VERTICAL STRATIFICATION IN SEDI... FROM A YOUNG OLIGOTROPHIC ... AFRICAN IMPOUNDMENT: IMPLICA... IN PHOSPHORUS CYCLING,
Natal Univ., Pietermaritzburg (South ... Dept. of Botany.
A. J. Twinch, and C. M. Breen.
Hydrobiologia, Vol. 92, p 395-404, July, ... Fig, 2 Tab, 42 Ref.

Descriptors: *Midmar Dam, *South Africa, ... phorus, *Oligotrophic lakes, *Sediments, ... carbon, Hydrogen ion concentration, Alu... Adsorption, Phosphates, Sediment-water in... Langmuir isotherms, Adsorption isotherm... topic tracers, Lakes.

Changes at the mud surface in Midmar Da... lowing impoundment, were studied by exa... vertical profiles of selected parameters in se... cores. Distinct stratification in organic carb... and exchangeable Al(3+) was evident. Phc... adsorption characteristics in the stratifie... ments was quantified using Langmuir ads... isotherms. The adsorption maxima and b... energy constants in the surface sediments ((... were markedly lower than those below ... indicating that the surface layers are less e... at binding phosphate than the deeper laye... diotracer experiments indicate that the layer ... prising the top 3 cm of sediment predomi... PO4-P exchange with the overlying wate... thor's abstract)
W85-02086

FLUX OF REDUCED CHEMICAL CONS... ENTS (FE(2+), MN(2+), NH4(+) AND ... AND SEDIMENT OXYGEN DEMAN... LAKE ERIE,
Wright State Univ., Dayton, OH. Dept. of ... istry.
D. D. Adams, G. Matisoff, and W. J. Snodgr...
Hydrobiologia, Vol. 92, p 405-414, July, 1... Fig, 4 Tab, 35 Ref. EPA contracts R 80571... R806756011, OWRT project A-059.

Descriptors: *Lake Erie, *Ammonium, *Me... *Ferrous iron, *Manganese, *Iron, *Se... oxygen demand, *Chemical reduction, C... demand, Lake sediments, Dissolved oxygen... ment-water interface, Interstitial water, Lake...

Sediment pore water concentrations of F... Mn(2+), NH4(+) and CH4 were analyzed... both diver-collected cores and an in situ equ... tion device (peeper) in Lake Erie's central ... Sediment oxygen demand (SOD) was measu... the same station with a hemispheric chamb... cluding DO probe and recorder) subtenc... known area of sediments. The average SO... 9.4 mM/sq m/day (0.3 g/sq m/day). From ... water gradients within the near-surface zon... chemical flux across the interface was calc... indirectly using Fick's first law modified fo... ments. These calculations, using core and ... gradients, always showed sediment loss to o... ing waters, and variations between the two ... niques differed by less than an order of mag... for Fe(2+) and CH4. The transport of the ... duced constituents can represent a sizeable o... demand, ranging from less than 1% for F... and Mn(2+) to as high as 26% for NH4(+... 30% for CH4. The average flux of these co... ents could account for about a third of the S... the sediment-water interface of this station. ... thor's abstract)
W85-02087

AVAILABLE PHOSPHORUS IN LAKE ... MENTS IN THE NETHERLANDS,
Northwestern Connecticut Regional Pla... Commission, Warren, CT. Lake Waramaug ... Force.
S. P. Klapwijk, J. M. W. Kroon, and M. L. M...
Hydrobiologia, Vol. 92, p 491-500, July, 1... Fig, 4 Tab, 21 Ref.

Descriptors: *Netherlands, *Phosphorus, ... sediments, *Algae, *Bioassays, Sediments, ...

, Nutrient uptake, Iron, Clays, Organic
, Lakes.

nount of phosphorus available to algae in the
nts of four lakes in the western part of the
rlands has been assessed by means of chemi-
ractions and bioassay techniques. In addition
ect chemical sediment analyses, extractions
carried out with an NTA column method
stepwise NH4 Cl-NaOH-HCl shaking
d, the latter supposedly separating the
bound, the Fe- and Al-bound and the Ca-
phosphates in the sediments. Bioassays, with
nt as the sole source of P, were made with
lesmus quadricauda in modified Skulberg's
dium to determine the amount of phosphates
le to algae. The average total P concentra-
the sediments varid from 0.8 to 3.6 mg P/g
and correlated well with the net external P
g of the lays. Uptake of P by algae in the
ys varied from 0.4 to 36% while NTA
ted 36-69% of the total P. The ratio NH4Cl
ted/NaOH extracted/HCl extracted phos-
is different from lake to lake, although in all
he highest extractions (27-62% of total P)
nd in the NaOH fraction. However, in the
sediments of these lakes, the NaOH step
ed not only the Fe- and Al-bound phos-
but, also, large amounts of humus com-
. Hence, this fraction also contains non-
le organic P. The results are related to soil
nd chemical characteristics of the sediments,
mpared with data from other authors. A
e correlation was found between phosphate
le to algae and NTA- and NaOH-extracta-
but the correlation with total phosphorus
gher. Algae-extractable P proved to be posi-
correlated with total iron and clay content
gatively with the amount of organic matter.
diments in the investigated lakes show great
lity and the chemical extraction techniques
replace the bioassays to assess the amount
sphorus available to algae. (Author's ab-

2092

**MNETIC NUTRIENT LOADING BY ME-
NETIC EROSION AND RESULTANT
L RESPONSES IN LAKE WARAMAUG,
ECTICUT,**
eemraadschap van Rijnland, Leiden (Neth-
).
Kortmann, D. D. Henry, A. Kuether, and S.
an.
biologia, Vol. 92, p 501-510, July, 1982. 8
Tab, 13 Ref.

ptors: *Lake Waramaug, *Connecticut,
nnion, *Nutrient loading, *Metalimnion,
growth, Cycling nutrients, Stratification,
iorus, Lake sediments, Secchi depth, Dis-
oxygen, Water temperature, Diffusion,
al stratification, Lakes.

iorus regeneration from lake sediments, and
ient migration to trophogenic surface water,
antly contributes to the lake nutrient budg-
algal bloom conditions in some lake types.
position of organic matter in deep water
liments results in the accumulation of regen-
nutrients, alternate electron acceptors (re-
products of anaerobic respirations = COD),
dioxide, and depletion of dissolved oxygen
n acceptor in aerobic respiration). Thermal
ation creates spatial segregation of tropho-
nd tropholytic environments in the lake,
g in gradients between sediments, hypolim-
nd the epilimnion. Exchange of oxygen,
ts, and reduced alternate electron acceptors
n the hypolimnion and epilimnion affects
ductivity of a lake. Secchi depth, tempera-
nd dissolved oxygen profiles were deter-
wice each week from May 1980 to October
each of five lake stations. Nutrient concen-
profiles, including total soluble and total
orus, ammonium-N, nitrate, soluble Kjel-
nd total Kjeldahl nitrogen were determined
ach month. Epilimnetic algal samples were
xd twice each week using Kemmerer and
column 'straw' samplers. Cell counts of
reen, bluegreen, and diatom algae groups
ade. Three methods were used to describe hypolimnetic-epilimnetic exchange, including coefficients of eddy diffusion (based on lake heat budget), a graphical method of defining thermocline location, and relative thermal resistance to mixing (RTRM, based on density differences). All three methods yielded comparable estimates of net seasonal transport. The graphical and RTRM methods described events occurring at shorter intervals (greater resolution). We find general agreement between the three methods of describing hypolimnetic-epilmnetic transport. The frequency of sampling resulted in increased resolution of thermal profiles (in time), allowing accurate estimation of short-term nutrient flux into epilimnetic waters. An algal bloom event occurred 5 to 12 days following erosion of the top of the metalimnion to below the aerobic-anaerobic interface. The lag time to peak algal concentration, following such events, decreased through the summer (June = 12 days, September = 5 days). (Author's abstract)
W85-02093

MECHANISMS FOR RELEASE OF SEDIMENT-BOUND PHOSPHATE TO WATER AND THE EFFECTS OF AGRICULTURAL LAND MANAGEMENT ON FLUVIAL TRANSPORT OF PARTICULATE AND DISSOLVED PHOSPHATE,
Ohio State Univ., Columbus. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W85-02095

ACIDIFIED LAKES: SEDIMENT TREATMENT WITH SODIUM CARBONATE - A REMEDY,
Lund Univ. (Sweden). Limnological Inst.
For primary bibliographic entry see Field 5G.
W85-02096

LAKE TREHORNINGEN RESTORATION PROJECT. CHANGES IN WATER QUALITY AFTER SEDIMENT DREDGING,
National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab.
For primary bibliographic entry see Field 5G.
W85-02097

SUMMER PEAK OF NUTRIENT CONCENTRATIONS IN LAKE WATER,
Japan Bottom Sediment Management Association, Tokyo.
For primary bibliographic entry see Field 5B.
W85-02098

DEEPWATER SEDIMENTS AND TROPHIC CONDITIONS IN FLORIDA LAKES,
Florida State Museum, Gainesville.
M. S. Flannery, R. D. Snodgrass, and T. J. Whitmore.
Hydrobiologia, Vol. 92, p 597-602, Jul, 1982. 4 Fig, 2 Tab, 12 Ref. NSF grant DAR 79-2418.

Descriptors: *Lake sediments, *Trophic level, *Eutrophication, *Florida, Lakes, Sediments, Aluminum, Iron, Calcium, Nitrogen, Phosphorus, Chlorophyll.

Sediment cores were taken from near maximum depth in 15 Florida lakes representing a wide range of trophic conditions. Chemical analyses of surface sediments showed Al, Fe, and Ca to be the most abundant elements in all samples, and the ratio of Al to Ca to be smaller for eutrophic lakes. Sediment organic matter increased with trophic state, as did the degree to which it was enriched in nitrogen. Corresponding sediment C/N ratios decreased with increasing lake trophic state and showed significant negative correlation with chlorophyll a, total N, and total P in the water column. The abrupt changes in the C/N ratios of the lake sediments may be indicative of dramatic changes in both trophic conditions and sedimentation rates. Before C/N ratios can be used along with sedimentary chlorophyll derivatives to indicate past trophic state, the sediment profiles must be reliably dated and compared to other fossil indicators of trophic condition. (Baker-IVI)
W85-02099

SEDIMENTATION RATES IN A SWISS-ITALIAN LAKE MEASURED WITH SEDIMENT TRAPS,
Commission of the European Communities, Ispra (Italy). Joint Research Centre.
For primary bibliographic entry see Field 2J.
W85-02100

CLIMATIC AND ANTHROPOGENIC EFFECTS ON THE SEDIMENTATION AND GEOCHEMISTRY OF LAKES BOURGET, ANNECY AND LEMAN,
Geneva Univ. (Switzerland). Inst. F.-A. Forel.
J. P. Vernet, and P.-Y. Favarger.
Hydrobiologia, Vol. 92, p 643-650, July, 1982. 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Sedimentation, *Geochemistry, *Climate, *Environmental effects, *Lake Bourget, *Lake Annecy, *Lake Leman, *France, *Switzerland, Palynology, Carbonates, Organic carbon, Heavy metals, Eutrophication, Lakes.

During the last glaciation, the Rhone glacier extended as far as the region of Lyon and covered Lakes Bourget, Annecy and Leman. Glacial retreat successively freed Lakes Bourget and Annecy, it reached Geneva around 14 000 B.P. and the head of Lake Leman at about 12 000 B.P. Deposits situated between Nyon and the foot of the Jura provide a complete palynological zonation and serve as a type section for the lake core studies. A palynological horizon (about 1 800 A.D.) has been found in Lake Bourget and wood has been dated at 3 230 +/- 65 B.P. (C-14) in a core from Lake Leman. Three 6 m cores from each lake were sampled together with many 0.5 m cores from Leman. The short Lake Leman cores have been dated by Cs-137 and provide a precise indication of changes in the basin during recent decades. Holocene climatic variations are evident in the Leman cores and are reflected by concentrations of carbonate and organic carbon which increase at the end of the Allerod and reach a maximum in the Atlantic Period (climatic optimum). Human settlement began at the beginning of the Christian era. All the cores show increases in the organic matter and nutrients; from the turn of the century in the Leman, and later for the other lakes where eutrophication started only a few decades ago. NAI-P shows a very recent increase, around 1965 in the Leman. Heavy metals (Hg, Cd and Pb) show increases at about 30 years ago in Annecy, at about the turn of the century in Lake Leman and in the mid-19th century in Lake Bourget. (Author's abstract)
W85-02102

SEASONAL STUDY OF METHANE OXIDATION IN LAKE WASHINGTON,
Washington Univ., Seattle. Dept. of Microbiology.
M. E. Lidstrom, and L. Somers.
Applied and Environmental Microbiology, Vol. 27, No. 6, p 1255-1260, June, 1984. 4 Fig, 3 Tab, 12 Ref. USDA grant 5901-0410-8-0154-0.

Descriptors: *Methane, *Oxidation, *Lake Washington, *Washington, Seasonal variation, Methane bacteria, Sediment-water interfaces, Sediments.

The distribution of methane and methane-oxidizing bacteria in the water column of Lake Washington was determined monthly for 1 year. The methane profiles were relatively constant, with little stratification and low concentrations (0.05 to 0.5 micro M). The number of methane-oxidizing bacteria detected by a filter-plating method was routinely < 1/ml throughout the water column, and no incorporation or oxidation of methane was detected by radioisotopic labeling, even after methane was added. However, samples taken from the sediment-water interface contained as much as 3 micro M methane and 50 CFU of methane-oxidizing bacteria per ml and showed significant rates of methane oxidation and incorporation. To define the region of maximum activity more precisely, vertical profiles of the sediment were examined. The concentration of methane increased with depth to a maximum of 150 to 325 micro M at 2.5 cm, and significant rates of methane oxidation were found within

the top 2.5 cm. The apparent Kms for methane and oxygen were determined for samples from the top 1.0 cm of the sediment and found to be ca. 10 and 20 micro M, respectively. Projected values for methane oxidation rates suggested that maximum methane oxidation occurred in the top 0.5 cm of the sediment. (Author's abstract)
W85-02134

DEPENDENCE OF HYPOLIMNETIC OXYGEN CONSUMPTION ON AMBIENT OXYGEN CONCENTRATION: FACT OR ARTIFACT,
McGill Univ., Montreal (Quebec). Dept. of Biology.
R. J. Cornett, and F. H. Rigler.
Water Resources Research, Vol. 20, No. 7, p 823-830, July, 1984. 7 Fig, 4 Tab, 35 Ref.

Descriptors: *Dissolved oxygen, *Hypolimnion, *Oxygen depletion, Aerobic respiration, Lake sediments, Chemical reactions, Seasonal variation.

Ten lakes studied in this investigation and the data presented by previous authors are all consistent with the hypothesis that rates of oxygen depletion in the hypolimnion of lakes do not depend upon the ambient oxygen concentration over the range of concentrations from 12 mg/L to 1.0 mg/L. By definition, aerobic respiration must stop when there is no more oxygen present. Therefore the hypolimnetic oxygen deficit can be modeled as a zero-order chemical process that is independent of oxygen concentration. Predictions of seasonal changes in hypolimnetic oxygen concentrations can be made by estimating the slope of the linear regression of oxygen concentration against the Julian day when the sample was collected. (Author's abstract)
W85-02149

2I. Water In Plants

STOMATAL CONTROL OF WATER USE EFFICIENCY IN POPLAR CLONES AND HYBRIDS,
Toronto Univ. (Ontario). Faculty of Forestry.
T. J. Blake, T. J. Tschaplinski, and A. Eastham.
Canadian Journal of Botany, Vol. 62, No. 7, p 1344-1351, July, 1984. 16 Fig, 2 Tab, 19 Ref.

Descriptors: *Water use efficiency, *Stomatal transpiration, *Poplar, Transpiration, Trees, Productivity, Leaves, Plant tissue.

Water use efficiency (WUE, the ratio of dry matter produced to water used in transpiration) was studied in 17 poplar clones and hybrids. Although WUE could not be predicted from the poplar group alone, water efficiency was found to vary in different poplar genotypes. For example, a balsam poplar, Populus maximowiczii M-4 (section Tacamahaca), and a white poplar clone, P. alba A-499 (section Leuce), had twice the dry matter production per unit of water transpired compared with another clone of P. maximowiczii (M-13) and a cottonwood clone, P. nigra N-80 (section Aegeiros), which showed low WUE. The reduced transpiration in water-efficient clones per unit of dry matter produced was associated with a higher stomatal resistance on the abaxial leaf surface. However, the physiological and morphological basis of WUE varied in different clones. Water-efficient clones exhibited one or more of the following adaptations restricting water loss: (i) conspicuous cuticular ledges or hairs above the pore openings of stomata, (ii) earlier partial stomatal opening in the morning, and (iii) smaller stomata and a lower stomatal frequency on the adaxial surface of the upper leaves. Poplar clones of low WUE exhibited less stomatal control of transpiration as a result of lower stomatal resistances and they lacked the above adaptations. Relative ranking of genotypes could not be predicted from either dry matter productivity or transpiration rate alone although the most water efficient clones generally exhibited lower transpiration rates compared with less efficient clones. (Author's abstract)
W85-01646

PHENOLOGY AND WATER RELATIONS OF THREE PLANT LIFE FORMS IN A DRY TREE-LINE MEADOW,
Washington Univ., Seattle. Dept. of Botany.
L. E. Jackson, and L. C. Bliss.
Ecology, Vol. 65, No. 4, p 1302-1314, August, 1984. 6 Fig, 2 Tab, 42 Ref. NSF grants DEB 79-13421 and DEB 78-23260.

Descriptors: *Drought, *Phenology, *Plant physiology, *Meadows, Soil water, Polygonum, Penstemon, Saxifraga, Dormancy, Stomatal transpiration, Conductance, Plant growth, Reproduction, Leaf water potential, Snowmelt.

The relationship between physiological and phenological adaptions to drought was examined in three species of different life form in a tree-line meadow in the Sierra Nevada. Soil moisture in this meadow is predictably high following snow melt, but decreases through the summer because of infrequent precipitation. There were large differences among the life forms in allocation patterns and in vegetative and reproductive phenologies, but there were no comparable differences in their water relations. The annual Polygonum minimum and the hemicryptophyte Penstemon heterodoxus respond to decreasing soil moisture by reducing conductance; they consequently maintain a longer activity period. The geophyte Saxifraga aprica has little stomatal control of water loss and becomes dormant as soils dry. Penstemon heterodoxus is a long-lived perennial with an intermediate root:shoot ratio (1.9), evergreen leaves, and a high allocationn to vegetative structures. Leaf growth occurs during the first part of the season, while the soil is moist. Flowering begins at the end of shoot growth, and fruits dehisce 3 mo after snow melt. During a dry summer, plants were observed to lose many leaves; 25% of the plants died, and none of the remaining plants flowered the next year. Although Penstemon decreases conductances under a limited range of leaf water potential, it is still not well adapted to long dry periods. Polygonum minimum is a very small annual with a low root:shoot ratio (0.15) and an indeterminate growth pattern. After a period of solely vegetative growth, leaves and floral structures produced continually until psi soil reaches - 5 MPa. Seeds dehisce about 2 mo after snow melt. Total seed production is a function of the length of the growth period. Regulation of water balance by stomatal control assures adequate time for fruit production. Other annuals in the community had a very similar phenological pattern. Saxifraga aprica has a high root:shoot ratio (5.0) and a small basal rosette of leaves. Leaf growth occurs for only 2 wk and is followed immediately by flowering. Only 5-10% of the plants flower each year. Fruits mature 5 wk after snow melt, and plants become dormant at - 0.5 MPa or within 6 wk of snow melt. This species and the other ephemeral geophytes complete their growth during the period of predictable high soil moisture, and therefore require little ability to regulate water balance. This study provides evidence that high diversity in life forms is maintained in environments with high yearly variability in the lengths of the drought and snow-free periods. No single set of phenological and physiological characteristics is optimally adapted to the variability in the subalpine environment that was studied, and therefore several adaptive strategies co-occur. (Author's abstract)
W85-01892

WATERLOGGING TOLERANCE OF LOWLAND TREE SPECIES OF THE SOUTH,
Clemson Univ., SC. Dept. of Forestry.
D. D. Hook.
Southern Journal of Applied Forestry, Vol. 8, No. 3, p 136-149, August, 1984. 2 Fig, 2 Tab, 79 Ref.

Descriptors: *Trees, *Flooding, *Waterlogging tolerance, Seedlings, Soil saturation, Soil-water plant relationships.

Waterlogging tolerance refers to a species' ability, from seedling stage to maturity, to tolerate soil saturation or inundation during the growing season. Many tree species in the South are adapted to periodic and/or prolonged soil waterlogging. Previously published waterlogging-tolerance ratings, a frequency-occurrence scheme, and relative waterlogging-tolerance rating are p ed in a table for southern lowland tree specie relative waterlogging tolerance ratings can b to predict in general what may happen population of a species in question under s conditions. In doing so, one must take into a the prior waterlogging history of the popu age, general vigor of the trees, type, du frequency, and timing of waterlogging. (I IVI)
W85-02111

AGRICULTURAL DROUGHTS AT PE PURAM, EAST GODAVARI DIST ANDHRA PRADESH,
Andhra Univ., Waltair (India). Dept. of Me ogy and Oceanography.
A. R. Subramaniam, and A. V. Rao.
Mausam, Vol. 34, No. 4, p 439-442, 1983. 2 Tab, 2 Ref.

Descriptors: *Drought, *Millet, *Crop *Peddapuram, *India, Soil water, Forec Water balance, Plant growth, Rainfall, Ragi.

Agricultural drought was studied in relat ragi (finger millet) grown under rainfed con at Peddapuram, India. Weekly meteorologic and yield data were analyzed for the perio to 1976. The regression relationship betwe yields of ragi and seasonal index of moistur quacy was developed for forecasting of crop The index of moisture adequacy and soil m as a percentage of available moisture capac computed during phenological stages of growth for the years of highest, normal and yields. For these years weekly water balan terns are also presented. For the highest yie (1964), soil moisture never fell below 50% the growth period. It never fell below 40% week of the growing season in 1960 when a yield was reported. Soil moisture only r 50% once during the crop growth period year (1965) when the crop failed comp (Moore-IVI)
W85-02126

WATER BALANCE AND CROPS IN KA TAKA,
Andhra Univ., Waltair (India). Dept. of Me ogy and Oceanography.
A. R. Subramaniam, and A. V. R. Kessavo R
Mausam, Vol. 35, No. 1, p 55-60, 1984. 9 Tab, 8 Ref.

Descriptors: *Hydrologic budget, *Plant wa tential, *India, *Climatic data, *Crop prod Rice, Kharif jowar, Rainfall, Evaporation Evapotranspiration, Water deficit, Moisture ability.

Karnataka, the sixth largest state in India, range of moist climates that allows a wide of crops. Climatic water balance data and have been calculated for all the available me logical stations in the State and they are graphically analyzed. The general distribut crops and the results of the analysis of m adequacy are compared to identify the lin moisture adequacy for certain important cro rice, jowar, baijra, ragi, sugarcane, grou cotton and coffee. In Kharif season, high p tion yields of jowar are generally being rec in areas of 70% moisture adequacy. (Wh IVI)
W85-02127

WATER HYACINTH CANOPY AND EVAPORATION,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 4A
W85-02128

Erosion and Sedimentation

ENTAL COMPOSITION OF SUSPEND-ARTICLES FROM THE YELLOW AND TZE RIVERS,
t-Doherty Geological Observatory, Pali-NY.
Li, H. Teraoka, T.-S. Yang, and J.-S. Chen.
imica et Cosmochimica Acta, Vol. 48, No. 561-1564, July, 1984. 2 Fig, 1 Tab, 14 Ref. grant EW 76-S-02-2185.

ptors: *Chemical composition, *Suspended nts, *Yellow River, *Yangtze River, , *Kansu Province, Loess, Erosion, Soil try, Trace metals, Calcium carbonate, um, Zinc, Copper, Nickle, Cobalt, Lead, pollution sources.

f the suspended particles downstream of the River are supplied by intensive erosion of s terraces of China. The elemental compo-f Yellow River suspended particles sampled 0 and 1981 closely resembles that of a loess obtained from the Kansu Province below soil surface). The high concentration nd Sr in both samples represents the occur-of CaCO3 minerals. The concentration of , Ni, Co and Pb in the suspended particles her in the Yangtze River than in the Yellow concentrations of these same elements in the River suspended particles are much closer e of the world's average soils than those of rld's average river suspended particles indi-that the pollution input of these trace metals Yellow River is minor as compared with the inputs. (Collier-IVI)
1703

STS, FLOODS, AND EROSION: A WA-HED EXPERIMENT IN THE SOUTH-ERN PIEDMONT,
a Univ., Athens. School of Forest Re-s.
lewlett, and R. Doss.
Science, Vol. 30, No. 2, p 424-434, June, Fig, 2 Tab, 16 Ref.

ptors: *Erosion, *Forest management, ing, *Georgia, *Forest watersheds, Forest-oods, Erosion, Storm runoff, Clearcutting, g management, Road construction.

ed watershed experiment to determine the of clearcutting and regeneration of pine on eorgia Piedmont showed that the small lows on dry soil may be increased 50 per-more, but that larger flood discharges from il were increased only 10 to 15 percent, if at e annual flood is apt to be of the latter type. asoned conclusion is that concern about the of forest operations on downstream flood-creeks and rivers is unwarranted. However, ates of discharge immediately below the on increased 30-45 percent, resulting in a cent annual increase in stormflow erosivity the 4-year cycle of harvesting, site prepara-nd machine planting. The increase in erosi-stormflows following this typical southern y operation, when considered in light of the panying increase in erosion hazard due to sturbance, warns the forest manager to in-his vigilance over road design, the selection eneration methods, and the maintenance of side protection zones. (Author's abstract)
1705

GN OF ARMOUR SYSTEMS FOR THE ECTION OF RUBBLE MOUND BREAK-RS,
(W.F.) and Associates, Ottawa (Ontario).
Baird, and K. R. Hall.
ian Journal of Civil Engineering, Vol. 11, p 164-176, June, 1984. 10 Fig, 41 Ref.

ptors: *Wave action, *Breakwaters, *Design , *Armor layers, Model studies, Concrete ction, Erosion control, Beach erosion.

Wave protection systems, or armor layers, evolved as breakwaters consisting of dumped stones or quarry run built in deeper water and at locations exposed to increasingly severe environmental loadings. There are two basic design methods, one involving the use of hydraulic model studies, the other involving the use of empirical equations that relate wave height to the weight of the armor unit. Both procedures have many limitations. Use of these design procedures in recent years have led to damage of many breakwaters. Well designed and carefully executed model studies are an essential part of the design of a large rubble mound structure located in deep water. Many of the rubble mound breakwaters existing today that have not been damaged contain an armor layer designed to be stable without the assistance of interlocking between units. The full potential of armor stones in protecting a breakwater has not been realized. Armor layers consisting of quarried stones could be used at many locations where more expensive and problematic concrete units have been used in the past, if innovative designs are used in place of traditional concepts. (Collier-IVI)
W85-01707

MORPHOLOGY AND RECENT SEDIMENTS OF THE LOWER ANASTOMOSING REACHES OF THE ATTAWAPISKAT RIVER, JAMES BAY, ONTARIO, CANADA,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
W. A. King, and I. P. Martini.
Sedimentary Geology, Vol. 37, No. 4, p 295-320, February, 1983/1984. 16 Fig, 2 Tab, 31 Ref.

Descriptors: *Attawapiskat River, *Ontario, *Sediments, *River morphology, *Channel morphology, Nival regime, Sediment transport, Floods, Anastamosis, Ice rafting, Ice jams, Sedimentation, Sedimentary structures.

The Attawapiskat River is one of the major low-gradient rivers which cross the flat wetlands of the Hudson Bay Lowland. It has a nival regime leading to strong, short-duration spring floods during which considerable amount of sediment is carried. For the remainder of the year only organic matter is transported in solution and suspension. The land is isostatically rebounding after the Pleistocene glaciations. The river downcuts through the softer Holocene estuarine basal clays and the Pleistocene tills, to the Paleozoic carbonate bedrock. The river develops an anastomosing pattern in the lower reaches and it acquires an irregular meandering character inland. It does not construct a significantly thick delta as the river-borne sediments are dispersed along the coasts by tides, longshore currents and ice rafting. The river is subjected to frequent ice jams its lower reaches as warmer southern waters flow toward the still frozen mouth and sea. During the jams, secondary channels become active, flooding develop and sedimentation occurs on the levees. Ice scours and ice-rafted materials affect the river banks greatly. The principal sedimentary environments within the river consist of: (1) erosional shoals covered by boulder and pebble lags over till, (2) sorted coarse to medium-sized sands in junction bars downstream from islands; these sands frequently develop gas bubbles, and they contain characteristic fining-upward sequences from boulder pavements at the base, grading up into rippled sand with abundant organic matter, grading up into laminated silt and sand and organic matter; (3) secondary channels, which develop thin silty and clay drapes on eroded hard substratum and are filled eventually by thick peats; and (4) river banks which show well-developed regressive sequences from Pleitocene tills at the base, overlain by estuarine sparsely fossiliferous clays, capped by thin conglomeratic units with abundant reworked Macoma balthica shells, grading upward into upper tidal flat sand, irregularly laminated sand and silt of marshes, and result interbedding of sand, silt and organic layers of the levees at the top. (Author's abstract)
W85-01734

SANTA ANA RIVER: AN EXAMPLE OF A SANDY BRAIDED FLOODPLAIN SYSTEM SHOWING SEDIMENT SOURCE AREA IMPRINTATION AND SELECTIVE SEDIMENT MODIFICATION,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
B. E. Haner.
Sedimentary Geology, Vol. 38, No. 1/4, p 247-261, March, 1984. 8 Fig, 18 Ref.

Descriptors: *Santa Ana River, *Floodplains, *Braided streams, *Sediments, Sediment sources, Sediment modification, Geomorphology, Sediment erosion, Particle, Sedimentation, Channel morphology.

The Santa Ana River floodplain can be divided into five geomorphic environments recognized by both morphology and sedimentary characteristics: braided channels, bars, vegetated islands, sand flats and floodplain terraces. The drainage basin discharge is dominated by the regional Mediterranean climate. The coarse channel sediment reflects the large temporal variations in drainage discharge and the resulting greater variability and competence to transport sediment. Major decreases in channel width during both seasonal summer drought and prolonged periodic drought exposes large areas of the floodplain to selective wind winnowing of fluvially derived sediment. This process operates on a small scale today, but during arid conditions in the late Wisconsin interglacial interval (prior to 22,000 yr B.P.) extensive sand flats along the Santa Ana River, distal alluvial fans, and sediment from minor tributaries were the sediment source for a major riverine dune field adjacent to the floodplain. Santa Ana River sediments originate from two distinct geologic provinces: the San Gabriel-San Bernardino granitic and metamorphic complex to the north and the granitic Perris Block to the south. Settling-tube analysis of sediments from tributary streams draining the Perris Block shows a distinctive bimodal distribution characterized by minimal sediment in the very coarse sand size (-1 to 0 phi size) inherited from the granitic grus parent material. Transportation results in sediment erosion; sediments are better sorted and finer grained with increasing distance from their source. A particle population is dependent upon grain size distribution at the initial source. Sediment populations are modified by subsequent erosion, selective grain-size transport deposition, and total deposition and mixing of several source areas. (Author's abstract)
W85-01735

SEDIMENTATION OF ORGANIC AND INORGANIC PARTICULATE MATERIAL IN LINDASPOLLENE, A STRATIFIED, LAND-LOCKED FJORD IN WESTERN NORWAY,
Bergen Univ. (Norway). Inst. of Marine Biology.
For primary bibliographic entry see Field 2L.
W85-01767

SEDIMENT TRANSPORT IN THE TANANA RIVER NEAR FAIRBANKS, ALASKA, 1982,
Geological Survey, Anchorage, AK. Water Resources Div.
P. E. Harrold, and R. L. Burrows.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4213, 1983. 53 p, 21 Fig, 35 Tab, 8 Ref.

Descriptors: Bed material, Bed material samplers, *Bedload, Bedload samplers, *Fluvial sediment, Geomorphology, Particle size, River hydraulics, *Sediment discharge, *Sediment load, Sediment transport, Suspended load, *Tanana River, *Alaska, Helley-Smith bedload sampler.

Suspended-sediment and bedload-transport rates for the Tanana River near Fairbanks can be related to water discharge, and annual sediment loads can be computed using these relations. For a site at Fairbanks the annual loads in 1982 were 26.1 million metric tons of suspended sediment and 227,000 metric tons of bedload. Data collected at five other sites within a 40-kilometer reach of the river indicate similar suspended-sediment-transport relations but bedload-transport relations varied from site to site. For all sites bedload is about 1 percent of

suspended-sediment load. Particle-size distribution of suspended sediment is similar at all six sites. Median particle size is generally in the silt range; only occasionally is it in the very fine sand range. Median particle size of bedload ranged from the gravel range to the medium sand range at four of the six sampling sites. At the farthest downstream site, Byers Island, and the farthest upstream site, above Chena River Floodway, median particle size of bedload was always in the sand range. (USGS)
W85-01769

SEDIMENT TRANSPORT IN THE TANANA RIVER NEAR FAIRBANKS, ALASKA, 1980-81,
Geological Survey, Anchorage, AK. Water Resources Div.
R. L. Burrows, and P. E. Harrold.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4064, 1983. 116 p, 42 Fig, 60 Tab, 8 Ref.

Descriptors: *Bed material, Bed material samplers, Bedload, Bedload samplers, Fluvial sediment, Geomorphology, Particle size, River hydraulics, Rivers, Sediments, Sedimentation, Sediment discharge, *Sediment load, *Sediment transport, Suspended load, Tanana River, *Alaska, Helley-Smith bedload sampler.

Suspended-sediment- and bedload-transport rates for the Tanana River near Fairbanks, Alaska, can be related to water discharge. Annual sediment loads can be computed using these relations. For a site at Fairbanks, the annual loads in 1980 were 22.0 million metric tons of suspended sediment and 272,000 metric tons of bedload; in 1981, 27.3 million metric tons of suspended sediment and 333,000 metric tons of bedload passed the Fairbanks site. Data collected at five other locations within a 40 km reach of the river indicate very similar suspended-sediment transport relations, but bedload-transport relations vary from site to site and between 1980 and 1981. For all sites bedload is usually 1 to 1.5 percent of suspended-sediment load. Particle-size distribution for suspended sediment is similar at all six sites. Median particle size is generally in the silt range; only occasionally is it in the very fine sand range. Median particle size of bedload varied from the gravel range to the medium sand range for five of the six sampling sites in both years. At the sixth site, the most downstream location, median particle size of bedload was in the sand range. (USGS)
W85-01788

DAILY WATER AND SEDIMENT DISCHARGES FROM SELECTED RIVERS OF THE EASTERN UNITED STATES: A TIME-SERIES MODELING APPROACH,
Geological Survey, Lakewood, CO. Water Resources Div.
M. J. Fitzgerald, and M. R. Karlinger.
Available from the Distr. Br., USGS, 604 S. Pickett St., Alex., VA 22304. USGS Water Supply Paper 2216, 1983. 24 p, 14 Fig, 7 Tab, 24 Ref.

Descriptors: *Model studies, Statistical models, *Hydrologic data, *Spectral analysis, Time-series modeling, *Sediment discharges, *Atlantic drainage.

Spectral and time-domain techniques were applied to daily water and sediment-discharge records from selected rivers of the eastern United States. Time-series models are constructed for analysis of the runoff-sediment yield system. Logarithmic transformation and first-order differencing of the data sets produced second-order, stationary time series and removed seasonal trends. Cyclic models accounted for less than 42 percent of the variance in the water series and 31 percent in the sediment series. Spectral results indicate frequently occurring storm runoff can account for as much as 50 percent of the variation in sediment discharge. Coherence and phase spectra indicate that a linear representation is reasonable for the water-sediment system. Transfer-function models that incorporate water discharge as input prove superior to univariate techniques in modeling and prediction of sediment yields. The random component that includes errors in measurement and model hypothesis indicates no serial correlation. The unit step-response function, calculated from impulse-response weights, can serve as an index of sediment production within or between drainage basins. (USGS)
W85-01823

EROSION AND SEDIMENTATION CHRONOLOGY OF THREE WATERSHEDS IN MARYLAND,
Maryland Univ., College Park. Dept. of Geology.
A. V. Segovia, J. D. Foss, D. Fanning, and G. Demas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207356, Price codes: A07 in paper copy, A01 in microfiche. Maryland Water Resources Research Center, College Park, Publication No. 77, August, 1983. 126 p, 13 Plates, 13 Tab, 23 Fig, 96 Ref, 3 Append. Project No. OWRT A-058-MD(1), Contract/Grant No. 14-34-0001-2122.

Descriptors: Carbon radioisotopes, *Erosion, *Sedimentation, *Small watersheds, Diatoms, Residual soils, Deposition, Soil horizons, Soil profiles, *Phytoliths, Vertical succession, Deforestation, Cultivation, *Maryland, *Soil erosion.

Three small watersheds located in the Piedmont and Eastern Shore of Maryland were studied. The investigation included descriptions of residual and depositional soils. Buried soil horizons were dated by Carbon-14. In addition, phytoliths were studied to identify the vegetation contemporaneous with the deposition of soil levels. The presence of vertical successions of soil profiles indicate that rates of erosion and redeposition of soils varied in the last thousand years. Noticeable soil horizons were formed during long periods of slow erosion and little deposition, following short intervals of fast erosion and redeposition. Soil erosion was strong after the European contact, as a result of deforestation and intensive agricultural use of the land. The pre-European surface is buried in the lower part of the watersheds to depths of up to 130 centimeters (4+ ft) and the average rate of erosion for the last 300 years is interpreted to have been close to two tons per acre per year. The soil profile buried under post European-contact sediments indicates a period of moderately fast erosion. The presence of corn phytoliths in this part of the section, the scarcity of grass phytolith and the presence of diatom tests in the soils of a closed depression suggest that erosion was caused by slash-burn methods of agriculture. Thus, the last two episodes of accumulation are ascribed to nonclimatic causes in contrast to previous episodes during the Holocene which were probably caused by climatic fluctuations. The study also demonstrated the feasibility of using phytoliths to interpret soil discontinuities in Maryland and to reconstruct past environmental conditions and sequences of dry and wet periods.
W85-01835

ESTIMATES OF DISSOLVED AND SUSPENDED SUBSTANCE YIELD OF STREAM BASINS IN MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 5A.
W85-01942

SEDIMENT TRANSPORT IN THE LOWER YAMPA RIVER, NORTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. G. Elliott, J. E. Kircher, and P. Von Guerard.
Available from the OFSS, USGS, Box, 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 84-4141, 1984. 44 p, 9 Fig, 14 Tab, 29 Ref.

Descriptors: *Sediment transport, Annual streamflow, Flow duration, *Annual sediment load, *Sediment budget, *Colorado, Yampa River, Deerlodge Park, Yampa Canyon, Dinosaur National Monument.

Discharge measurements and sediment
were taken at streamflow-gaging station 09
Yampa River at Deerlodge Park in 1982 a
to determine the annual sediment supply
Yampa Canyon in Dinosaur National Mon
Forty-three years of discharge records at tw
utary sites were combined to determine the
discharge of the Yampa River at Deerlodg
A mean annual hydrograph and flow-d
curve were derived from these data. Se
transport equations were derived for total se
discharge, suspended-sediment discharge,
dischagre, and the discharge of sediment in
particle-sizes. Annual sediment discharge w
termined by the flow-duration, sediment
curve method and indicated annual total se
discharge was approximately 2.0 million t
year of which 0.8 million tons per year wa
sized material. Bedload was almost entirel
and annual bedload discharge was 0.1 milli
per year. Development of water resources
Yampa River basin could effect the geom
character of the Yampa River at Deerlodg
and the Yampa Canyon. Several scenario
tered streamflow frequency distribution,
streamflow volume, and reduced sediment
are examined to estimate the effect on the se
budget at Deerlodge Park. (USGS)
W85-02045

BOTTOM DYNAMICS IN LAKES,
National Swedish Environment Protection
Uppsala (Sweden). Water Quality Lab.
L. Hakanson.
Hydrobiologia, Vol. 91, p 9-22, July, 1982.
2 Tab, 39 Ref.

Descriptors: *Lake sediments, *Bottom sed
*Bottom sampling, Sediments, Erosion,
ment, Wind-driven currents.

A proper understanding of the bottom d
conditions (erosion, transportation, accum
in lakes is essential in most sedimentologic
texts. Fine cohesive materials generally do
the open water areas, whereas coarser
(sand, gravel) dominate shallow regions whe
sion and transportation of fine materials prev
present, there is no physical model available
describes the linkage between the energy
of the water-mass and the capacity for se
entrainment in open water areas. Wat
energy depends on, e.g. wind direction, du
velocity, fetch, and the presence of a therm
Entrainment depends on, e.g. density, comp
water and organic content of the sediments
number and type of bottom fauna. Four di
methods are used to determine bottom dy
two are site typical and two lake typical. S
lake typical methods each include one
based on collected field data and one ba
theoretical data. One method, the cone app
is presented for the first time. It consists
cones, one of which has a narrow angle a
other a wide angle, which are zero adjusted
sediment surface before being released to pe
the sediments. The differential cone penet
refered to as the penetration ratio, is used
cate the degree of surficial sediment comp
This simple, inexpensive instrument provides
titative data on physical sediment charact
which may be related to bottom dynamic
tions. (Author's abstract)
W85-02054

**ENTRAINMENT, DEPOSITION, AND T
PORT OF FINE-GRAINED SEDIMENT
LAKES,**
California Univ., Santa Barbara. Dept. of Me
cal and Environmental Engineering.
W. Lick.
Hydrobiologia, Vol. 91, p 31-40, July, 1982.
1 Ref.

Descriptors: *Entrainment, *Sedimentation,
Erie, Great Lakes, Deposition, Sediment tra
Turbidity, Vertical distribution, Benthic en
ment.

cent work on the settling, diffusion, entrain-
nt, and deposition of fine grained sediments in
hwater is reviewed and synthesized. Particular
ention is given to the dependence of these proc-
es on sediment properties such as particle size.
e application of this knowledge to the analysis
numerical modeling of sediment transport is
discussed. Much of the work is concerned
h the Great Lakes, and more specifically, with
Western Basin of Lake Erie. Entrainment ex-
iments have been carried out which demon-
te that entrainment depends on at least the
ulent stress at the sediment-water interface;
er content of the deposited sediments; composi-
of the deposited sediments, including mineral-
particle-size distribution and organic content;
ical distribution of sediment properties, manner
leposition of sediments; and activity of benthic
anisms and bacteria. Particle size variation is a
ificant factor and because of this the amount of
erial available for entrainment at a particular
s is finite. The available sediments participate
inuously in the entrainment and deposition
e. Some numerical modeling of sediment trans-
has been done. Problems arise because sedi-
t properties are highly variable spatially and
with time. Additional research is needed to
rmine particle collision rates, the probability
particles will adhere after collision, the causes
isaggregation, and the rates at which particles
ggreagate. (Baker-IVI)
-02055

**/SICAL AND GEOCHEMICAL CHARAC-
ISTICS OF SUSPENDED SOLIDS,
TON CREEK, ONTARIO,**
onal Water Research Inst., Winnipeg (Manito-

primary bibliographic entry see Field 2H.
-02056

**IMENTATION IN FLUVIAL AND LACUS-
NE ENVIRONMENTS,**
wa Univ. (Ontario). Dept. of Geology.
Rust.
robiologia, Vol. 91, p 59-70, July, 1982. 10 Fig,
, 60 Ref.

riptors: *Lake sediments, *Stream sediments,
imentation, *Ottawa River, Channeling, Clas-
eposition, Mercury, Path of pollutants, Lakes.

nentation in rivers is dominated by a complex
physical processes associated with the unidir-
nal flow of water. Variations in these process-
ive rise to different fluvial channel types,
e character can commonly be recognized in
ncient record. Chemical and biological proc-
are comparatively unimportant in fluvial sedi-
ation. In contrast, physical, chemical or bio-
al processes can each dominate sedimentation
es. Physical (clastic) deposition dominates in
latitude and mountain lakes (in which chemi-
nd biological activity are low), and in lakes
high relief of the drainage basin and lake
Its variety reflects a range of processes influ-
by river inflow, wave and current action,
al and density effects. Economic benefits
the study of lake and river sedimentation
le both resource and environmental aspects.
ample is given of a mercury pollution study
Ottawa River, Ottawa. It shows that return
ckground levels can take place within a rela-
short interval after cessation of pollutant
(Author's abstract)
02057

**PARISON OF SEDIMENT ENERGY-TEX-
E RELATIONSHIPS IN MARINE AND LA-
RINE ENVIRONMENTS,**
la Centre for Inland Waters, Burlington (On-

Sly, R. L. Thomas, and B. R. Pelletier.
biologia, Vol. 91, p 71-84, July, 1982. 11 Fig,
, 37 Ref.

riptors: *Sediments, *Lake sediments,
ne sediments, *Sediment erosion, Sedimenta-
Silt, Clay, Erosion.

Sediments in the marine environment are generally subject to higher energy levels than those of lake systems, and lakes are virtually unaffected by tidal range which modifies beach structures formed in response to wave effects. However, despite different energy levels, the textural characteristics of both marine and lacustrine sediments are very similar. The main difference between marine and lacustrine facies is the depth range over which characteristics remain consistent. In lakes, depth limitation may influence the development of surface waves and restrict textural distributions. Simple textural relationships can be used to describe comparable marine and lacustrine sedimentary conditions. Sediments which have been altered by post-depositional erosion, such as lag deposits, or by ice-drop or wind blown settlement, show comparable textural modifications. The settlement of silt and clay particulates, in the marine environment and lakes, may differ slightly because of the chemical differences between salt and fresh water. (Author's abstract)
W85-02058

LAND USE EFFECTS ON SEDIMENT YIELD AND QUALITY,
British Columbia Univ., Vancouver. Dept. of Geography.
For primary bibliographic entry see Field 6G.
W85-02060

BASIC CONCEPTS AND ASSOCIATED STATISTICAL METHODOLOGY IN THE GEOCHEMICAL STUDY OF LAKE SEDIMENTS,
Geneva Univ. (Switzerland). Inst. F.-A. Forel.
J. M. Jaquet, E. Davaud, F. Rapin, and J. P. Vernet.
Hydrobiologica, Vol. 91, p. 139-146, July, 1982. 4 Fig, 1 Tab, 23 Ref.

Descriptors: *Lake sediments, *Sedimentation, *Lac Leman, *Switzerland, Lakes, Sediment transport, Geochemistry, Particle size, Calcium carbonate.

A few of the fundamental concepts that underlie geochemical investigations are discussed on the basis of data collected in Lac Leman, Switzerland. Specifics include the carrier substance, the natural background level, the grain-size effects and the areal variability of geochemical associations. The key role played by the statisical methods in expressing, testing, and refining these concepts is emphasized. Ordination diagrams clearly suggest the existence of several carrier substances in Lac Leman, some of them unsuspected. The need for reliable background levels in environmental geochemistry can be met by expressing them as a simple function of a major sediment constituent, calcium carbonate, in the case of Lac Leman. The use of the complete grain-size spectrum, instead of its moments only, leads to a significant refinement of the notion of grain-size effect. It is now possible to know, by means of a simple correlation analysis, in what size fractions major and minor constituents are most likely to be found. A combination of R- and Q-mode analysis was instrumental in demonstrating the variability of geochemical associations within the lake. Relationships between carrier substances and trace metals can be computed facies by facies, thus avoiding the adverse effect, on the correlation coefficients, of lumping together distinct sub-populations. (Baker-IVI)
W85-02064

CARBON FLOW ACROSS THE SEDIMENT-WATER INTERFACE IN LAKE VECHTEN, THE NETHERLANDS,
Limnologisch Inst., Nieuwersluis (Netherlands).
For primary bibliographic entry see Field 2H.
W85-02066

LOADING CONCENTRATION MODELS FOR PHOSPHATE IN SHALLOW LAKES,
Centre d'Ecologie de Camargue (France).
For primary bibliographic entry see Field 2H.
W85-02067

DIURNAL VARIATION IN THE OXYGEN UPTAKE OF RIVER SEDIMENTS IN VITRO BY USE OF CONTINUOUS FLOW-THROUGH SYSTEMS,
Copenhagen Univ., Hilleroed (Denmark). Det Ferskvands-Biologiske Lab.
For primary bibliographic entry see Field 2E.
W85-02069

MASS BALANCE MODELS OF PHOSPHORUS IN SEDIMENTS AND WATER,
Canada Centre for Inland Waters, Burlington (Ontario).
D. C. L. Lam, W. M. Schertzer, and A. S. Fraser.
Hydrobiologia, Vol. 91, p 217-225, July, 1982. 8 Fig, 6 Ref.

Descriptors: *Sediment-water interfaces, *Phosphorus, *Model studies, Mass balance models, Sediment transport, Lakes, Lake Erie.

A hierarchy of models is examined and the advantages and disadvantages of increasing their spatial complexity is determined as it relates to mass balance of phosphorus in sediments and water. In addition, the relationships of the results derived from these models are explained with the view that the results from models of progressive complexity are interdependent and can be synthesized into a more comprehensive description of the actual environment than any particular one of them can. As an example, the total phosphorus concentrations in the Western, Central and Eastern Basins of Lake Erie are simulated with the three-box, six-box and multi-box mass-balance models. The emphasis, here, is placed on the effect of thermal stratification and interbasin transport on the settling and sediment return of total phosphorus as the spatial complexity of the model increases. While it is understood that there are several forms or compartments of phosphorus which contribute differently to the total concentration, there are uncertainties associated with the kinetics between the different forms. (Baker-IVI)
W85-02071

ANALYSIS OF TOTAL PHOSPHORUS TRANSPORT IN RIVER SYSTEMS,
West Virginia Univ., Morgantown.
For primary bibliographic entry see Field 2E.
W85-02074

MICROBIAL METABOLISM IN SURFACE SEDIMENTS AND ITS ROLE IN THE IMMOBILIZATION OF PHOSPHORUS IN OLIGOTROPHIC LAKE SEDIMENTS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
C. Doremus, and L. S. Clesceri.
Hydrobiologia, Vol. 91, p 261-268, July, 1982. 5 Fig, 2 Tab, 30 Ref.

Descriptors: *Lake sediments, *Oligotrophic lakes, *Phosphorus, *Lake George, *New York, Microorganisms, Metabolism, Organic matter, Detritus, Eutrophication, Anaerobic conditions.

Rapid microbial metabolism and a large phosphorus uptake potential were noted in surface sediments of Lake George, New York. This sediment also exhibited a phosphorus limited condition and a large reservoir of inorganic phosphorus associated with humic substances. These observations suggest that the empirically observed phosphorus retention in oligotrophic lake sediments may be promoted by a rapid cycling of phosphorus between microflora and its associated organic matter. A conceptual model is presented describing phosphorus interactions in surface profundal sediments. Sedimenting organic P settles onto the oxidized sediment where it cycles rapidly within the microbial-detrital complex. Detritovores mobilize phosphorus through excretion and burrow pumping. A significant quantity of phosphate-phosphorus is adsorbed onto the biodetrital complex. This adsorbed pool is part of the biodetrital P buffering capacity because it participates as an intermediary between microbial biomass and inorganic phosphorus. Non-adsorbed inorganic phosphorus probably becomes sequestered

in ferric hydroxide compounds. Biodetritus in the reduced sediments tends to be less microbially active and less efficient due to anaerobic metabolism. This phenomenon and the lack of an iron sequestering mechanism causes phosphate to accumulate in deep sediments and diffuse upward. As a lake proceeds along the eutrophication continuum, phosphorus release in anoxic eutrophic sediments may be attributed to phosphorus inputs to the sediments in quantities that are greater than the buffering capacity of the biodetritus. The shift from an aerobic to an anaerobic metabolism in surface sedimentary biodetritus may also aid in the loss of retentive efficiency in eutrophic lake sediments. (Baker-IVI)
W85-02076

PHOSPHATE ADSORPTION KINETICS OF RESUSPENDED SEDIMENTS IN A SHALLOW LAKE, NEUSIEDLERSEE, AUSTRIA,
Vienna Univ. (Austria). Limnologische Lehrkanzel.
For primary bibliographic entry see Field 2H.
W85-02079

PARTICLE SIZE DISTRIBUTION AND CHEMICAL PARAMETERS OF THE SEDIMENTS OF A SHALLOW TURBID IMPOUNDMENT,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Botany.
For primary bibliographic entry see Field 2H.
W85-02082

INTERACTION BETWEEN INTERSTITIAL WATER AND SEDIMENT IN TWO CORES OF LAC LEMAN, SWITZERLAND,
Geneva Univ. (Switzerland). Dept. of Inorganic, Analytical and Applied Chemistry.
For primary bibliographic entry see Field 2H.
W85-02084

VERTICAL STRATIFICATION IN SEDIMENTS FROM A YOUNG OLIGOTROPHIC SOUTH AFRICAN IMPOUNDMENT: IMPLICATIONS IN PHOSPHORUS CYCLING,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Botany.
For primary bibliographic entry see Field 2H.
W85-02086

TRANSPORT OF IRON AND MANGANESE IN RELATION TO THE SHAPES OF THEIR CONCENTRATION-DEPTH PROFILES,
Freshwater Biological Association, Windermere (England).
For primary bibliographic entry see Field 2K.
W85-02090

DEEPWATER SEDIMENTS AND TROPHIC CONDITIONS IN FLORIDA LAKES,
Florida State Museum, Gainesville.
For primary bibliographic entry see Field 2H.
W85-02099

SEDIMENTATION RATES IN A SWISS-ITALIAN LAKE MEASURED WITH SEDIMENT TRAPS,
Commission of the European Communities, Ispra (Italy). Joint Research Centre.
G. Premazzi, and G. Marengo.
Hydrobiologia, Vol. 92, p 603-610, July, 1982. 4 Fig, 5 Tab, 26 Ref.

Descriptors: *Tripton, *Sedimentation, *Lake Lugano, *Italy, *Switzerland, Mineralization, Stratification, Phosphorus, Nitrogen, Organic carbon, Diffusion, Decomposition, Lake sediments, Nutrients.

Tripton sedimentation was investigated in the eutrophic Lake Lugano (Ponte Tresa basin) from October 1979 to October 1980. The annual amount of tripton collected was 748 g/sq m/y. Phosphorus, nitrogen and organic carbon fluxes into the hypolimnion were estimated to be 1.9, 16.2 and 121 g/sq m/y respectively. Mineralization rates into the trophogenic layer varied from 11% to 19% per day during summer stratification. The regeneration processes contribute about 60% of the calculated P deficit in the epilimnion. The tripton is decomposed mostly in the metalimnion, out of the euphotic zone; from here the phosphorus is carried back to the overlying waters by diffusion processes. (Author's abstract)
W85-02100

EFFECTS OF SEDIMENTATION ON THE STORAGE CAPACITY OF THE HIGH ASWAN DAM RESERVOIR,
Ministry of Irrigation, Cairo (Egypt). Research Inst. of High Dam Side Effects.
For primary bibliographic entry see Field 4A.
W85-02101

CLIMATIC AND ANTHROPOGENIC EFFECTS ON THE SEDIMENTATION AND GEOCHEMISTRY OF LAKES BOURGET, ANNECY AND LEMAN,
Geneva Univ. (Switzerland). Inst. F.-A. Forel.
For primary bibliographic entry see Field 2H.
W85-02102

STANDARDIZATION OF METHODS OF ANALYSIS FOR HEAVY METALS IN SEDIMENTS,
Institute for Soil Fertility, Groningen (Netherlands).
For primary bibliographic entry see Field 5A.
W85-02104

SEDIMENT CONCENTRATIONS FROM INTENSIVELY PREPARED WETLAND SITES,
Clemson Univ., SC. Belle W. Baruch Forest Science Inst.
For primary bibliographic entry see Field 4C.
W85-02112

OBJECTIVE IDENTIFICATION OF POOLS AND RIFFLES,
State Univ. of New York at Buffalo. Dept. of Geography.
For primary bibliographic entry see Field 2E.
W85-02159

2K. Chemical Processes

NITROGEN AND PHOSPHORUS IN THE NGONGOTAHA STREAM,
Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Science Centre.
For primary bibliographic entry see Field 5B.
W85-01635

VEGETATION AND WATER CHEMISTRY OF FOUR OLIGOTROPHIC BASIN MIRES IN NORTHWESTERN ONTARIO,
Alberta Univ., Edmonton. Dept. of Botany.
For primary bibliographic entry see Field 2H.
W85-01648

STATISTICAL ANALYSIS AND EVALUATION OF WATER-QUALITY DATA FOR SELECTED STREAMS IN THE COAL AREA OF EAST-CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-01770

ORIGINS AND DISTRIBUTION OF SALINE GROUND WATERS IN THE FLORIDAN AQUIFER IN COASTAL SOUTHWEST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. C. Steinkampf.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, Price: $4.75 in paper copy, $3.50 in microfiche. USGS Water Resources Investigations Report 82-4052, 1982. 34 p, 13 Fig, 7 Tab, 36 Ref.

Descriptors: *Geochemistry, *Water qu *Groundwater, *Saline water, Aquifers, Carbo rocks, Diagenesis, Distribution, Salinity, *Flo Floridan aquifer, Charlotte County, De County, Lee County, Manatee County, Sara County.

Twenty-three ground-water samples from Floridan aquifer in coastal southwest Florida s that water quality deteriorates to the south west. The waters grade from a fresh calcium nesium bicarbonate sulfate type to a very sa sodium magnesium chloride type downgrad Bromide-chloride and specific conductance r indicate that dilution of marine-like ground w is a signigicant mechanism in the evolution of different water types found. Calcium, magnes and bicarbonate concentrations occur within a atively narrow range and are primarily a func of mineral equilibria. Magnesium and stront concentration distributions suggest several min water interactions, including aragonite inver incongruent solution of magnesium calcite lower magnesian form, and dedolomitization. fate concentrations increase downgradient evince gypsum-anhydrite solution, particularl the fresher waters. The extent to which each fa affects dissolved specie concentrations is a func of the location of the water in the flow syst (USGS)
W85-01778

HYDROGEOCHEMICAL INVESTIGATION THERMAL SPRINGS IN THE BLA CANYON-HOOVER DAM AREA, NEVA AND ARIZONA,
Nevada Univ. System, Reno. Water Resou Center.
W. A. McKay, and D. E. Zimmerman.
Available from the National Technical Informa Service, Springfield, VA 22161 as PB84-202 Price codes: A04 in paper copy, A01 in microfi Publication 41092, November 1983. 40 p, 10 Fi Tab, 36 Ref. Project No. OWRT A-100-NEV Contract/Grant No. 14-34-0001-2130.

Descriptors: *Thermal water, *Colorado Ri *Stable isotopes, *Chemical analysis, *Ther springs, Geochemistry, *Tritium, Chemical geo ermometry, Nevada, Arizona, Black Canyon.

An estimated 80 liters/sec. of spring flow charges from both sides of the Colorado River Black Canyon, Nevada, and Arizona. The spri issue primarily from the highly faulted and fr tured volcanic rocks which are exposed throu out the canyon from Hoover Dam to 9.5 kilo ters downstream. Chemical analysis of the spr waters, including environmental isotope and t um results, indicate a variety of possible orig Possible source waters include, in order of estim ed importance, recirculated Lake Mead water, gional groundwaters from the north, west, east, deep circulating hydrothermal fluids, and cally recharged groundwaters. Observed surf temperatures range from 24 C to 62 C. To dissolved solids values range from 500 mg/l 3600 mg/l. Tritium concentrations range from T.U. to 116 T.U. While thermodynamic calcu tions indicate oversaturation of these waters w respect to several silicate and carbonate miner the occasional absence of secondary mineral dep its suggests a potentially young system.
W85-01804

SHORT-TERM CHANGES IN THE BASE NE TRALIZING CAPACITY OF AN ACID AI RONDACK LAKE, NEW YORK,
Syracuse Univ., NY. Dept. of Civil Engineeri
For primary bibliographic entry see Field 5B.
W85-01917

DISTRIBUTION OF SELECTED CHEMIC CONSTITUENTS IN WATER FROM TH FLORIDAN AQUIFER, SOUTHWEST FLOR DA WATER MANAGEMENT DISTRICT,
Geological Survey, Tallahassee, FL. Water R sources Div.

primary bibliographic entry see Field 7C.
-01928

UND WATER IN THE REDDING BASIN, STA AND TEHAMA COUNTIES, CALI-NIA,
ogical Survey, Menlo Park, CA. Water Re-ces Div.
primary bibliographic entry see Field 4B.
-01945

GLET OXYGEN IN SURFACE WATERS - T I: FURFURYL ALCOHOL AS A TRAP-G AGENT,
enoessische Anstalt fuer Wasserversorgung, asserreinigung und Gewaesserschultz, Due-orf (Switzerland).
. Haag, J. Hoigne, E. Gassman, and A. M. n.
nosphere, Vol. 13, No. 5/6, p 631-640, 1984. 5 29 Ref. Swiss National Science Foundation ect 2.027-0.81.

criptors: *Oxygen, *Trapping, *Furfuryl alco-*Natural waters, Water analysis, Photochemi-eactions, Oxidants, Oxidation-reduction poten-Chemical reactions.

mparison was made between the product dis-tions obtained with Black Lake humic acid rose bengal as a test of the intermediacy of et oxygen in humic acid photosensitized oxy-tion of furfuryl alcohol (FFA). The HPLC ses showed that peaks due to phosphate and c acid were too small to interfere, and that the uct distributions were the same both in the k Lake humic acid and the rose bengal sensi-systems. These facts, together with the obser-ns that no oxygen consumption occurred in rradiated solutions in the absence of either or sensitizer, constitutes sizeable evidence for ntermediacy of singlet oxygen in these reac-. Singlet oxygen concentrations in natural rs exposed to sunlight are most easily deter-d by adding a low concentration of acceptor following its first order rate of consumption. is recommended as a highly soluble, efficient ing agent for singlet oxygen determinations in ral waters. (Baker-IVI)
-01964

GLET OXYGEN IN SURFACE WATERS - T II: QUANTUM YIELDS OF ITS PRO-CTION BY SOME NATURAL HUMIC MA-IALS AS A FUNCTION OF WAVE-GTH,
enoessische Anstalt fuer Wasserversorgung, asserreinigung und Gewaesserschultz, Due-orf (Switzerland).
. Haag, J. Hoigne, E. Gassman, and A. M. n.
nosphere, Vol. 13, No. 5/6, p 641-650, 1984. 5 2 Tab, 12 Ref. Swiss National Science Foun-n Project 2.027-0.81.

criptors: *Oxygen, *Water analysis, *Natural rs, *Dissolved solids, Chemical reactions, ochemical reactions.

ntum yields of singlet oxygen production by ral aquatic organic matter decrease with in-sing wavelength, indicating that calculations ming a constant quantum yield measured at a let short wavelength can overestimate the ly state singlet oxygen concentrations in sunlit ace waters by more than a factor of 2. Isolated ic acids exhibit peaks in singlet oxygen pro-ion at longer wavelengths than natural dis-ed organic materials suggesting that com-nds other than humics are also responsible for let oxygen production in natural waters. Vari-methods of measurement suggest that singlet gen concentrations in the upper few centime-of natural surface waters under noon, spring or Swiss sunlight lie in the range of 1-3 x 10 to the s 14 M per mg/L dissolved organic material. f-lives of reactive organics are a few days to a hours. Reaction with singlet oxygen will be an ortant degradation pathway for relatively few ropollutants. (Baker-IVI)
5-01965

OCCURRENCE, QUALITY, AND USE OF GROUND WATER IN ORCAS, SAN JUAN, LOPEZ, AND SHAW ISLANDS, SAN JUAN COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-02043

ALGAL-AVAILABILITY OF PARTICULATE PHOSPHORUS FROM DIFFUSE AND POINT SOURCES IN THE LOWER GREAT LAKES BASIN,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
T. C. Young, and J. V. DePinto.
Hydrobiologia, Vol. 91, p 111-119, July, 1982. 6 Fig, 5 Tab, 24 Ref. EPA grant R-806817-01.

Descriptors: *Phosphorus, *Great Lakes, *Algal growth, *Algae, Phytoplankton, Productivity, Aquatic productivity, Nutrients, Bioassay, Wastewater treatment.

Control of phytoplankton production in the Great Lakes can be achieved most efficiently by limiting inputs of biologically available P. We report the results of studies performed to characterize the chemical forms and availability of particulate P in wastewater and tributaries which enter the lower Lakes, the eroding bluffs which border Lake Erie, and bottom samples from the near-shore of western Lake Erie. Rates of release of available P were estimated from a simple first-order model of the process, as observed during algal bioassays. Available P in wastewater samples, as a fraction of total particulate P, was affected minimally by wastewater treatment, including chemical precipitation and filtration; it correlated well with levels of total particulate P. Available particulate P levels in fluvial suspended sediments showed regional uniformity, but appeared to be strongly dependent on levels of both NaOH-P and CDB-P. Rates of release of available P decreased during wastewater treatment to values which were similar in magnitude to those observed for fluvial sediments. Release rates, however, were not related to any of the particulate P fractions which were measured. Analysis of the bluff and bottom samples indicated that P availability in the former was negligible, but the latter contained levels which approached those of wastewater particulates, though available P was released from the bottom sediments at relatively low rates. (Author's abstracts)
W85-02061

TRANSPORT OF IRON AND MANGANESE IN RELATION TO THE SHAPES OF THEIR CONCENTRATION-DEPTH PROFILES,
Freshwater Biological Association, Windermere (England).
W. Davison.
Hydrobiologia, Vol. 92, p 463-471, July, 1982. 5 Fig, 31 Ref.

Descriptors: *Iron, *Manganese, *Sediments, *Transport, *Model studies, Redox boundary, Concentration gradient, Oxidation, Chemical reduction, Interstitial water.

A model is presented which describes the transport of iron and manganese in the vicinity of a redox boundary. It is based on input of a particulate component, to form a point source, from which soluble species diffuse along a concentration gradient. The shapes of concentration-depth profiles in marine and freshwater sediments and water columns are reviewed and discussed in terms of the model. Transport, either entirely within a water column or within the sediment, may be simply treated because the rate of vertical transport can be regarded as constant. The discontinuity in the rate of vertical transport which occurs at the sediment-water interface can provide a complicated example of the model, especially when it coincides with the redox boundary. Authigenic mineral formation processes can modify the model, sometimes to such an extent that it becomes invalid. This particulary true for soluble iron profiles on organically rich marine sediments. Sampling interval is critical to the resultant profile shape and must be relevant to the particular environment, e.g. meters in water columns and millimeters in sediments. The differences in the rate of reduction and oxidation of iron and manganese tend to modify both the position of the profile with respect to the redox-cline and its stage of development in a seasonally anoxic system. It is these factors which determine why most of the iron which reaches a sediment is permanently incorporated whereas manganese is re-released. This mechanism determines the average ratio of iron to manganese in sedimentary rocks. The development of peaked profile shapes in water columns implies that under certain conditions dissolved iron and manganese may be transported from the waters of the sediment. (Author's abstract)
W85-02090

INFLUENCE OF SIMULATED GROUNDWATER-MOVEMENT ON THE PHOSPHORUS RELEASE FROM SEDIMENTS, AS MEASURED IN A CONTINUOUS FLOW SYSTEM,
Amsterdam Univ. (Netherlands). Lab. voor Microbiologie.
For primary bibliographic entry see Field 2F.
W85-02094

MOTION OF TWO COMPRESSIBLE FLUIDS WITH INTERFACE IN A POROUS RESERVOIR,
Department of Scientific and Industrial Research, Wellington (New Zealand). Applied Mathematics Div.
For primary bibliographic entry see Field 2F.
W85-02154

2L. Estuaries

SOILS OF SWAMPS IN THE APALACHICOLA, FLORIDA, ESTUARY,
C. L. Coultas.
Florida Scientist, Vol. 47, No, 2, p 98-107, 1984. 3 Fig, 3 Tab, 15 Ref.

Descriptors: *Apalachicola estuary, *Florida, *Swamps, *Soil types, Wetlands, Estuaries, Sulfaquents, Sulfihemists, Fluvaquents, Acidic soils, Salinity, Conductivity, Clays, Soil classification.

Until recently, forested wetlands in Florida were classified as miscellaneous land types or as broadly defined soil series. Selected soils in swamps of the Apalachicola, Florida estuary were sampled and analyzed. Three great groups, Sulfihemists, Sulfaquents, and Fluvaquents were found. These soils were wet, moderately acid, high in clay content, and low in salinity. Conductivity values increased from the surface downward because the surface tends to be frequently flushed with rain and river waters resulting in a dilution of salts. Kaolinite, vermiculite, quartz, and mica were the principal clay-sized minerals. Decisions concerning agronomic utilization of these soils should be carefully made because of their high potential acidity, low-bearing strength, and frequent flooding. (Collier-IVI)
W85-01641

MODELING ESTUARINE NUTRIENT GEOCHEMISTRY IN A SIMPLE SYSTEM,
Florida State Univ., Tallahassee. Dept. of Oceanography.
L. W. Kaul, and P. N. Froelich, Jr.
Geochimica et Cosmochimica Acta, Vol. 48, No. 7, p 1417-1433, July, 1984. 13 Fig, 4 Tab, 87 Ref.

Descriptors: *Cycling nutrients, *Estuarine environment, *Geochemistry, *Model Studies, *Nutrients, *Ochlockonee Bay, *Florida, Primary production, Phosphorus, Nitrogen, Silica, Phosphates, Nutrient removal, Estuaries.

A model of estuarine nutrient fluxes through a simple estuary over a one-year period demonstrates that estuaries are geochemical transformers that enchance the reactive fluvial phosphate flux to the oceans (by activation of fluvial particulates) and pass the fluvial silica flux unaltered. The model

was applied to 39 nutrient (P, N, Si) profiles collected over a 14-month period in the pristine river/estuary, Ochlockonee Bay, Florida. Each profile is deconvolved into three component functions: linear mixing (conservative), first-order removal (biological productivity), and parabolic input (regeneration). After correction for temporal variations in the fluvial end-members, the model provides quantitative estimates of total estuarine primary production, net regeneration, and subsequent fluxes to the ocean over a year-long period. The modeled data set is internally self-consistent: virtually all the phosphorus and silica removed during primary production is quickly returned to the water column by regeneration and enters the ocean. One-third of the fluvial reactive-P enters the estuary as particles whose phosphate is released after deposition in estuarine sediments. About 20% of the dissolved fluvial silica flux is removed biologically; all of this biogenic silica dissolves in the estuary and enters the ocean. N cannot be mass balanced, probably because it enters and escapes the bay in unmeasured forms (as NH4 or via denitrification to N2 and N2O). In the Ochlockonee, biological productivity removes nutrients in the ratios N:P approximately = 9:1 and Si:P approximately = 20:1. The Bay is an inefficient nutrient recycler due to its small size and rapid washout rates. (Collier-IVI)
W85-01702

CHANGES IN THE FISH FAUNA OF THE FORMER GREVELINGEN ESTUARY, BEFORE AND AFTER THE CLOSURE IN 1971,
For primary bibliographic entry see Field 6G.
W85-01765

TRANSPORT OF DISSOLVED ORGANIC CARBON THROUGH A MAJOR CREEK OF THE NORTH INLET ECOSYSTEM,
Texas Univ. at Arlington. Dept. of Biology.
T. H. Chrzanowski, L. H. Stevenson, and J. D. Spurrier.
Marine Ecology - Progress Series, Vol. 13, No. 2/3, p 167-174, August, 1983. 6 Fig, 5 Tab, 26 Ref. NSF grant DEB 7683010.

Descriptors: *Organic carbon, *Dissolved solids, *Town Creek, *South Carolina, Solute transport, Marshes, Tidal waters, Spartina, Nutrients.

Sampling was at a transect across Town Creek in the North Inlet Ecosystem, South Carolina. The creek drains much of the northern section of a 3200 ha salt marsh and forms a large section of the marsh inlet. Samples were collected every 1.5 h for 50 consecutive hours during neap tides (4 tidal cycles) and 50 consecutive hours during corresponding spring tides of each season. Dissolved organic carbon (DOC) concentrations were variable, ranging from 0.9 to 13.0 g/cu m of water with as much as 2.5 g/cu m of water variation during a 1.5 h period. There was no apparent trend toward higher DOC concentrations during spring tides. DOC was exported from the marsh during each sampling period. Net transports ranged from approximately 5 to 480 g DOC/s. Annual budgets revealed a DOC export as high as 7.5 +/- 1.8 x 10 to the 9th g C/yr corresponding to 416 g DOC/sq m/yr. Net exports of DOC and TOC (total organic carbon) correspond to 91% and 117% of the Spartina production, which is not reasonable. Either Spartina may not be the most important input of DOC to the system, or the sampling scheme used in this study generated transport estimates that could not be reliably extended to annual budgets. (Moore-IVI)
W85-01766

SEDIMENTATION OF ORGANIC AND INORGANIC PARTICULATE MATERIAL IN LINDASPOLLENE, A STRATIFIED, LAND-LOCKED FJORD IN WESTERN NORWAY,
Bergen Univ. (Norway). Inst. of Marine Biology.
P. Wassmann.
Marine Ecology - Progress Series, Vol. 13, No. 2/3, p 237-248, August, 1983. 5 Fig, 5 Tab, 77 Ref.

Descriptors: *Particulate matter, *Lindaspollene, *Norway, *Sedimentation, Fjords, Organic matter, Organic carbon, Mineralization, Organic nitrogen, Diatoms, Zooplankton.

Sedimentation of particulate material to the bottom (90 m) was measured in Lindaspollene, a landlocked, highly stratified, west Norwegian fjord, receiving fresh water from a small glacier free watershed. Five cylindrical sediment traps positioned at 10, 20, 40, 70, and 85 m below the surface were exposed from April to November. Organic material comprised 40 to 60% of the sedimented matter. Sedimentation rates of particulate inorganic material (PIM) and particulate organic carbon (POC) decreased from 229 and 111 at 20 m to 71 and 22 g/sq m/yr, respectively, in the deeper water. Possible reasons for the low sedimentation in the stagnant water below 40 m are high mineralization rates in the upper 40 m and the lack of resuspension in the water below. Three pulses of POC and PON (particulate organic nitrogen) reached the bottom related to phytoplankton blooms in April and May. The pulse in April was the largest and the sedimented material consisted of unidentified aggregates, diatoms and some few fecal pellets. Few recognizable structures were found in the samples below 20 m except in April. This might indicate a low zooplankton grazing efficiency in April, but a high efficiency during the rest of the investigation period. (Author's abstract)
W85-01767

FLUXES OF HEAVY METALS IN DELAWARE RIVER FRESHWATER TIDAL WETLANDS,
Rider Coll., Lawrenceville, NJ. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W85-01805

RECENT VERTICAL ACCRETION RATES AT BLACKWATER WILDLIFE REFUGE,
Maryland Univ., College Park. Dept. of Geography.
M. S. Keaeney, S. P. Leatherman, and G. T. F. Wong.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190107, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Technical Report No. 78, August 1983. 43 p, 8 Fig, 3 Tab, 17 Ref, 2 Append. Project No. OWRT A-064-MD(1), Contract/Grant No. 14-34-0001-2122.

Descriptors: *Accretion, Tidal marshes, Sedimentation rates, Lead radioisotopes, Organic matter, Sea level rise, Peat, Density, *Maryland, Blackwater National Wildlife Refuge.

Vertical accretion rates and sediment composition analyses were determined for Scirpus olneyi-dominated marshes near Shorter's Wharf Road in the Blackwater National Wildlife Refuge. Pb210 activity profiles of two cores from backmarsh sites suggest that long-term marsh accretion rates (ranging from 1.7 mm/yr to 3.6 mm/yr have not kept up with the local rate of sea level rise of 3.87 mm/yr. Organic carbon and bulk density analyses demonstrated that accumulation of organic matter is the primary accretionary mechanism in these marshes. However, marsh loss is probably not so much a function of inorganic sediment starvation, but the result of the slow burial and decay of older peat sediments.
W85-01809

RIVER ELBE: PROCESSES AFFECTING THE BEHAVIOUR OF METALS AND ORGANOCHLORINES DURING ESTUARINE MIXING,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 5B.
W85-01836

RIVER WESER PROCESSES AFFECTING THE BEHAVIOUR OF METALS AND ORGANOCHLORINES DURING ESTUARINE MIXING,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 5B.
W85-01837

ONE-DIMENSIONAL MIXING AND FLUSHING MODEL OF THE EMS-DOLLARD ESTUARY: CALCULATION OF TIME SCALE DIFFERENT RIVER DISCHARGES,
Nederlands Inst. voor Onderzoek der Zee,
W. Helder, and P. Ruardij.
Netherlands Journal of Sea Research, Vol. 1
3/4, p 293-312, December, 1982. 12 Fig, 2 T
Ref.

Descriptors: *Estuaries, *Ems-Dollard Es
*Mixing, *Flushing, River flow, Tidal e
Model studies, Salinity.

The Ems-Dollard estuary is situated at the D
German border, and is part of the Wadder
characterized by channels and extensive tidal
Of the total surface area 40 to 50% consists o
flats; in the Dollard, 80%. The tidal prism
estuary as a whole is about 1100 million
meters. The tide is semidiurnal and mean
amplitude about 3 m. Starting from longitu
salinity distributions over the years 1970 to 1
was shown that the flushing time decreases
increasing river flow. At average discharg
flushing time of Ems water was found to
days and that of Westerwoldse Aa water v
the Dollard 14 days. By segmentation of the
Dollard estuary in 17 compartments a box m
was constructed that can be used to predic
dispersion of water and dissolved constitu
Comparison of the distribution of water typ
calculated by the box model are in agreement
independent calculations from using fluoresc
and salinity as tracers. Comparison of model
dicted and measured salinity distribution show
sonable agreement. Turn-over times, mean
and residence times are calculated and it is sh
that these time scales vary with fresh water
charge too. (Baker-IVI)
W85-01838

USE OF A MODEL TO ASSESS FACTORS FECTING THE OXYGEN BALANCE IN WATER OF THE DOLLARD,
Biologisch Centrum, Haren (Netherlands).
F. B. Van Es, and P. Ruardij.
Netherlands, Journal of Sea Research, Vol. 15,
3/4, p 313-330, December, 1982. 8 Fig, 1 Tab
Ref.

Descriptors: *Estuaries, *Mixing, *Flush
*Model studies, *Ems Estuary, *Dollard, Oxy
balance, Seasonal variation, Primary producti
Reaeration.

A mathematical model was developed to calcu
the contribution of several processes to the oxy
balance in the water of the Dollard, the inner
of the Ems Estuary. This model was based
mixing and flushing model for the calculatio
the dispersal of organic wastewater discharge
the Dollard. Measured data were available of b
ground and total oxygen consumption and prim
production in the water, sediment respiration
decomposition rates of the organic waste.
enabled a mean reaeration coefficient to be estir
ed. The model satisfactorily described the distr
tion of oxygen concentrations in the Dollard, b
in time and space. In summer, the oxygen bala
was determined to be the same amount by s
ment respiration and oxygen consumption in
water, and in autumn largely by the waste
charges. The physical process of reaeration
the predominant oxygen providing process, tho
in summer primary production was important.
input of oxygen-rich water from the middle par
the estuary was of minor importance. During
highest waste water discharges the oxygen c
sumption in the mouth of the Dollard was 4 ti
the background level. Beyond that area the
crease was negligible. (Baker-IVI)
W85-01839

PHOSPHORUS DISTRIBUTION IN SE MENTS OF THE DELAWARE RIVER EST ARY,
Delaware Univ., Newark. Dept. of Geology.
R. N. Strom, and R. B. Biggs.
Estuaries, Vol. 5, No. 2, p 95-101, June, 1982
Fig, 2 Tab, 34 Ref.

riptors: *Phosphorus, *Sediments, *Delaware r Estuary, Estuarine environment, Salinity, oxyhydroxide, Clay, Calcium carbonate.

der to determine the primary factors related e accumulation of phosphorus in estuarine ents, a study of phosphorus fractions in sedi- s of the Delaware River Estuary was under- . A correlation matrix between the phospho- ractions, determined by serial extraction, and diment variables was computed. Total phos- us and total inorganic phosphorus in the sedi- -phosphorus reservoir decreases with increas- alinity. This variation is correlated with de- ing iron oxyhydroxide content in the sedi- . Neither clay content nor calcium carbonate nt appear to be significantly correlated with tion in total inorganic phosphorus content in ine-grained sediments of this estuary. Al- gh calcium phosphate is concluded to be a r constituent of the sediment-phosphorus res- r, there was no evidence found that it is genic in this environment. (Author's abstract) 01843

L AND SEASONAL VARIATIONS OF FATE ION IN A NEW JERSEY MARSH TEM,
Coll. of New Jersey, Union. Dept. of Chem- Physics.
rimary bibliographic entry see Field 5B.
01848

PHIC RESPONSE OF FISHES TO HABI- VARIABILITY IN COASTAL SEAGRASS TEMS,
da State Univ., Tallahassee. Dept. of Biologi- cience.
Livingston.
gy, Vol. 65, No. 4, p 1258-1275, August, 7 Fig, 5 Tab, 57 Ref, 2 Append. EPA grant 5288010.

riptors: *Fish, *Estuarine environment, itats, *Water pollution effects, Water temper- Pulp wastes, Storm runoff, Fish food, Fish ior, Seagrasses, Environmental effects, Water y, Macrophytes, Phytoplankton.

ow coastal areas of the northeast Gulf of co are physically unstable in terms of short- seasonal, and year-to-year changes in temper- salinity, nutrient concentration, and other quality features. A 9-yr comparison was of two estuaries, one polluted and one in the al state, to determine the response of fish blages to habitat alteration in space and time. g the study period, extreme natural habitat es due to storm water runoff and low winter eratures were superimposed over water qual- anges (increased color, turbidity, nutrients; ed dissolved oxygen) associated with release lp mill effluents. Various grassbed fishes fol- l regular seasonal, age-specific feeding pat- which did not change substantially in terms alitative foods composition in the unpolluted y over a 7-yr period of observation. Such g behavior helped to explain temporally con- ive cycles of relative abundance despite ex- (natural) habitat change. Anthropogenous t alterations, though seemingly slight, were ated with reductions in benthic macrophyte olution, enhanced phytoplankton productivity, hanges in the relative dominance and numeri- bundance of associated fish assemblages. bed species were replaced by plankton-feed- shes, and disruption of feeding habits of vari- pecies benthic food organisms altered their g habits during the years of pollution in the ed estuary. Subsequent water quality im- ment over time was associated with shifts in ge-specific dietary patterns of various species d those observed in the unaffected estuary, gh such recovery varied from species to s according to habitat utilization and trophic . From these results, it is clear that a relative- nplex coastal seagrass system exposed to peri- extreme natural disturbance is relatively resil- such changes in terms of relative dominance food web structure. However, apparently water quality changes due to pollution, which are outside the evolutionary experience of the biotic components, can cause serious disruptions of the basic habitat structure, energy flow, and community composition of the grassbed assemblages at various levels of biological organization. (Author's abstract)
W85-01890

226RA AND 228RA IN THE MIXING ZONES OF THE PEE DEE RIVER-WINYAH BAY, YANGTZE RIVER AND DELAWARE BAY ESTUARIES,
South Carolina Univ., Columbia. Dept. of Geology.
R. J. Elsinger, and W. S. Moore.
Estuarine, Coastal and Shelf Science, Vol. 18, No. 6, p 601-613, June, 1984. 5 Fig, 1 Tab, 22 Ref. NSF grants OCE-81-10405 and OCE-82-44535.

Descriptors: *Radium radioisotopes, *Estuarine environment, *Yangtze River, *China, *Pee Dee River, *Winyah Bay, *Delaware Bay, Desorption, Salinity, Sediments, Dilution, Diffusion, Mixing zone.

Ra-226 and Ra-228 have non-conservative excess concentrations in the mixing zones of the Pee Dee River-Winyah Bay estuary, the Yangtze River estuary, and the Delaware Bay estuary. Laboratory experiments, using Pee Dee River sediment, indicate desorption of Ra-226 to increase with increasing salinities up to 20%. In Winyah Bay desorption from river-borne sediments could contribute almost all of the increases for both isotopes. Desorption adds only a portion of the excess Ra-228 measured in the Yangtse River and adjacent Shelf waters and Delaware Bay. In the Yangtze River the mixing zone extends over a considerable portion of the Continental Shelf where Ra-228 is added to the water column by diffusion from bottom sediments, while Ra-226 concentrations decrease from dilution. Diffusion of Ra-228 from bottom sediments in Delaware Bay primarily occurs in the upper part of the bay (< 22% water) where fine grained sediments predominate. A diffusive flux for Ra-228 of 0.33 dpm/sq cm year was determined for Delaware Bay. (Author's abstract)
W85-01912

BEHAVIOR OF ORGANICALLY-BOUND IRON IN SEAWATER OF ESTUARIES,
Hokkaido Univ., Hakodate (Japan). Faculty of Fisheries.
K. Matsunaga, K. Igarashi, S. Fukase, and H. Tsubota.
Estuarine, Coastal and Shelf Science, Vol. 18, No. 6, p 615-622, June, 1984. 8 Fig, 19 Ref.

Descriptors: *Red tide, *Iron, *Estuarine environment, *Salinity, *Hakodate Bay, *Osaka Bay, *Japan, Eutrophication, Primary productivity, Flocculation, Phytoplankton, Heavy metals.

Two rivers and estuaries were selected for experiments on organically bound iron. The Kunebetsu River has its origin in Lake Ohnuma, and the river flows into Hakodate Bay. The estuary has normal primary production and no pollution. The other river is the Yodo River, which flows into Osaka Bay. The bay is contaminated with heavy metals and nutrients, and the estuary has red tide outbreaks during the summer. In Hakodate Bay, the iron complex decreases with increasing salinity because of its flocculation. In Osaka Bay, the iron complex as well as nutrients except silicate are completely assimilated by phytoplankton. Among nutrients, silicate diffuses only by water mixing because the main species of phytoplankton were green colored algae at the river mouth. High nitrite concentration was found at about 15% salinity. This means that both phytoplankton decomposition and photosynthesis occur. The iron complex assimilated would be released to seawater with the decomposition of phytoplankton and then red tide outbreaks at the estuary would continue for a long period. (Moore-IVI)
W85-01913

STATISTICAL ANALYSIS OF ESTUARINE PROFILES: II APPLICATION TO ARSENIC IN THE TAMAR ESTUARY (S.W. ENGLAND),
Marine Biological Association of the United Kingdom, Plymouth (England).
For primary bibliographic entry see Field 5B.
W85-01914

HYDROCARBONS IN WASHINGTON COASTAL SEDIMENTS,
Washington Univ., Seattle. School of Oceanography.
For primary bibliographic entry see Field 5B.
W85-01915

BENTHIC PHOSPHORUS REGENERATION IN THE POTOMAC RIVER ESTUARY,
Geological Survey, Reston, VA.
E. Callender.
Hydrobiologia, Vol. 92, p 431-446, July, 1982. 6 Fig, 47 Ref.

Descriptors: *Potomac River, *Estuaries, *Phosphorus, *Sediment-water interface, Phosphates, Sediments, Benthos, Estuarine environment, Primary production, Iron oxides, Interstital water, Cycling nutrients.

The flux of dissolved reactive phosphate from Potomac riverine and estuarine sediments is controlled by processes occurring at the water-sediment interface and within surficial sediment. In situ benthic fluxes (0.1 to 2.0 mmoles/sq m/day) are generally five to ten times higher than calculated diffusive fluxes (0.020 to 0.30 mmoles/sq m/day). The discrepancy between the two flux estimates is greatest in the transition zone (river mile 50 to 70) and is attributed to macrofaunal irrigation. Both in situ and diffusive fluxes of dissolved reactive phosphate from Potomac tidal river sediments are low while those from anoxic lower estuarine sediments are high. The net accumulation rate of phosphorus in benthic sediment exhibits an inverse pattern. Thus a large fraction of phosphorus is retained by Potomac tidal river sediments, which contain a surficial oxidized layer and oligochaete worms tolerant of low oxygen conditions, and a large fraction of phosphorus is released from anoxic lower estuary sediments. Tidal river sediment pore waters are in equilibrium with amorphous $Fe(OH)_3$ while lower estuary pore waters are significantly undersaturated with respect to this phase. Benthic regeneration of dissolved reactive phosphorus is sufficient to supply all the phosphorus requirements for net primary production in the lower tidal river and is sufficient to supply all the phosphorus requirements for net primary production in the lower tidal river and transition-zone waters of the Potomac River Estuary. Benthic regeneration supplies approximately 25% as much phosphorus as inputs from sewage treatment plants and 10% of all phosphorus inputs to the tidal Potomac River. When all available point source phosphorus data are put into a steady-state conservation of mass model and reasonable coefficients for uptake of dissolved phosphorus, remineralization of particulate phosphorus, and sedimentation of particulate phosphorus are used in the model, a reasonably accurate simulation of dissolved and particulate phosphorus in the water column is obtained for the summer of 1980. (Author's abstract)
W85-02088

METHANE PRODUCTION IN MINNESOTA PEATLANDS,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
R. T. Williams, and R. L. Crawford.
Applied and Environmental Microbiology, Vol. 27, No. 6, p 1266-1271, June, 1984. 1 Fig, 6 Tab, 20 Ref.

Descriptors: *Peat, *Methane, *Methane, Methanogenesis, Temperature, Hydrogen ion concentration, Metabolism, Dissolved gases.

Rates of methane production in Minnesota peats were studied. Surface (10- to 25-cm) peats produced an average of 228 nmol of CH_4 per g (dry weight) per h at 25 degrees C and ambient pH. Methanogenesis rates generally decreased with depth in ombrotrophic peats, but on occasion were

observed to rise within deeper layers of certain fen peats. Methane production was temperature dependent, increasing with increasing temperature (4 to 30 degrees C), except in peats from deep layers. Maximal methanogenesis from these deeper regions occurred at 12 degrees C. Methane production rates were also pH dependent. Two peats with pHs of 3.8 and 4.3 had an optimum rate of methane production at pH 6.0. The addition to peat of glucose and H2-CO2 stimulated methanogenesis, whereas the addition of acetate inhibited methanogenesis. Cysteine-sulfide, nitrogen-phosphorus-trace metals, and vitamins-yeast extract affected methane production very little. Various gases were found to be trapped or dissolved (or both) within peatland waters. Dissolved methane increased linearly to a depth of 210 cm. The accumulation of metabolic end products produced within peat bogs appears to be an important mechanism limiting carbon turnover in peatland environments. (Author's abstract)
W85-02135

RELATIVE CONTRIBUTIONS OF BACTERIA AND FUNGI TO RATES OF DEGRADATION OF LIGNOCELLULOSIC DETRITUS IN SALT-MARSH SEDIMENTS,
Georgia Univ., Athens. Dept. of Microbiology.
R. Benner, S. Y. Newell, A. E. Maccubbin, and R. E. Hodson.
Applied and Environmental Microbiology, Vol. 48, No. 1, p 36-40, July, 1984. 3 Fig, 2 Tab, 24 Ref.
NSF grant OCE-8117834 and Dept. of Commerce grant NA 80AA-D-00091.

Descriptors: *Salt marshes, *Bacteria, *Fungi, *Decomposition, *Lignocellulose, Detritus, Microorganisms, Mineralization, Wetlands, Spartina.

Specifically radiolabeled (C-14 lignin)lignocellulose and (C-14 polysaccharide)lignocellulose from the salt-marsh cordgrass Spartina alterniflora were incubated with an intact salt-marsh sediment microbial assemblage, with a mixed (size-fractionated) bacterial assemblage, and with each of three marine fungi, Buergenerula spartinae, Phaeosphaeria typharum, and Leptosphaeria obiones, isolated from decaying S. alterniflora. The bacterial assemblage alone mineralized the lignin and polysaccharide components of S. alterniflora lignocellulose at approximately the same rate as did intact salt-marsh sediment inocula. The polysaccharide component was mineralized twice as fast as the lignin component; after 23 days of incubation, ca. 10% of the lignin component and 20% of the polysaccharide component of S. alterniflora lignocellulose were mineralized. Relative to the total sediment and bacterial inocula, the three species of fungi mediated only very slow mineralization of the lignin and polysaccharide components of S. alterniflora lignocellulose. Experiments with uniformly C-14 labeled S. alterniflora material indicated that the three fungi and the bacterial assemblage were capable of degrading the non-lignocellulosic fraction of S. alterniflora material, but only the bacterial assemblage significantly degraded the lignocellulosic fraction. The results suggest that bacteria are the predominant degraders of lignocellulosic detritus in salt-marsh sediments. (Author's abstract)
W85-02138

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

EVALUTION OF HOLLOW FIBER ULTRAFILTRATION AS A PRETREATMENT FOR REVERSE OSMOSIS DESALINATION OF SEA-WATER,
Romicon, Inc., Woburn, MA.
B. R. Breslau, A. J. Testa, and B. M. Kilcullen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-212406, Price codes: A09 in paper copy, A01 in microfiche. Completion Report, (1984). 164 p, 106 Fig, 41 Tab. Project No. OWRT C-80309-S(8558)(1), Contract/Grant No. 14-34-0001-8558.

Descriptors: Membranes, *Ultrafiltration, *Pretreatment, Membrane processes, Reverse osmosis pretreatment, *Desalination.

An intensive study was conducted at the Wrightsville Beach Test Facility to evaluate the performance of hollow fiber ultrafiltration membranes as a pretreatment for seawater desalination via reverse osmosis. Several polymer types were evaluated to determine the best ultrafiltration membrane. In addition, two different fiber diameters (20 and 43 mil) were studied to investigate the effects of flow through the hollow fiber cartridge on flux, cleaning, and membrane life. The results from these tests show that the polysulfone PM-50 membrane (50,000 M.W. cutoff) which has a 43 mil internal diameter is well suited for seawater pretreatment. Various cleaning chemicals (sodium hydroxide, sodium hypochlorite, citric acid, surfactant types, etc.) were evaluated in several combinations of operating modes (reverse flow, backflush) to optimize the membrane performance. Economic analyses show that the three inch diameter, 26.5 square foot PM-50 hollow fiber cartridge can pretreat seawater at a cost of approximately one dollar per thousand gallons of seawater produced using a totally automated system.
W85-01830

3B. Water Yield Improvement

DEVELOPING THE RESOURCE POTENTIAL OF A SHALLOW WATER TABLE,
California Univ., Davis. Dept. of Land, Air and Water Resources.
D. W. Grimes, and D. W. Henderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207315, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center Completion Report, April, 1984. 63 p, 14 Fig, 15 Tab, 36 Ref, 1 Append. Project No. OWRT B-216-CAL(1), Contract/Grant No. 14-34-0001-1210.

Descriptors: *Shallow water, *Evapotranspiration, *Water budget, *Irrigation scheduling, *Soil salinity, *Water salinity, *Plant water status, Perched water, Irrigation management, California, San Joaquin Valley.

Observations and estimates indicate that shallow water table encroachment affects increasingly large areas of agriculturally productive land in the central and western San Joaquin Valley. With current management techniques, the present drain and disposal facilities are inadequate to effectively handle the water volume that moves through soils and becomes a part of the shallow water system. In the presence of active plant roots, soil water is depleted in upper profile zones with the establishment of a potential gradient sufficient to effect upward capillary water movement in the presence of a shallow water table. A three-year study was done to evaluate the resource potential of shallow-perched water tables as a resource to meet crop evapotranspiration (ET) requirements. Using water-budget and chlorine-tracer techniques independently to measure shallow water table contributions to crop ET revealed that as much as 50 to 60 percent of crop ET could be met by the shallow water table. The amount of water contributed by the shallow water table was strongly conditioned by water table salinity and depth to the shallow water. Study results show the need for a total management system approach for effective utilization of the resource potential of shallow water tables in contrast to specific entities considered in isolation. (Snyder-California)
W85-01832

APPROPRIATE WATER SUPPLY TECHNOLOGY FOR DEVELOPING COUNTRIES,
For primary bibliographic entry see Field 5F.
W85-01981

DRINKING WATER IN DEVELOPING C TRIES - THE MINIMUM TREATMENT LOSOPHY. A CASE STUDY,
Norconsult A/S, Sandvika (Norway).
J. A. Myhrstad, and O. Haldorsen.
Aqua, No. 2, p 86-90, 1984. 2 Fig, 3 Tab,

Descriptors: *Water quality control, *Deve countries, *Bacteria, *Water supply develop Drinking water, Water management, Wat sources development, Sanitation.

A priority list is presented of items to be c ered in selection of water sources. Selecti proper sources combined with proper inta rangements and the introduction of sanitary requiring the simplest possible treatment me should be an appropriate approach to a saf sound water quality policy, referred to here minimum treatment philosophy. The study pr ed deals with specifics for water supply Kigoma Region in Tanzania. In this regio bacteriological rather than chemical quality water which is a problem. Virtually all s water sources (both existing and potentia heavily polluted by bacteria regardless o intake location. Consequently, all surface sources should have their bacteriological q improved prior to delivery to consumers source selection process in Tanzania should consider use of waters not requiring disinfe deep groundwater, properly protected sh groundwater and properly protected springs; turbidity waters which can be directly disinf including lakes and headwater reaches of str water requiring treatment prior to disinfecti cluding streams and rivers and other source cannot be immediately disinfected or that re treatment for other reasons; and finally, wate cannot be treated by conventional mean comply with standards such as those conta high sulfates, nitrates, fluorides and other lems. (Baker-IVI)
W85-02018

WATER BALANCE AND CROPS IN KA TAKA,
Andhra Univ., Waltair (India). Dept. of Mete ogy and Oceanography.
For primary bibliographic entry see Field 2I.
W85-02127

3D. Conservation In Domestic a Municipal Use

RESTORATION OF FAILING ON-S WASTEWATER DISPOSAL SYSTEMS US WATER CONSERVATION,
Pennsylvania State Univ., University Park. for Research on Land and Water Resources.
For primary bibliographic entry see Field
W85-01656

STATE LAWS MANDATING WATER CONS VATION,
Maryland Univ., College Park. Dept. of Geo phy.
For primary bibliographic entry see Field 6E.
W85-01806

RESULTS AND EXPERIENCE OF THE GR WATER-SUPPLY DISTRICT IN THE FU OF RATIONAL WATER USE (ERGEBNI UND ERFAHRUNGEN DES VERSORGUN BEREICHS GREIZ BEI DER RATIONEL WASSERVERWENDUNG),
U. Koschmieder, H. Tunger, and L. Hoffmann
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 37-39, February, 1984. 2 Fig.

Descriptors: *Water conservation, *Greiz, * Germany, Water treatment, Wastewater treatn Water management, Drinking water, Economi pects, Water pollution control.

The Greiz water-supply district, German De cratic Republic, has chosen to implement rati

use particularly by reducing water losses
y preventing water wastage. The basis for
lan was information exchange with other
ies, party policy on rational water use includ-
e 1982 water law, and the Colbitz experience.
of the plan are a stable drinking-water
, sewer system, and wastewater treatment;
l use of available funds; savings in and
of investment; increasing worker productiv-
ducing energy use and costs; instituting order
ability; and guaranteeing environmental pro-
n while relieving the demands made on water
natural resource. The main means of imple-
ng the plan are to reduce water losses togeth-
h water demand within the district, to reduce
olume of drinking water used for industrial
ses, to decrease pollution by wastewater and
e valuable chemicals, and to ensure adequate
quantity and quality. The means of achiev-
ese ends include direction by the party orga-
on within each facility, ideological and sub-
ecific instruction of workers and users;
ation of results of technological and scientific
s into practice; participation of youth, inno-
, and inventors; and close cooperation with
-management professionals in the district.
-IVI)
01880

US OF RESEARCH AND DEVELOP-
T IN WATER SUPPLY SYSTEMS IN
A,
nal Environmental Engineering Research
Nagpur (India).
man, and B. B. Sundaresan.
No. 1, p 19-22, 1983. 28 Ref.

iptors: *India, *Research priorities, *Water
yance, *Operating policies, Administrative
ies, Water conservation, Metropolitan water
gement, Water management, Rural areas,
gement planning, Leakage.

recently in India, it was not realized that
ch and development efforts in water supply
ns should focus on conservation of water,
y and resources, simplicity of construction
aintenance, and operation without sacrificing
quality. Research and development has
y concentrated on modifications to, develop-
of, and innovations in the existing systems.
ed field evaluation of selected rural water
y schemes are being carried out with the
ing objectives: to identify technological, or-
ational, adminstrative, financial, and socio-
al factors that have contributed to the suc-
or lack of success, of the schemes so as to
de proper feed-back for future planning,
n, and implementation of rural water supply
ams. A single agency is needed at state level
ts functions decentralized at district level, to
after financial, administrative, and technical
rs at state level and execution and mainte-
at district level. Design criteria and specifi-
s need to be revised to suit regional needs. In
ey of water distribution systems in cities and
s of India, it was determined that 20-35% of
flow in the systems is lost through leakage;
xpenditure on a preventive maintenance pro-
for the systems could be recovered in 12-18
ns, based on the quantum of water saved.
er-IVI)
01982

KAGE CONTROL,
national Water Supply Association, London
and).
Bays.
, No. 1, p 51-55, 1984. 5 Ref.

iptors: *Leakage, *Water loss, *Water
y, Water conservation, Economic aspects,
, Resources development, Water resources
opment, Resources management.

age or loss of water between source and con-
r has been a cause for concern in many coun-
of the world for a long time. Water supplies
ver the world are becoming increasingly
e of the need to make the fullest use of avail-
water resources before investing money into
further resources which may be of doubtful quality. International funding agencies require the reduction of high losses from systems before agreeing to financial help to develop new sources. The paper will attempt to outline the many aspects of leakage control with emphasis on an economical approach to the subject. The purpose of leakage control is to reduce consumption and the reduction of consumption also involves the reduction of 'waste' involving the education of consumers in their daily habits. It is therefore necessary to define the terms used in waste reduction quite carefully so that everyone has an understanding of what is meant and the paper will attempt to clarify terms used which are often misunderstood. The financial benefits of reducing consumption must be balanced against the cost of achieving such reductions. Water undertakings employing some techniques at present can often put their existing resources to more efficient use with resultant benefits. (Author's abstract)
W85-02016

3F. Conservation In Agriculture

WATER-USE PRODUCTION FUNCTIONS OF SELECTED AGRONOMIC CROPS IN NORTHWESTERN NEW MEXICO, PHASE II,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
C. E. Kallsen, E. J. Gregory, and T. W. Sammis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-195866, Price codes: A09 in paper copy, A01 in microfiche.
New Mexico Water Resources Research Institute Technical Report No. 155, Las Cruces, October 1982. 180 p, 31 Fig, 61 Tab, 25 Ref, 6 Append. Project No. OWRT C-90229-G(9444)(2), Contract/Grant No. 14-34-0001-9444.

Descriptors: *Evaporation, *Transpiration, *Evapotranspiration, Water use efficiency, Evapotranspiration potential, Nitrogen, *New Mexico, Water requirements, Plant growth rates, Irrigation, Crop yield, Barley, Beans, Alfalfa.

The water requirement for growth of spring barley, pinto beans, and alfalfa was investigated in northwestern New Mexico. Results strongly suggest that the level of nitrogen fertility does not alter the water-use efficiency (WUE) of spring barley when WUE is expressed as a function of transpiraton. WUE may change, depending on irrigation scheduling, if WUE is expressed as a function of evapotranspiration. We attribute this difference to differential soil-water evaporation. Further evidence supports the hypothesis that a common function exists independent of season, with respect to a given crop, relating economic yield to transpiration. Crop coefficients based on various methods of calculating potential evapotranspiration were found to vary considerably, as much as 50 percent, between years due in part to the difference in the evaporation component of the measured evapotranspiration. Caution should be exercised in using crop coefficients to predict alfalfa, pinto beans and spring barley seasonal or intra-seasonal water requirements when the crops are grown under conditions requiring frequent light irrigation.
W85-01817

YIELD AND QUALITY OF COTTON GROWN WITH WASTEWATER,
Arizona Univ., Tucson. Dept. of Plant Sciences.
For primary bibliographic entry see Field 5D.
W85-01869

WATER CONSERVATION THROUGH LIMITED IRRIGATION OF CORN AND GRAIN SORGHUM IN THE GREAT PLAINS,
Nebraska Univ.-Lincoln. Dept. of Agricultural Engineering.
D. G. Watts, C. Y. Sullivan, W. F. Kroutil, and R. J. Supalla.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207372. Price codes: A05 in paper copy, A01 in microfiche.
Completion Report, (1984). 67 p, 43 Fig, 7 Tab. Project No. OWRT B-054-NEB(1), Contract/Grant No. 14-34-0001-0230.

Descriptors: *Water conservation, Water availability, *Evapotranspiration control, *Crop response, *Water yield improvement, Crop yield, Water stress, Farm management, *Irrigation efficiency, Great Plains, Corn, Grain sorghum.

The overall purpose was to conduct agronomic and economic evalution of the potential of limited irrigation of corn and grain sorghum for conserving and extending water supplies in the central Great Plains. A high linearity was found in the relationship between yield and evapotranspiration (ET) with both crops. The maximum yields in 1981 were obtained with less ET than in 1980, and the slope for yield reductions with decreased ET (limited irrigation) was greater in 1980 than in 1981. Higher mean relative humidity in 1981 may have contributed to this. When a factor was added to account for the effect of the relative humidity, the yield reductions became nearly constant. When ET-yield functions were normalized and expressed on a relative basis, the slopes for all varieties of a specific crop and at a particular location were very similar. In fact, the slopes for corn and sorghum were also similar for locations and years. However, on an actual yield-ET basis, differences in genotypes were apparent. Since project data shows the yield-ET regression is usually linear, a water supply which fails to meet the conditions for full ET demand would be expected to reduce yields. The rate reduction, or slope of the regression, may differ with environment, crop and variety. At higher ET values, corn equaled or exceeded sorghum yields.
W85-01952

IRRIGATED AGRICULTURAL EXPANSION PLANNING IN DEVELOPING COUNTRIES: INVESTMENT SCHEDULING INCORPORATING DRAINAGE WATER REUSE,
Cairo Univ., Giza (Egypt). Dept. of Irrigation and Hydraulics.
M. N. Allam, and D. H. Marks.
Water Resources Research, Vol. 20, No. 7, p 757-766, July, 1984. 3 Fig, 15 Tab, 33 Ref.

Descriptors: *Developing countries, *Irrigation, *Planning, *Water reuse, *Investment scheduling, Agricultural development, Optimization, Mathematical models, Drainage systems, Economies of scale, Irrigation water, Water quality.

Agricultural expansion planning in developing countries where there is extensive government involvement in the planning process can be defined in a two-level heirarchy. At the first level, the role of the agricultural expansion investment in achieving the strategic goals of the sector is to be determined. At the second level, analysis of the agricultural expansion is to be carried out in such a way that the strategic decisions from the first level can be implemented. The focus of this paper is on the analysis of investment scheduling, the major issue of the second level. A mathematical optimization model is built to aid in analyzing the scheduling problems of land development, crop selection, drainage water reuse, and capacity expansion of the irrigation and drainage networks. A minimum cost criterion is used, where costs of land development, farming, irrigation and drainage infrastructures, maintenance and operations, and pump stations are considered. The model has a nonlinear objective function to account for economies of scale and linear and nonlinear constraints. A fixed charge approximation is used for the nonconvex cost functions, and a mixed integer programming algorithm along with an enumeration procedure is used for solving the model. The solution procedure guarantees global optimality for the approximated problem. A hypothetical expansion of 70,000 acres (28,350 ha) based on data from the Nile Delta in Egypt is used as a case study to illustrate the procedure under different conditions of irrigation water quality. (Author's abstract)
W85-02142

IRRIGATED AGRICULTURAL EXPANSION PLANNING IN DEVELOPING COUNTRIES: INCOME REDISTRIBUTION OBJECTIVE,

Cairo Univ., Giza (Egypt). Dept. of Irrigation and Hydraulics.
M. N. Allam, and D. H. Marks.
Water Resources Research, Vol. 20, No. 7, p 767-774, July, 1984. 1 Fig, 13 Tab, 17 Ref.

Descriptors: *Developing countries, *Irrigation, *Planning, *Income redistribution, Agricultural development, Economic aspects, Optimization, Mathematical models.

The role of agricultural expansion investment in improving the income redistribution conditions in society has been of considerable concern to planners. In this paper an approach based on distributing the newly developed land to a poorer sector (landless farmers) in society to gain agricultural revenues and improve their income is investigated. A mathematical optimization model is built to determine the distribution of land and a pricing policy established for the new areas in such a way that (1) a specified (by the government) income increase to the farmers can be achieved, (2) a predetermined level of recovery of the expansion cost can be insured, (3) high agricultural efficiency in the new land can be maintained, and (4) redistribution benefits can be maximized. In a case study application of the model, no conflict is found between the economic efficiency and income redistribution critieria in agricultural expansion investment within the planning framework presented in the companion paper (Allam and Marks, this issue). For a specified cost recovery condition it is found that the least cost planning alternatives give the opportunity to the largest number of landless farmers to own the new land and receive a specified income increase from the agricultural revenues, but a conflict between government return from the investment and redistribution objectives is found. This conflict is addressed and the trade-off between the two objectives is illustrated. (Author's abstract)
W85-02143

REAL TIME IRRIGATION SCHEDULING VIA 'REACHING' DYNAMIC PROGRAMMING,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
S. Pleban, D. F. Heermann, J. W. Labadie, and H. R. Duke.
Water Resources Research, Vol. 20, No. 7, p 887-895, July, 1984. 6 Fig, 6 Tab, 8 Ref.

Descriptors: *Irrigation scheduling, *Computer models, *Real time, High Plains, Soil water, Costs, Dynamic programming, Optimization.

A large number of farm operations in the High Plains states have surface irrigation systems supplied by wells pumped at a fixed discharge rate. The scheduling of irrigations for such systems can be challenging if the farmer desires to avoid crop yield reduction due to insufficient soil moisture while minimizing irrigation costs. A dynamic programming model is formulated for determining surface irrigation schedules over the short term that minimize irrigation labor costs while meeting crop requirements under a limited water supply. The model is capable of solving high-dimensional problems by a 'reaching' forward algorithm that defines a surrogate state by using binary decision policies rather than by discretization of the actual state variables. Data from the Northern Colorado Research Demonstration Center were used for testing the viability of the algorithm and its practical usefulness for irrigators through simulated real time experiments. The model optimized the scheduling of nine field groups divided into a total of 24 fields. An 8% savings in irrigation costs resulted for two years, as compared with conventional scheduling, while maintaining acceptable soil moisture levels. Sizeable savings are potentially available through extension to large systems. (Moore-IVI)
W85-02155

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

FLOOD-PLAIN MANAGEMENT PROGRAM IN RAPID CITY, SOUTH DAKOTA,
South Dakota School of Mines and Technology, Rapid City. Dept. of Geology and Geological Engineering.
For primary bibliographic entry see Field 2E.
W85-01643

FLOOD ELEVATIONS FOR THE SOLEDUCK RIVER AT SOL DUC HOT SPRINGS, CLALLAM COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
L. M. Nelson.
Available from the OFSS, USGS, Box 25424, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4083, 1983. 17 p, 9 Fig, 1 Tab, 3 Ref.

Descriptors: Flood control, Maximum probable floods, *Flood peaks, Flood plain zoning, *Soleduck River, Clallam County, *Washington, 100-year floods.

Elevations and inundation areas of a 100-year flood of the Soleduck River, Washington, were determined by the U.S. Geological Survey for the area in the vicinity of the Sol Duc Hot Springs resort, a public facility in the Olympic National Park that under Federal law must be located beyond or protected from damage by a 100-year flood. Results show that most flooding could be eliminated by raising parts of an existing dike. In general, little flood damage is expected, except at the southern end of an undeveloped airstrip that could become inundated and hazardous due to flow from a tributary. The airstrip is above the 100-year flood of the Soleduck River.
W85-01773

STREAMFLOW CHARACTERISTICS OF THE YELLOWSTONE RIVER BASIN, MONTANA, THROUGH SEPTEMBER 1982,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01781

IMPROVEMENT OF FLOOD-FREQUENCY ESTIMATES FOR SELECTED SMALL WATERSHEDS IN EASTERN KANSAS USING A RAINFALL-RUNOFF MODEL,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-01786

PREDICTION OF PEAK FLOWS FOR CULVERT DESIGN ON SMALL WATERSHEDS IN OREGON,
Oregon State Univ., Corvallis. School of Forestry.
A. J. Campbell, R. C. Sidle, and H. A. Froehlich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-212398, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute Publication WRRI-74, Oregon State Univ., Corvallis, January 1982. 96 p, 1 Fig, 5 Tab, 65 Ref, 4 Append. Project No. OWRT A-053-ORE(1), Contract/Grant No. 14-34-0001-1139.

Descriptors: *Flood frequencies, *Culverts, *Culvert design, *Flood peaks, *Peak flows, Watersheds, Forest engineering, Flood prediction, *Oregon, Forested watersheds, Small watersheds.

Forest engineers must estimate flood frequencies for very small watersheds when designing culvert installations. Empirical formulae and simplified rainfall runoff models require considerable ment to give reasonable results. As an alter this study presents equations to predict peak on small watersheds in Oregon. Equations developed from 80 watersheds ranging in size 0.21 to 10.60 square miles. Six physiograph gions were used, based on previous flood fre cy studies. In each region, annual peak flows gaging stations with 20 or more years of were analyzed using four flood frequency dis tions (Gumbel, two-parameter log-normal, parameter log-normal, log Pearson type III) Pearson type III distribution was found suitab all regions, based on the chi-square goodness test. Floods with recurrence intervals of 10, and 100 years were related to physical and cli indices of drainage basins by multiple regre analysis. Basin area was most important in ex ing the variation of flood peaks in all re Mean basin elevation and mean annual prec tion were also significantly related to flood in two regions in western Oregon. Equatio predict the 25-year flood were developed for physiographic region. Average percent erro these regression equations ranged from 16.1 t percent, the smaller errors being associated the more humid regions. Confidence limits fo equations provide estimates of prediction u tainties over the range of design flows. T equations provide a better basis for culvert d of small forested watersheds than rule of thum empirical methods.
W85-01820

REPORT ON HYDROELECTRIC POWER LIZATION AND RESERVED-WATER PR LEMS (BERICHT UBER WASSERKRAFTU ZUNG UND RESTWASSERPROBLEME).
Wasser, Energie, Luft, Vol. 75, No. 3, p 4 1983. 13 Fig, 2 Tab, 14 Ref. (in German French).

Descriptors: *Hydroelectric power, *Switzerl *Reserved water, Hydroelectric plants, Cons tion, Costs, Electric power production, Water cation, Economic aspects.

Switzerland is heavily dependent on other c tries for its energy supply; in 1980, only one fif its energy was produced domestically, and of 90% was hydroelectric power (HEP). Expan of HEP facilities can raise production somew but will not cover the expected increase in elec ity demand. Preparations before beginning struction of a medium-sized HEP plant take at 6-8 yr, and construction requires a further 4-6 An important criterion for assessing the suitab of a site is cost of production, though the neces of covering demand is becoming increasingly portant. In most cases, an HEP plant makes spe use of public waters, for which the local autho must grant a concession in which all conditions specified and which runs for 80 yr at most. cost structure of an HEP facility is based on f costs; annual production costs have a minor in ence on total annual cost. Electricity cost is slightly dependent on market mechanisms. Uti tion of HEP requires extensive construction investments, which influence the economy, ployment, water management, the environm and the ecosystem. Any water diverted from stream used by the HEP facility (reserved wa means a reduction in energy production and a in cost per kWH as well as the necessity another compensating energy source. Conditi for utilization of reserved water should be sp fied in the water concession, and failure to com should result in penalty. Other consequences reserved water use are lower water taxes paid the HEP plant to the authority, higher ene costs for the consumer, and inability to ope optimally for the HEP facility. In the long te the ecological and land-use benefits derived fr reserved-water use must be weighed against environmental and economic disadvantages cau by the production of compensatory energy. (G IVI)
W85-01855

KS OF THE DAM KEEPER (LES TACHES GARDIEN DE BARRAGE),
au d'Ingenieurs-Conseils, Lausanne (Switzer-
ndermaur.
er, Energie, Luft, Vol. 76, No. 3/4, p 44-47, 2 Fig.

riptors: *Reservoir operation, *Dam keepers, al aspects, Personnel, Maintenance.

legal duties of the owner of a dam regarding rol of its operation are reviewed, and the ions existing between all persons and organiza- involved in supervision. The main duties of a keeper are: visual observation of the operation the surroundings; execution of control meas- control and maintenance of the measurement llation and the control galleries. The qualities ssary in a dam keeper are: a sense of responsi-; initiative; ability to work independently; pre- n in work; and the ability to draft simple ages. (Moore-IVI)
-01859

ULTS OF SURFACE-WATER, DYKE, AND STAL INSPECTION -- WAYS TOWARD RE EFFECTIVE INSPECTION FOR THE URE,
lausnitzer.
serwirtschaft-Wassertechnik, Vol. 34, No. 1, p January, 1984.

riptors: *Inspection, *Surface waters, *Dykes, stal areas, *East Germany, Legal aspects, itoring, Water facilities, Water quality.

German Democratic Republic Guideline for icity, Duties, Composition, and Method of Op- on of the Inspection Commission came into t as part of the 1982 Water Law and stresses igh level of responsibility of local councils for nonitoring of surface-water condition, use, and ervation and of the functional capacity of r facilities in their area. In fall 1982, 16,000 kers performed 4,100 water, dyke, and coastal ections; over 20,000 workers from all sections he population as well as representatives of rnment and social organizations carried out e than 5,800 inspections during both spring and 1983. In 1983, 77% of surface waters, 99% of s, and 90% of water facilities were inspected us 70, 90, and 75%, respectively, in 1982. ctional capacity was satisfactory for 97.4% of ace waters, 99.6% of dykes, and 98.6% of r facilities in fall 1983, compared with 95.3, and 95.9%, respectively, in spring 1983. In irst six months of 1983, the number of citations unsatisfactory condition of water or facilities 130, compared with 206 for the same period in . Unsatisfactory conditions are rectified in r of importance using measures decided upon ie time of inspection. The participation of lay ple in inspections has led to a greater sense of onsibility for water quality. The quality of ection must be improved by participation of bers of the forestry and agricultural communi- experienced citizens, and representatives of ronmental organizations. (Gish-IVI)
5-01874

ALLOW GROUND-WATER FLOW AND AINAGE CHARACTERISTICS OF THE OWN DITCH BASIN NEAR THE EAST T, INDIANA DUNES NATIONAL LAKE-ORE, INDIANA, 1982,
logical Survey, Indianapolis, IN. Water Re- ces Div.
. Shedlock, and W. E. Harkness.
ilable from the OFSS, USGS, Box 25425, Fed. Denver, CO 80225. USGS Water-Resources estigations Report 83-4271, 1984. 37 p, 14 Fig, 8

criptors: *Drainage ditches, *Groundwater, drologic models, *Indiana, Lake Michigan, Na- al Parks, Organic soils, *Sand aquifers, *Un- fined aquifers, Water table decline, Wetlands, inage-ditch maintenance, Porter County, eambed gradients, The Pines.

Brown ditch drains wetlands between three parallel ridges of sand dunes near the East Unit of Indiana Dunes National Lakeshore in Poter County, Indiana. Dune and lacustrine sands form a surficial aquifer that is the source of base flow to the ditch. Profiles established in July and August 1982 show that the average streambed slope of the ditch in the Lakeshore (0.19 percent) is six times that of the upstream east reach in the adjacent town, The Pines (0.03 percent). Although the ditch contains debris and vegetation, the reach in the Lakeshore seems to convey all the base flow it receives. In contrast, the upstream east arm contains several ponded sections where flow is sluggish. Digital model simulations show that dredging to form a uniformly graded streambed and eliminate ponding in the upstream east arm of the ditch south of The Pines could lower the water table 0.2 to 2.0 feet in The Pines. Lowering the ditch stage in the Lakeshore by 0.5 to 1.0 foot would cause additional water-table decline of less than 0.5 foot in The Pines. Lowering the ditch stage both in the Lakeshore and in The Pines could lower the water-table in the Lakeshore by nearly 1.0 foot. (USGS)
W85-01948

FLOOD POTENTIAL OF FORTYMILE WASH AND ITS PRINCIPAL SOUTHWESTERN TRIBUTARIES, NEVADA TEST SITE, SOUTHERN NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-02037

MAGNITUDE AND FREQUENCY OF FLOODS FROM URBAN STREAMS IN LEON COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. A. Franklin, and G. T. Losey.
Available from OFSS, USGS, Box, 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 84-4004, 1984. 37 p, 10 Fig, 8 Tab, 31 Ref.

Descriptors: *Flood frequency, *Rainfall-runoff, *Unit hydrograph, Data collections, *Florida, Leon County, Urban areas.

Techniques are provided for estimating flood magnitudes for urban-flow streams in Leon County, Florida, for recurrence intervals of 2, 5, 10, 25, 50, 100, and 500 years. Synthetic flood peaks were generated by using a calibrated lumped-parameter rainfall-runoff model, pan evaporation data from Milton, Florida, and long-term unit rainfall records from Thomasville-Collidge, Georgia, and Pensacola, Florida. The flood peaks were used in multiple linear regression analyses to derive regional equations relating flood magnitude to basin characteristics. Significant basin characteristics were drainage area and impervious area. The average standard error of prediction ranged from + or - 32 percent for the 5-year recurrence interval to + or - 47 percent for the 500-year recurrence interval flood. (USGS)
W85-02047

FLOODS OF AUGUST 7-8, 1979, IN CHAUTAUQUA COUNTY, NEW YORK, WITH HYDRAULIC ANALYSIS OF CANADAWAY CREEK IN THE VILLAGE OF FREDONIA,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-02051

EFFECTS OF SEDIMENTATION ON THE STORAGE CAPACITY OF THE HIGH ASWAN DAM RESERVOIR,
Ministry of Irrigation, Cairo (Egypt). Research Inst. of High Dam Side Effects.
S. Shalash.
Hydrobiologia, Vol. 92, p 623-639, July, 1982. 12 Fig, 14 Tab, 2 Ref.

Descriptors: *Nile River, *Egypt, *High Aswan Dam, Storage capacity, *Sedimentation, Dam effects, Suspended sediments, Flood discharge, Dead storage.

The River Nile receives most of its sediment load from the Atbara and Blue Nile rivers, which carry eroded sediments north from the Ethiopian mountains during the seasonal flood between August and October. Prior to the construction and operation of the High Aswan Dam, in 1964, 9-10 x 10 to the 6th metric tons of suspended sediment were deposited annually in the flood plain of the Nile, while about 93% of the total average annual suspended load of 124 x 10 to the 6th metric tons was carried out into the Mediterranean Sea. Since the full operation of the High Aswan Dam in 1968, the flood discharge of the Nile, below the dam, has been greatly modified and more than 98% of the total suspended load has been retained within the reservoir. Based on long-term records, estimated relationships between discharge and suspended load, and field measurements, the life span of the dead storage capacity has been estimated at a minimum of about 360 years. Although this preliminary calculation is less than the estimated design capacity of 450 years, it is expected that progressively more suspended solids will be released in the outflow of the reservoir and that together with the use of flood diversion schemes the High Aswan Dam is likely to approach its design life span. (Author's abstract)
W85-02101

INVESTIGATION OF TWO POSSIBLE MODES OF ACTION OF THE INERT DYE AQUASHADE ON HYDRILLA,
University of South Florida, Tampa. Chemical and Environmental Management Services Center.
D. C. Manker, and D. F. Martin.
Journal of Environmental Science and Health, Vol. A19, No. 6, p 725-733, 1984. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Hydrilla, *Aquatic weed control, *Aquashade, Submersed plants, Plant growth, Shading, Photodynamic action.

The response of the submersed plant Hydrilla verticillata (Royle) in well water solutions of the inert dye Aquashade was measured. Growth rate was measured as increase in wet weight following two weeks in a phytotron room at 125 micro E/sq m/sec. It was found that plants treated with 3 ppm Aquashade grew 30.8% +/- 9.9% compared to plants without Aquashade which grew 62.0% +/- 18%. The two mechanisms of action which were investigated were shading and photodynamic action. A plot of percent growth versus concentration of Aquashade showed exponential decrease owing to shading. Available data indicate that the effect of shading is the major, if not exclusive, mode of action affecting the growth of hydrilla. (Author's abstract)
W85-02122

WATER HYACINTH CANOPY AND PAN EVAPORATION,
Meteorological Office, Poona (India).
L. S. Rathore, S. J. Maske, and S. K. Shaha.
Mausam, Vol. 35, No. 1, p 81-86, 1984. 5 Fig, 4 Tab, 3 Ref.

Descriptors: *Pan evaporation, *Water hyacinth, *Water loss, *Aquatic weeds, *Evaporation, *Evapotranspiration, *Vaporization, India, Climatic data, Weather patterns, Canopy, Air temperature, Transpiration control.

Using an open pan evaporimeter covered with water hyacinth, water loss was compared to a pan evaporimeter not covered by this aquatic weed. Meteorological parameters such as wind speed, rainfall, air temperature, water, temperature and canopy temperature were taken into consideration. The influence of water hyacinth canopy on water losses from free water surfaces doubles the water losses due to the plants higher transpiration rate. The application of a water budget to the canopy area provides the quantity of water vaporized from it during a particular budget period. These values of water loss will be helpful in water management,

irrigation and other agricultural operations. (Wheatley-IVI)
W85-02128

CASE FOR AUTOMATED WATER MANAGEMENT,
For primary bibliographic entry see Field 6A.
W85-02130

USE OF MODELS FOR WATER RESOURCES MANAGEMENT, PLANNING, AND POLICY,
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 6A.
W85-02146

DESCRIPTIVE DECISION PROCESS MODEL FOR HIERARCHICAL MANAGEMENT OF INTERCONNECTED RESERVOIR SYSTEMS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
R. I. Adiguzel, and O. Coskunoglu.
Water Resources Research, Vol. 20, No.7, p 803-811, July, 1984. 6 Fig, 3 Tab, 40 Ref, 1 Append.

Descriptors: *Model studies, *Multireservoir networks, *Reservoir operation, Optimization, Decision making, Planning, Multipurpose reservoirs.

A significant limitation of prescriptive optimization models is that their formulation is disassociated from the behavioral and organizational attributes of the problem addressed. In an attempt to alleviate this limitation a decision process model is formulated directly within a framework of decision agents involved in integrated long- and short-term planning and management of multipurpose and multireservoir system operations. The resulting model is hierarchical, multilevel, multilayer, and decentralized. As such it is descriptive of a reservoir system managed and operated by geographically separated multiple agents with different authorities and responsibilities. Robustness and performance of the model is investigated by using the Shasta-Trinity system of California as an example. Results are encouraging for the descriptive as well as prescriptive relevance of the model. (Author's abstract)
W85-02147

4B. Groundwater Management

WATER-LEVEL CHANGES IN THE HIGH PLAINS REGIONAL AQUIFER, NORTHWESTERN OKLAHOMA, PREDEVELOPMENT TO 1980,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01771

WATER RESOURCES OF THE FORT UNION COAL REGION, EAST-CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01772

LP EMBEDDED SIMULATION MODEL FOR CONJUNCTIVE USE MANAGEMENT OPTIMIZATION,
Nevada Univ. System, Reno. Water Resources Center.
C. R. Koltermann.
Available from the National Technical Information Services, Springfield, VA 22161 as PB84-202522, Price codes: A07 in paper copy, A01 in microfiche. Publication 41091, November 1983. 134 p, 31 Fig, 11 Tab, 50 Ref, 3 Append. Project No. OWRT A-103-NEV(1), Contract/Grant No. 14-34-0001-2130.

Descriptors: *Conjunctive use, *Linear programming, *Simulation analysis, Management planning, *Optimization, Groundwater management, Numerical analysis, *Model studies.

Equations for groundwater flow and surface water continuity are embedded in a linear programming hydraulic management model for the optimal conjunctive use of a groundwater and surface water system. This management model uses groundwater and surface water variables directly as decision variables. Problem reduction methods by reduction of decision variables and reduction of constraints, is of little utility. Time was incorporated in a lumped transient formulation in which all time periods are executed at once and in a step-wise procedure in which final heads from current time step are used as initial heads in the next time step. The hydraulic management approach is valid for the groundwater model, but appears too simplistic for the conjunctive use model. The embedding method is useful for small problems over a limited number of time steps, but encountered numerical difficulties when applied to a large real-world problem.
W85-01801

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN CHAMBERS, LIBERTY, AND MONTGOMERY COUNTIES, TEXAS, 1975-79,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01818

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN BRAZORIA, FORT BEND, AND WALLER COUNTIES, TEXAS, 1975-79,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01819

GROUND WATER IN THE REDDING BASIN, SHASTA AND TEHAMA COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. J. Pierce.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4052, 1983. 37 p, 7 Fig, 8 Tab, 23 Ref.

Descriptors: *Geohydrology, *Groundwater basins, *Groundwater level, Groundwater movement, Groundwater recharge, Groundwater storage, Water quality, *California, Redding Basin, Central Valley.

An appraisal of ground-water conditions in the Redding Basin was made by the U.S. Geological Survey and the California Department of Water Resources during 1979 and 1980. The basin covers about 510 square miles in the northern part of the Central Valley of California. Ground water in the basin is obtained principally from wells tapping continental deposits of Tertiary and/or Quaternary age. These deposits are arranged in a synclinal structure that trends and plunges southward. Recharge to the basin is from subsurface inflow; infiltration of precipitation and excess irrigation water; and percolation of certain reaches of streams and creeks. Ground-water movement is generally from the periphery of the basin towards the Sacramento River. Hydrographs for the period 1956 to 1970 show only a slight water-level decline and virtually no change between 1970 and 1979. The total estimated pumpage for 1976 was 82,000 acre-feet. Estimated usable storage capacity for the basin is about 5.5 million acre-feet. Chemical quality of ground water is rated good to excellent. Water type is a magnesium-calcium bicarbonate in character. The underlying Chico Formation contains saline marine water which is of poor quality. (USGS)
W85-01945

APPRAISAL OF WATER FROM SURFICIAL-OUTWASH AQUIFERS IN TODD COUNTY AND PARTS OF CASS AND MORR COUNTIES, CENTRAL MINNESOTA,
Geological Survey, St. Paul, MN. Water sources Div.
C. F. Myette.
Available from OFSS, USGS, Box 25425, Ctr. Denver, CO 80225, USGS Water-Reso Investigations Report, 1984. 43 p, 21 Fig, 8 Ta Ref.

Descriptors: *Groundwater resources, *Ac characteristics, Water quality, Hydrologic m Todd County, Morrison County, Cass Co *Minnesota.

Outwash deposits consisting of medium to coarse sand are an important aquifer in County and in parts of Cass and Morrison C ties, Minnesota. The outwash ranges in thic from 0 to 150 feet. Depth to water is generall than 15 feet and annual water-level fluctuation less than 5 feet. Aquifer-test results indicate transmissivities range from 4,600 to 18,500 squared per day and storage coefficients r from 0.10 to 0.25. Well yields of more than gallons per minute can be obtained locally in p erly constructed wells. The water is a cal bicarbonate type and is generally suitable for uses. The water is hard to very hard with solved-solids concentrations ranging from a 200 to 400 milligrams per liter. Locally, nitrate as much as 6.4 milligrams per liter. Pesticides present in elevated concentrations but do exceed U.S. Environmental Protection Ag recommended limits for domestic consump Results from numerical modeling experiments cate that, with proper development, the gro water system is capable of accommodating a tional withdrawals. (USGS)
W85-02038

AQUIFER TESTS IN THE STRATIFIED DR CHIPUXET RIVER BASIN, RHODE ISLA
Geological Survey, Providence, RI.
For primary bibliographic entry see Field 2F.
W85-02039

HYDROGEOLOGY OF WELL-FIELD AR NEAR TAMPA, FLORIDA, PHASE 2--DEV OPMENT AND DOCUMENTATION OF QUASI-THREE-DIMENSIONAL FINITE-D FERENCE MODEL FOR SIMULATION STEADY-STATE GROUND-WATER FLOW,
Geological Survey, Tallahassee, FL. Water sources Div.
For primary bibliographic entry see Field 2F.
W85-02052

COMPETITION VERSUS OPTIMAL C TROL IN GROUNDWATER PUMPING WH DEMAND IS NONLINEAR,
New Mexico Univ., Albuquerque. Dept. of Mat matics and Statistics.
R. C. Allen, and M. Gisser.
Water Resources Research, Vol. 20, No. 7, p 7 756, July, 1984. 2 Fig, 3 Tab, 12 Ref.

Descriptors: *Water demand, *Groundwater m agement, *Water use, *Competition, *Optimal c trol, Pumping, Agriculture, Water rights.

Optimal control versus no control in groundw pumping is considered under the assumption c nonlinear demand function for water use. T study considers the case where many farmers other users pump water from a common aqui Exclusiveness is present in the aquifer, since o farmers who own land overlying the aquifer pump water, and other farmers are excluded fr the resource. Cities and nonfarm producers o limited water rights, and can increase their wa use only by purchasing water rights from otl users. For the case of the nonlinear demand fu tion, if water rights are properly defined and if storage capacity of the aquifer is relatively lar the difference between a strategy of no control a a strategy of optimal control is small and thus be ignored for practical policy consideratio Even if simulated optimal control yields sligh

- results than no control, a strategy of no
ol is likely to yield better results than optimal
ol, unless one is sure that the estimated
nd for groundwater is very close to the true
nd. (Moore-IVI)
02141

Effects On Water Of
lan's Non-Water
ctivities

**D USE, RUNOFF AND RECHARGE ON
ECTED WATERSHEDS IN THE U.S.
GIN ISLANDS,**
bean Research Inst., St. Thomas, VI.
nith, and O. Ajayi.
nical Report No. 13, September 1983. 57 p, 10
11 Tab, 33 Ref. Project No. OWRT A-012-
, Contract/Grant No. 14-34-0001-2150.

riptors: *Land use, *Surface runoff, *Rainfall-
f relationships, Groundwater recharge, *Nat-
recharge, Land management, Land develop-
Surface-groundwater relationships, *Water-
, *Virgin Islands, *St Thomas, West Indies.

e watersheds with different land use charac-
ics on St. Thomas, Virgin Islands were instru-
ed and monitored to study the effects of vari-
and use patterns on runoff and groundwater
rge. The water crop (combined runoff and
ndwater recharge) for each watershed was
lated using two different methods, and the
f determined independently using a Soil Con-
tion Service method. While results illustrated
ffect of different land uses on recharge, the
discrepancies in results according to the
od applied highlighted the need for extensive
collection for such a study to be conclusive.
-01799

**UND-WATER HYDROLOGY AND QUAL-
BEFORE AND AFTER STRIP MINING OF
MALL WATERSHED IN JEFFERSON
NTY, OHIO,**
ogical Survey, Columbus, OH. Water Re-
es Div.
. Razem.
lable from OFSS, USGS, Box 25425, Fed.
Denver, CO 80225. USGS Water-Resources
stigations Report 83-4215, 1984. 39 p, 18 Fig, 5
12 Ref.

riptors: Coal, *Groundwater, *Strip mines,
nentary rocks, Perched water, Observation
, Spoil banks, *Base flow, *Ohio, Jefferson
nty.

nd-water conditions before and after surface
ng of a small watershed are described as part
study to determine the effects of mining on
ologic systems. The watershed was underlain
tratified sedimentary rocks containing local
fers above shaley clay beds associated with the
r coal seams. Mining involved removing the
burden rocks, including most of the top aqui-
stripping the coal, and recontouring the over-
en spoils to the approximate premining shape
e watershed. Replacement of the top aquifer
spoils during regrading has caused many
ges in recharge and discharge rates, saturated
ness, aquifer characteristics, and water qual-
In the middle aquifer there were changes in
rated thickness and water quality. Resaturation
e top-aquifer spoils during and after reclama-
has been slow. Saturated thicknesses have
ed from zero initially after mining to 4 feet
1 1/2 years. Water levels in the middle aqui-
ave risen from a few feet to 40 feet. Water
ity generally has been degraded: concentra-
s of bicarbonate, calcium, magnesium, chloride,
manganese, sulfate, and dissolved solids have
eased. Premining water types remained about
same after mining, except for some changes
bicarbonate type to sulfate type. (USGS)
-01943

**OOD-FREQUENCY ESTIMATES FOR FIVE
GED BASINS IN WICHITA, KANSAS,**
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-01949

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE CORRAL CREEK AREA, HANGING WOMAN CREEK COAL FIELD, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-02040

HYDROLOGY OF AN ABANDONED COAL-MINING AREA NEAR MCCURTAIN, HASKELL COUNTY, OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-02041

MAGNITUDE AND FREQUENCY OF FLOODS FROM URBAN STREAMS IN LEON COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4A.
W85-02047

SEDIMENT CONCENTRATIONS FROM INTENSIVELY PREPARED WETLAND SITES,
Clemson Univ., SC. Belle W. Baruch Forest Science Inst.
G. R. Askew, and T. M. Williams.
Southern Journal of Applied Forestry, Vol. 8, No. 3, p 152-157, August, 1984. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Sedimentation, *Logging, *Drainage systems, *Bay lands, *South Carolina, *Suspended sediments, Erosion, Roads, Drainage ditches, Construction Wetlands, Water pollution sources, Water pollution control.

Conversion of pocosin and bay lands in the southeastern US from natural hardwood stands to loblolly pine plantations usually involves the installation of some form of drainage system followed by logging, site preparation, and planting. The drainage system may provide a pathway for sediment produced by these activities to reach natural streams. Suspended sediment concentrations were measured in water draining from a 5,900-acre Carolina bay located in southeastern Georgetown County, South Carolina, which is undergoing conversion to loblolly pine plantations. Samples were collected during the first storm-flow event of each month between January 1981 and December 1982 from subwatersheds involved in some of several phases of conversion. Suspended sediment concentrations in water draining from the bay averaged 16 mg/l despite logging, site preparation road maintenance and use, and installation of drainage ditches. Road erosion and ditch installation produced the highest suspended sediment concentrations. Suspended sediment concentrations decreased substantially with increasing distance from the sediment source. Logging and site preparation did not lead to increased sedimentation as long as heavy equipment was not allowed to operate in the ditches. Apparently on the flat coastal soils overload flow normally transports sediment only from roads or from disturbed sites immediately adjacent to drainage ditches. One way to minimize the impact of roads and new drainage ditches is to use a drainage system that contains a length of main channel between sediment sources and sensitive areas. (Moore-IVI)
W85-02112

EFFECT OF CLEAR-CUT SILVICULTURE ON DISSOLVED ION EXPORT AND WATER YIELD IN THE PIEDMONT,
Georgia Univ., Athens. School of Forest Resources.
For primary bibliographic entry see Field 5B.
W85-02171

4D. Watershed Protection

SEDIMENT TRANSPORT IN THE TANANA RIVER NEAR FAIRBANKS, ALASKA, 1980-81,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 2J.
W85-01788

EROSION CONTROL AT HIGH ALTITUDES (EROSIONSBEKAMPFUNG IM HOCHGEBIRGE),
Buero fuer Landschaftsplanung, Uster (Switzerland).
T. Weibel.
Wasser, Energie, Luft, Vol. 76, No. 3/4, p 62-63, 1984. 3 Fig.

Descriptors: *Erosion control, *High altitude, *Vegetation, *Austria, Trees, Forests, Stream erosion, Stream banks, Bank stabilization, Floods.

Biological means of erosion control in the Austrian high Alps were the subject of the Biological Engineering Association's fourth annual conference, held in Brixen, Austria. Emphasis was placed on steep slopes and on running water. In the South Tyrol, spruce, larch, and Scotch fir offer maximum erosion protection. The difficulty of finding suitable species and the seeds thereof for planting in eroded areas (in order to stabilize them) at the edge of forests at altitudes of 2,500 m produced less than satisfactory results. Zanggenbach is a stream whose bed was anchored with barriers 10 yr ago. Lack of bank reinforcement has resulted in the stream scouring into its banks between the barriers. Since 1980, its flow profile has been undergoing restoration and is being secured by plantings on the banks; stone blocks at the foot of the planting sites prevent the stream from undermining them. There is a head of 3 m between stream barriers, which is the maximum for biological bank stabilization. Proof of success of the plantings was seen when they withstood tractive stresses of 12 and 22 kg/sq m 6 and 15 mo after planting during the floods of October 1980 and July 1981. The limited success of measures at Piz Culac, 1,900-1,100 m above sea level where forests were planted to secure eroded areas was attributed to the use of unsuitable species. (Gish-IVI)
W85-01863

ENSURING A HIGH LEVEL OF EFFECTIVENESS AND INTENSITY OF AGRICULTURAL AND WATER-MANAGEMENT PRODUCTION IN DRINKING-WATER CATCHMENT AREAS (SICHERUNG HOHER EFFEKTIVITAT UND INTENSITAT DER LANDWIRTSCHAFTLICHEN UND WASSERWIRTSCHAFTLICHEN PRODUKTION IN TRINKWASSER-EINZUGSGEBIETEN),
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
S. Dyck, U. Grunewald, and D. Uhlmann.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 3, p 56-58, April, 1984. 2 Fig, 14 Ref.

Descriptors: *Watershed protection, *Agriculture, *East Germany, Catchment areas, Drinking water, Water management, Land use, Cycling nutrients, Hydrologic models.

Rational use and effective protection of natural resources are vital components of the German Democratic Republic's economic strategy for the 1980s. Since the ground acts as a reservoir for nutrients and water, the implementation of these goals with regard to drinking water is largely dependent on integrating the interests of intense agricultural production and those of water management in drinking-water catchment areas (comprising about 14% of the country's agricultural land). Interdisciplinary research is being conducted in drinking-water reservoir catchment areas in the Erz mountains with the aim of developing general principles for planned, scientifically-based multiple land use in all catchment areas in the hard-rock region. The studies will also objectify and revise existing restrictions on agricultural land use, cattle

farming, and communal land use. Especially significant is the development of methods of analyzing interrelationships between land, plants, and animals determined by natural cycles (e.g., nitrogen, phosphorus, agricultural, or water cycles) and their effect on water resources. Such complex analysis also places new demands on intradisciplinary research: e.g., the old block model of hydrological processes is no longer adequate and is replaced by continuous process analysis of separate flow components. (Gish-IVI)
W85-01883

SEDIMENT TRANSPORT IN THE LOWER YAMPA RIVER, NORTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2J.
W85-02045

5

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

PRELIMINARY FINDINGS OF THE PRIORITY POLLUTANT MONITORING PROJECT OF THE NATIONWIDE URBAN RUNOFF PROGRAM,
Dalton-Dalton-Newport, Inc., Cleveland, OH.
R. H. Cole, R. E. Frederick, R. P. Healy, and R. G. Rolan.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 898-908, July 1984. 1 Fig, 7 Tab, 10 Ref.

Descriptors: *Monitoring, *Pollutant identification, *Organic compounds, *Urban runoff, *Metals, Pentachlorophenol, Copper, Lead, Zinc, Cadmium, Path of pollutants.

Twenty-four pollutants were detected in at least 10% of the urban runoff samples. These were selected for further evaluation and consideration of their implications in water quality protection and maintenance. The organic priority pollutants found most frequently in the predominantly residential and commercial area samples pose little risk to humans at detected levels. The predominant pathway for human exposure to the organics associated with gasoline is through ingested food and inhalation, so that contaminated surace water should pose little risk at the levels measured in Nationwide Urban Runoff Program (NURP) samples. Some of the priority pollutant metals in urban runoff could represent a potential risk to human health. The noncarcinogenic human health criteria, drinking water standards, and human carcinogenic criteria were exceeded. Nickel concentrations in undiluted runoff exceeded the human health criterion of 13.4 micro g/liter in 30% of the samples. Arsenic concentrations in undiluted runoff frequently exceeded the EPA human carcinogenic criterion. Because most storms last between 2 and 16 hours, the most meaningful measure of potential aquatic life effects is a comparison of pollutant concentrations with acute water quality criteria and toxicity values. If pollutant levels exceed these values before dilution, then aquatic species are likely to be impacted in the mixing zone. Pentachlorophenol was the only organic priority pollutant to exceed freshwater acute aquatic life criteria. Four priority pollutant metals, Cd, Cu, Pb, and Zn, exceeded freshwater acute aquatic life criteria in 9 to 50% of the samples. (Baker-IVI)
W85-01661

DETERMINATION OF ORGANOHALOGENIC ACIDS IN WATER SAMPLES (BESTIMMUNG HALOGENORGANISCHER SAUREN IN WASSERPROBEN),
Bremen Univ. (Germany, F.R.). Fachbereich Chemie/Biologie.
U. Lahl, B. Stachel, W. Schroer, and B. Zeschmar.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17, No. 2, p 45-49, 1984. 7 Fig, 5 Tabs, 5 Ref.

Descriptors: *Halogenated hydrocarbons, *Trichloroacetic acid, *Chlorination, Chemical analysis, Hypochlorite, Humic acids, Lignin sulfonic acids, Bromine, Drinking water, Swimming pools, Tribromacetic acid, Surface water.

A method for the determination of halogenorganic acids in water samples is presented. As the results of the analyses show, trichloroacetic acid (TCA) seems to be a by-product of drinking water chlorination. Laboratory experiments show, that TCA is generated by reaction of hypochlorite with humic and ligninsulfonic acids. Furthermore in the presence of comparatively high bromide concentrations the generation of tribromoacetic acid (TBrA) could be seen. Analytical results of different drinking, surface and swimming pool water samples are presented. Mean concentrations of 36 micro g/l TCA were found in the water of several public swimming pools. (Author's abstract)
W85-01663

DETERMINATION OF CHLORINE DIOXIDE AND CHLORITE IN DRINKING-WATER (BESTIMMUNG VON CHLORDIOXID UND CHLORIT IM TRINKWASSER),
Technische Univ., Munich (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
For primary bibliographic entry see Field 5F.
W85-01664

DETERMINATION OF 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN IN TREATED WASTEWATER,
Dow Chemical Co., Midland, MI. Analytical Labs.
T. L. Peters, T. J. Nestrick, and L. I. Lamparski.
Water Research, Vol. 18, No. 8, p 1021-1024, 1984. 2 Fig, 1 Tab, 4 Ref.

Descriptors: *TCDD, *Wastewater analysis, Dioxins, Gas chromatography, Mass spectrometry.

The EPA recently proposed a procedure designated as Method 613 for the determination of parts-per-trillion concentrations of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in wastewater effluents. Interference problems encountered while attempting to utilize this procedure led to modifications which shorten the analysis time, simplify the procedure and improve the recoveries. A combination of cleanup steps on silica, alumina, and reactant modified adsorbents yields a relatively interference-free residue when examined by gas chromatography/mass spectrometry in the selected ion monitor (SIM) mode of operation. (Moore-IVI)
W85-01729

DETERMINATION OF OXIDANTS FORMED UPON THE DISINFECTION OF DRINKING WATER WITH CHLORINE DIOXIDE,
Louisiana State Univ., Baton Rouge. Inst. for Environmental Studies.
B. Limoni, E. Choshen, and Ch. Rav-Acha.
Journal of Environmental Science and Health, Vol. A19, No. 8, p 943-957, December, 1984. 3 Fig, 3 Tab, 17 Ref.

Descriptors: *Disinfection, *Drinking water, *Oxidants, *Chlorine dioxide, *Israel, Chlorine, Chlorate, Chlorite, Water treatment, Halogenated hydrocarbons.

The disinfection policy of the National Water Carrier of Israel has recently been changed from chlorine to chlorine dioxide. The need for a precise determination of ClO2 and all its inorganic by-products has been recognized. A careful study of the analytical methods needed for such precise determinations leads to the conclusion that combined methods should be applied simultaneously. While the specific chlorine electrode method could satisfactorily determine the concentrations of Cl2 and ClO2 together at pH 7, the chlorophenol red method was needed for the specific determination of ClO2. The chlorite was determined by the specific chlorine electrode at pH 2, and a good correlation was found with the polarographic method which is specific for chloride. The small concentrations of chlorine produced upon disinfection with ClO2 can explain the few chloro-organic materials that were formed. It seems that the ch rine which is produced during disinfection w ClO2 reacts further with some of the organic ma rials found in the water to produce halogena organic compounds. (Baker-IVI)
W85-01743

DETERMINATION OF 4-AMINOPHENOL WATER BY HIGH-PERFORMANCE LIQU CHROMATOGRAPHY WITH FLUORE CENCE DETECTION,
State Chemical Supervision Service, Soebc (Denmark).
B. Schultz.
Journal of Chromatography, Vol. 299, No. 2, 484-486, September, 1984. 2 Fig, 8 Ref.

Descriptors: *Water analysis, *Phenols, *Chrom tography, *Pollutant identification, *Insecticic Parathion, Water quality control.

The determination of 4-aminophenol, a metaboli of the insecticide parathion, in water is describ using ion pair HPLC and fluorescence detectio Maximum excitation and emission wavelengths f 4-aminophenol were 323 and 373 nm, respectivel Phenol has excitation and emission maxima at 27 and 298 nm, respectively. The detection limit usir fuorescence detection of 4-aminophenol was 3 pg. Injection of 100 micro l water sample the gives a detection limit for 4-aminophenol in wat corresponding to 3 micro g/l, or 3 ppb. The analy sis of tap water and surface water did not sho any interference, giving the same detection limi in these media as in Millipore-filter water. Regre sion analysis showed a linear correlation betwee the injected amount and the fluorescence intensit for 4-aminophenol in the range 0.3-3 ng. A relativ standard deviation of 0.4% was obtained for direc determination of 4-aminophenol at a concentratio of 5 micro g/l in tap water. (Baker-IVI)
W85-01746

QUANTITATIVE DETERMINATION OF PPI LEVELS OF CARBAMATE PESTICIDE I WATER BY CAPILLARY GAS CHROMATOG RAPHY,
New York State Coll. of Human Ecology, Ithaca Dept. of Design and Environmental Analysis.
W. Z. Zhong, A. T. Lemley, and J. Spalik.
Journal of Chromatography, Vol. 299, No. 1, p 269-274, September, 1984. 2 Fig, 2 Tab, 9 Ref
EPA grant R809867.

Descriptors: *Water analysis, *Pesticides, *Carbamates, *Aldicarb, *Chromatography, Water quality control, Drinking water, Wells, Surface waters.

A new gas chromatographic method is reported for the quantification of aldicarb and its oxidative metabolites. The method has also been modified for quantification of carbofuran, oxamyl and methomyl. An open tubular column and a nitrogen phosphorus detector are used to quantify nanogram levels of aldicarb, aldicarb sulfoxide and aldicarb sulfone in a one injection procedure. Linear calibration curves are obtained for each species. The method is particularly useful for environmental sampling and for degradative studies in soil-water systems in the laboratory since all three metabolites can be determined in one sample. A typical chromatogram of a mixture contaning 2 micro g/ml each of aldicarb, aldicarb sulfoxide and aldicarb sulfone is shown. By comparing peak areas obtained from injections of the individual compounds to those obtained from the mixture, it is shown that there is no evidence of oxidation of the aldicarb or aldicarb sulfoxide to the next metabolite under the experimental conditions described. The amount recovered by the extraction procedure for each metabolite in four standard aqueous solutions in both distilled water and well water ranging in concentration from 5 to 20 ppb was 96 to 105%. The high recoveries of aldicarb can only be achieved with slow evaporation of the solvent extract at a temperature less than 40 C. The extraction procedure permits analysis of water samples with concentrations of aldicarb and its metabolites as low as 1 ppb. (Baker-IVI)
W85-01747

RMINATION OF ALDICARB AND ITS ATIVES IN GROUNDWATERS BY PERFORMANCE LIQUID CHROMAAPHY WITH UV DETECTION,
Univ., Gainesville. Dept. of Environmental ering Sciences.
iles, and J. J. Delfino.
of Chromatography, Vol. 299, No.1, p 275- ptember, 1984. 2 Fig, 2 Tab, 14 Ref.

ptors: *Water analysis, *Aldicarb, *Pesti- *Chromatography, Water quality control, nt identification.

ethod presented allows rapid and precise ination of aldicarb and several of its deriva- groundwater down to the micro g/l or am level without sample pretreatment. UV of aldicarb and its derivatives showed the um absorption wavelengths to range from 203 nm with the exception of aldicarb nitrile. A chromatogram of four aldicarb ives separated isocratically with a mobile of acetonitrile-water on a Zorbaxoctyl sta- phase is shown. Standard curves for the unds tested were linear over the range ex- and squares of the correlation coefficients ir-point standard curves were very good. of detection for the three carbamyl oximes eir oximes were approximately 10 micro g/l g each. Detection of aldicarb sulfone nitrile vastly improved by decreasing the wave- of detection, however, increased absorption rferences and mobile phase limit the usefulf this modification. Reversed-phase HPLC V detection proved a useful method for the letermination of aldicarb and its derivatives eous samples down to the micro g/l or am level. Two isocratic runs were used to e all the aldicarb compounds in a reasonable although solvent programming could de- total analysis time. No sample pretreatment eeded which allowed rapid and precise meas- nts of degradation of aldicarb, aldicarb sulf- and aldicarb sulfone in groundwater micro- (Baker-IVI)
1748

Y METALS IN ULVA LACTUCA COLED WITHIN TOLO HARBOUR, AN OST LANDLOCKED SEA,
e Univ. of Hong Kong, Shatin. Dept. of y.
imary bibliographic entry see Field 5B.
1762

CTS OF PHOSPHATE FERTILIZER APATIONS AND CHEMISTRY-MINERALOF THE IRON OXIDE SYSTEM ON PHOSE ADSORPTION-DESORPTION BY AM SEDIMENTS,
State Univ., Columbus. Dept. of Agronomy.
imary bibliographic entry see Field 5B.
1794

AL SPECIATION IN SURFACE WATERS HE GREAT LAKES REGION,
gan State Univ., East Lansing. Dept. of Fish- nd Wildlife.
iesy.
able from the National Technical Information e, Springfield, VA 22161 as PB84-190396, codes: A04 in paper copy, A01 in microfiche. te of Water Research Completion Report, nber 1983. 60 p, 9 Fig, 5 Tab, 130 Ref. t No. OWRT A-121-MICH(1), Contract/ No. 14-34-0001-2124.

iptors: *Uranium, *Trace metals, Computer , Ion exchange, Chemical reactions, Dynam- lumic acids, Chemical analyses, *Stability nts, Model studies, Thermodynamics, Laser metry, Scatchard analyses, Gaussian model, ction.

cting the dynamics of trace metals such as m by thermodynamic prediction models is gent upon accurate stability constants. Con- al stability constants (K') for the binding of l ion (UO2(2+)) to humic substances were determined by both Scatchard analyses and by fitting the data to a Gaussian model of multiple sites. UO2(2+) was separated from that which was bound to humic material by ion exchange. Uranium concentration was measured by laser fluorometry. There is a broad range of strengths of sites such that K' was dependent on the UO2(2+) humic ratio. The maximum binding capacity of the humic material was 4.83 x 10 to the minus 4th power M/g. The log K' determined for log metal/ligand ratios of -1.5 to -0.5, the ecologically significant range of interest for UO2(2+), which was from 10 - 50 micrograms/l at the carbon concentration of 2.36 mg/l used in this study, was determined by Scatchard analysis to be 7.38. The estimate based on a Gaussian distribution was 6.85. W85-01811

FLUORIDE, NITRATE, AND DISSOLVED-SOLIDS CONCENTRATIONS IN GROUND WATERS OF WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01828

HEPATIC MIXED-FUNCTION OXIDASES IN CALIFORNIA FLATFISHES ARE INCREASED IN CONTAMINATED ENVIRONMENTS AND BY OIL AND PCB INGESTION,
Lawrence Livermore National Lab., CA.
R. B. Spies, J. S. Felton, and L. Dillard.
Marine Biology, Vol. 70, No. 2, p 117-127, September, 1982. 6 Fig, 5 Tab, 45 Ref. DOE contract W-7405-Eng-48 and EPA contract EPA-IAG-D6-E681-CF.

Descriptors: *Oil pollution, *Polychlorinated biphenyls, *Flatfish, *California, *Monitoring, *Mixed-function oxidases, Water pollution effects, Coastal areas, Enzymes, Effluents, Fish, Adaptation.

Hepatic mixed-function oxidases (MFOs) were measured in the bothid flatfishes Citharichthys sordidus and C. stigmaeus from relatively uncontaminated and from polluted coastal populations of California, USA, at various times of the year during 1979-1980 and in individuals fed crude oil and polychlorinated biphenyl-augmented food in the laboratory. For C. sordidus, aryl hydrocarbon hydrocylase (AHH) specific activity was generally highest around the Los Angeles County sewage outfall on the Palos Verdes Shelf, intermediate near the 7-mile Hyperion sewage outfall in Santa Monica Bay and around a petroleum seep in the Santa Barbara Channel, the lowest in relatively unpolluted Monterey Bay. For C. stigmaeus, which had about ten times less specific activity than the foregoing species, specimens from the Santa Barbara petroleum seep had significantly greater AHH specific activity than those from Monterey Bay. Fishes from contaminated environments also showed increases of microsomal proteins with molecular weights of 56, 54, 57, and 46 x 10 to the 3rd; moreover, the content of cytochrome P-450 was elevated in specimens of C. sordidus from such environments. Augmentation of food with seep oil or polychlorinated biphenyls (PCBs) induced significant increases in the specific activity of AHH and amounts of microsomal proteins in C. stigmaeus. Thus, these two species of flatfishes are good candidates for monitoring biologically meaningful levels of petroleum and polychlorinated biphenyls in contaminated environments. Moreover, the mixed function oxidase pattern in fish populations from the Santa Barbara petroleum seep is evidently a functional adaption to chronic intake of petroleum hydrocarbons. (Author's abstract)
W85-01894

MYTILUS GALLOPROVINCIALIS AND PARAPENAEUS LONGIROSTRIS AS BIOINDICATORS OF HEAVY METAL AND ORGANOCHLORINE POLLUTION,
Institute of Oceanographic and Fisheries Research, Athens (Greece).
J. Satsmadjis, and F. Voutsinou-Taliadouri.
Marine Biology, Vol. 76, No. 2, p 115-124, November, 1983. 1 Fig, 6 Tab, 31 Ref.

Descriptors: *Bioindicators, *Mussels, *Shrimp, *Heavy metals, *Chlorinated hydrocarbons, *Saronikos Gulf, *Greece, Seasonal variation, Sampling, Marine environment.

The mussel Mytilus galloprovincialis and the shrimp Parapanaeus longirostris were evaluated as bioindicators for pollution by heavy metals (Fe, Zn, Cu, Pb, Mn, Ni, Cd, Cr, Co) and chlorinated hydrocarbons (PCBs, p,p'DDE, p,p'DDT, p,p'DDD, BHCs, heptachlor epoxide, dieldrin, endrin). The accuracy of the determinations, the spot and area variability, the overall coefficient of variation, the effect of the season and the size, the differences observed in four sections of the Saronikos Gulf (Greece) for P. longirostris, and the degree of pollution, which was estimated independently by measuring the concentration in the water of nutrients and dissolved oxygen. The organisms can be used as bioindicators of pollution. The individual variability of response, the season and the size do not cause as much assessment error as the large temporal fluctuations and the frequent inadequacies of the analytical procedures. A truly representative sample can be collected by selecting a definite specimen size range, and collecting the organisms over a three month period in an area of uniform salinity and at the same depth. (Moore-IVI)
W85-01899

SPATIAL AND TEMPORAL TRENDS IN HEAVY METAL CONCENTRATIONS IN MUSSELS FROM NORTHERN IRELAND COASTAL WATER,
Queen's Univ., Belfast (Northern Ireland). Dept. of Agricultural and Food Chemistry.
N. F. S. Gault, E. L. C. Tolland, and J. G. Parker.
Marine Biology, Vol. 77, No. 3, p 307-316, December, 1983. 8 Fig, 7 Tab, 29 Ref.

Descriptors: *Bioindicators, *Heavy metals, *Mussels, *Northern Ireland, Coastal waters, Spatial distribution, Temporal distribution, Mercury, Chromium, Water pollution effects, Marine environment.

Data are presented on the heavy metal concentrations in mussels, Mytilus edulis (L), sampled over a 1 yr period (August 1980-August 1981) from Northern Ireland coastal waters. The study was aimed at investigating the spatial extent and temporal trends in heavy metal contamination and highlighting any areas with exceptionally high levels of toxic metals. With the exception of two sites with high values for mercury and chromium, respectively, contamination by metals was relatively low. Significant spatial and temporal differences in the concentrations of several metals were found. There were also significant spatial x temporal interactions for all metals studied. Significant negative correlations between the percentage dry matter content of mussels and the concentrations of several metals were found. There were also significant positive correlations between certain pairs of metals. It is proposed that small variations in contamination of the marine environment can be detected by subtle differences in the concentration of metals in mussels and that mussel condition may be adversely affected by metal contamination. (Author's abstract)
W85-01901

BIOAVAILABILITY OF PB AND ZN FROM MINE TAILINGS AS INDICATED BY ERYTHROCYTE DELTA-AMINOLEVULINIC ACID DEHYDRATASE (ALA-D) ACTIVITY IN SUCKERS (PISCES: CATOSTOMIDAE),
Columbia National Fisheries Research Lab., MO.
C. J. Schmitt, F. J. Dwyer, and S. E. Finger.
Canadian Journal of Fisheries and Aquatic Science, Vol. 41, No. 7, p 1030-1040, 1984. 3 Fig, 4 Tab, 38 Ref.

Descriptors: *Suckers, *Enzymes, *Lead, *Zinc, *Bioavailability, *Mine wastes, Heavy metals, Cadmium, Bioassay, Blood, Statistical models, Fish.

The activity of the erythrocyte enzyme delta-aminolevulinic acid dehydratase (ALA-D) was meas-

ured in 35 catostomids (black redhorse, Moxostoma duquesnei; golden redhorse, M. erythrurum; northern hogsucker, Hypentelium nigricans) collected from three sites on a stream contaminated with Pb-, Cd-, and Zn-rich mine tailings and from an uncontaminated site upstream. Enzyme activity was expressed in terms of hemoglobin (Hb), DNA, and protein concentrations; these variables can be determined in the laboratory on once-frozen blood samples. Concentrations of Pb and Zn in blood and of Pb in edible tissues were significantly higher, and ALA-D activity was significantly lower, at all three contaminated sites than upstream. At the most contaminated site, ALA-D activity was 62-67% lower than upstream. Lead concentrations in the edible tissues and in blood were positively correlated ($r = 0.80$), whereas ALA-D activity was negatively correlated with Pb in blood ($r = -0.70$) and in edible tissues ($r = -0.59$). Five statistically significant relations between Pb and Zn in blood and ALA-D activity were determined. The two models that explained the highest percentage ($> 74\%$) of the total variance also included factors related to Hb concentration. All five significant models included negative coefficients for variables that represented Pb in blood and positive coefficients for Zn in blood. The ALA-D assay with results standarized to Hb concentration represents an expedient alternative to the more traditional hematocrit standardization, and the measurement of ALA-D activity by this method can be used to document exposure of fish to environmental Pb. (Author's abstract)
W85-01918

ESTIMATES OF DISSOLVED AND SUSPENDED SUBSTANCE YIELD OF STREAM BASINS IN MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
T. R. Cummings.
USGS Water-Resources Investigations Report 83-4288, 1984. 57 p, 4 Fig, 5 Tab, 2 Ref.

Descriptors: *Water quality, *River basins, Streams, *Hydrologic data networks, *Regression analysis, Yield equations, *Great Lakes, *Michigan.

Water-quality data collected at 20 stations in Michigan were used to develop regression equations relating discharge to loads of 19 dissolved and suspended substances measured at each station. These equations and mean daily discharge were used to estimate long-term loads, which then were converted to estimates of drainage basin yields. These yields were compared to measured yields and to previous estimates. Fifty percent of the equations had standard errors of 22 percent or less; 90 percent had standard errors of 80 percent or less. Regression exponents indicate that the load increases as discharge increases in all cases, but for about two-thirds of the substances or properties the increase is less rapid than that of discharge. Seventy-eight percent of the nitrogen, phosphorus, and sediment loads, taken as a group, increase more rapidly than discharge. With respect to concentration, about 63 percent of the substances or properties decrease as discharge increases.
W85-01942

PESTICIDE AND PCB LEVELS IN FISH FROM ALBERTA (CANADA).
Alberta Environmental Centre, Vegreville.
Chemosphere, Vol. 13, No. 1, p 19-32, 1984. 2 Fig, 3 Tab, 12 Ref.

Descriptors: *Pollutant identification, *Alberta, *Pesticides, *Fish, *Polychlorinated biphenyls, Organic compounds, Path of pollutants.

Concentrations of 43 pesticides and PCB's were determined in muscle and fat samples of 750 fish collected from 11 lakes and rivers in Alberta. Of the 43 compounds tested for, evidence was found for only 12. Although phenoxy and organophosphate residues were always below detectable limits, traces of chlorinated pesticides and their derivatives, particularly DDE, DDD and chlordane, were detected in most fat samples. Methoxychlor was frequently found in goldeye from the North Saskatchewan River but not recorded in fish from any other lake or river. Its presence in goldeye, a highly migratory species, was probably a result of biting-fly control programs in the Saskatchewan part of the river. PCB levels exceeded 25 mg/kg in the fat of several species from the North Saskatchewan River but were generally lower in the other systems. Analysis of 160 sediment samples from the North Saskatchewan River revealed no point source of PCB contamination, with residues always less than 0.01 mg/kg dry weight. As a result, residues in the muscle tissue of fish were also relatively low compared to other industrialized areas. (Baker-IVI)
W85-01954

IDENTIFICATION OF NONIONIC DETERGENTS BY GC/CI-MS: I. A COMPLEMENTARY METHOD OR AN ATTRACTIVE ALTERNATIVE TO GC/EI-MS AND OTHER METHODS,
Stanford Univ., CA. Dept. of Civil Engineering.
E. Stephanou.
Chemosphere, Vol. 13, No. 1, p 43-51, 1984. 8 Fig, 2 Tab, 19 Ref. National Science Foundation Grant No. CEE-81-1756.

Descriptors: *Pollutant identification, *Wastewater analysis, *Organic compounds, *Chemical ionization mass spectra, *Detergents, Alkylphenol ethoxylates, Alcohol ethoxylates.

Chemical ionization (CI) mass spectra was used to identify tertiary octylphenol and lauryl alcohol ethoxylates with one to six oxyethylene groups in the effluent from the primary clarifiers of a Palo Alto wastewater treatment plant. This plant provides secondary treatment with trickling filters and activated sludge processes in series, and filtration prior to effluent chlorination. In lab studies technical grade tertiary octylphenol ethoxylates and lauryl alcohol ethoxylates were dissolved in methylene chloride to give a concentration of 1.5-2 mg/ml. Both products are nonionic detergents with an average number of oxyethylene groups of 5-6. The methane CI induced mass spectra of the tertiary octylphenol ethoxylates gives very reliable information on the molecular weight of the compounds because of the presence of the adduct ions $(MH)+$ and $(MC2H5)+$. These ions are subsequently fragmented to the ions $(MH-112)+$ and $(MC2H5-112)+$ (olefin displacement), which allows determination of the length of the oxyethylene chain. The alkyl ion displacement gives information about the alkyl substituent of the phenolic ring. The mass chromatograms show that a selective detection of these surfactants, using their CI mass spectra, is very appropriate for routine procedures. (Baker-IVI)
W85-01955

AQUATIC LEECHES (HIRUDINEA) AS BIOINDICATORS OF ORGANIC CHEMICAL CONTAMINANTS IN FRESHWATER ECOSYSTEMS,
Canada Centre for Inland Waters, Burlington (Ontario).
J. L. Metcalf, M. E. Fox, and J. H. Carey.
Chemosphere, Vol. 13, No. 1, p 143-150, 1984. 3 Tab, 14 Ref.

Descriptors: *Fate of pollutants, *Bioindicators, *Leeches, *Ganagagigue Creek, Ontario, Domestic wastes, Industrial wastes, *Organic compounds, Chlorinated hydrocarbons, Chlorophenols.

Ganagagigue Creek is a minor tributary of the Grand River which in turn empties into Lake Erie. It receives domestic and industrial sewage effluent from the town of Elmira, Ontario, as well as leachates from a disused chemical waste dump. The latter appears to be the principal source of chlorinated contamination of the creek. Freshwater leeches from the creek contain very high residues of chlorophenols, being one to two orders of magnitude greater than levels found in fish, tadpoles and most other benthic invertebrates. Only aquatic oligochaetes, which are a class of annelids closely related to leeches, had comparable residues. Of the four leech species, Dina dubia appears to be the best bioinidicator on the basis of its high bioaccumulation potential for chlorophenols. It is a common, geographically restricted species which little is known. Erpobdella punctata, G phonia complanata and Helobdella stagnalis a common and widespread in North Americ their use would permit comparisons among which are widely separated geographi (Baker-IVI)
W85-01958

ADSORPTION OF SURFACTANTS ON S MENTS,
Yokohama National Univ. (Japan). Dept. of S and Environmental Engineering.
K. Urano, M. Saito, and C. Murata.
Chemosphere, Vol. 13, No. 2, p 293-300, 198 Fig, 5 Tab, 5 Ref.

Descriptors: *Fate of pollutants, *Adsorp *Isotherms, *Surfactants, Rivers, Sediments, I sediments.

Surfactants are abundantly used for a wide r of industrial and domestic uses, and they are charged into wastewater, which in turn con nates the water environment. Adsorption isoth of 5 priority surfactants on 7 river sediments obtained and discussed for presumption of the of surfactants in water environment. The ad tion abilities of the sediments seemed to be pendent of the surface area and to be related t organic carbon contents. The surfactants ready to adsorb in the same order as their ad tion on microorganisms. The adsorbed amo per gram of the organic carbon in the sedim were nearly equal for most of the sediments ied. (Baker-IVI)
W85-01960

METHOD FOR TOTAL ORGANIC CHLOR DETERMINATION IN BLEACH PLANT CIPIENT WATERS,
Abo Akademi, Turku (Finland). Lab. of Fo Products Chemistry.
J. Hemming, and B. Holmbom.
Chemosphere, Vol. 13, No. 4, p 513-520, 198 Fig, 6 Tab, 12 Ref.

Descriptors: *Pollutant identification, *Org compounds, *Chlorine, *Industrial wastes, Ble Particle Induced X-ray Emission, Resin sorb Water analysis.

A method based on XAD-8 resin sorbtion Particle Induced X-ray Emission (PIXE) was veloped for total organic chlorine (TOCl) dete nations in diluted water solutions with special phasis on bleach plant effluents/recipients. P offers a fast and sensitive method for multielem tal analysis. The major advantages compared usual methods for halogen determinations are no conversion of organo-halogen into halogen- is needed and that PIXE discriminates between different halogens. The method was applied recipient waters of a kraft bleach plant, and determined TOCl values were compared v other parameters. The detection limit was abou micro g/liter. (Baker-IVI)
W85-01962

WATER QUALITY OF LAKE ARLINGTON VILLAGE CREEK, NORTH-CENTRAL TEX 1973 TO 1981,
Geological Survey, Austin, TX. Water Resour Div.
For primary bibliographic entry see Field 2H.
W85-02042

STANDARDIZATION OF METHODS ANALYSIS FOR HEAVY METALS IN SE MENTS,
Institute for Soil Fertility, Groningen (Neth lands).
A. J. de Groot, K. H. Zschuppe, and W. Salomo
Hydrobiologia, Vol. 92, p 689-695, July, 1982 Fig, 2 Tab, 14 Ref.

scriptors: *Heavy metals, *Sediment analysis, mpling, Sample preparation, Chemical analysis, ray fluorescence, Neutron activiation analysis, iter pollution sources.

studies of heavy metals in sediments, there is a ed for standardization of the procedures for mple collection and preservation, chemical anal- s and presentation of results. The method and pth of sampling depend on the aim of the investi- ion and on local sediment conditions, such as nsistency of the sediment, rate of sedimentation, gnetic processes and bioturbation. Therefore no neral recommendations can be given in this re- ct. During collection and preservation, con- ination and loss of constituents must be avoid- In sediments, the best means for estimating al contents of metals is digestion with HF, in mbination with strong acids. Other methods in- de X-ray fluorescence and neutron activation alyses. The use of HF is considered objection- e by some laboratories. A reasonable alternative qua regia. Because variations in granular com- sition affect metal contents, it is advisable to use fraction < 63 micro m for the analysis. Chemi- partition of sediments provides an insight into source of metallic constituents, and their path- ys to deposition areas. A three-step extraction ocedure, in the sequence 0.1 M hydroxylamine- C1, H2O2 30% and HF, is proposed. Finally, ention is paid to the anthropogenic enrichment metals in sediments. The establishment of base- e levels is discussed. (Author's abstract)
85-02104

IEMICAL DERIVATIZATION ANALYSIS OF STICIDE RESIDUES. VIII. ANALYSIS OF 15 ILOROPHENOLS IN NATURAL WATER BY SITU ACETYLATION,
nada Centre for Inland Waters, Burlington (On- io).
-B. Lee, L.-D. Weng, and A. S. Y. Chau.
urnal of the Association of Official Analytical emists, Vol. 67, No. 4, p 789-794, July-August, 84. 3 Fig, 4 Tab, 8 Ref.

escriptors: *Pesticide residues, *Chlorophenols, as chromatography, Natural waters, Chemical alysis, Phenols.

the presence of KHCO3, phenols in water are etylated by acetic anhydride directly without e-extraction. The resultant acetates are extracted petroleum ether and analyzed by electron cap- re gas chromatography. This method is simple d involves no more steps than a method which quires no derivatization. The major advantages the method are that phenol acetates are much sier to recover from water samples and they are o easier to chromatograph on gas chromatogra- y columns than free phenols. The method ap- es to the di-, tri-, tetra-, and pentachlorophenols natural waters from 100 to 0.01 ppb with 1 L ter sample. (Moore-IVI)
85-02113

ETERMINATION OF PHENOLS IN WATER SING RAMAN SPECTROSCOPY,
orida State Univ., Tallahassee. Dept. of Chemis- y.
A. Marley, C. K. Mann, and T. J. Vickers.
pplied Spectroscopy, Vol. 38, No. 4, p 540-543, ly/August, 1984. 4 Tab, 16 Ref. NOAA contract A82AA-D-00012.

escriptors: *Phenols, *Raman spectroscopy, Water analysis, Chlorophenols, Spectroscopy.

he potential of Raman spectroscopy for quantita- ve analysis of phenols in water solution has been vestigated. A group of six compounds - phenol, chlorophenol, 2,4-dichlorophenol, 2,4,6-trichlor- henol, 2-chloro-5-methylphenol and 2-chloro-4- trophenol - was studied with the use of the 514.5, 88.0, and 457.9 nanometer lines of an argon ion ser. Attention was given to the effects of source tensity, optical alignment, and background fluc- ations on quantitative results. It was found that e use of an internal standard with each measure- ent made a significant improvement in the accu- cy and precision of results. Two methods of quantitation, peak area measurement and cross-correlation, were used. Results were somewhat better for cross-correlation, presumably because of more effective exclusion of background interference. Limits of detection were calculated based upon the slope and the standard deviation of the intercept of the standard curve. These varied from the range of 100 ppm to 0.3 ppm, depending on the compound. The most important factor controlling sensitivity is occurrence of resonance enhancement. (Author's abstract)
W85-02114

SIMULTANEOUS DETERMINATION OF PARTITION COEFFICIENTS AND ACIDITY CONSTANTS OF CHLORINATED PHENOLS AND GUAIACOLS BY GAS CHROMATOGRAPHY,
Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Analytical and Marine Chemistry.
T. M. Xie, and D. Dyrssen.
Analytica Chimica Acta, Vol. 160, p 21-30, June, 1984. 2 Fig, 1 Tab, 26 Ref.

Descriptors: *Partition coefficients, *Acidity constants, *Gas chromatography, *Chlorinated phenols, *Guaiacols, Phenols, Organic compounds, Hydrogen ion concentration.

The partition coefficients, P, of organic compounds in the n-octanol/water system have been used for the assessment of bioaccumulation potential and the distribution pattern of organic pollutants. The partition coefficients, P, in the n-octanol/water system and the acidity constants, Ka, of 15 chlorinated phenols and guaiacols at 20 degrees were simultaneously determined by investigating the pH dependence of the apparent partition coefficients, Pa. For determining Pa, the relative responses of individual phenols and guaiacols in the aqueous phase after equilibration were measured by glass-capillary gas chromatography with electron-capture detection and compared with those in the octanol phase before partition. Curve-fitting, linear regression, and non-linear regression were used for treating the partition data. The present pKa values of chlorinated phenols and guaiacols are determined simultaneously; thus the surrounding conditions are more nearly identical than in other methods in which the determinations must be done individually. This means that these values may represent a more correct relative relation, which is important in studies of the distribution of these compounds in the environment. In this method, only <1-mg amounts of substance are needed for the pKa determination with an accuracy of 0.1 pKa units, and the purity of the substances is not critical if the impurity separates form the main peak. (Moore-IVI)
W85-02115

ORGANIZATION AND EVALUATION OF INTERLABORATORY COMPARISON STUDIES AMONG SOUTHERN AFRICAN WATER ANALYSIS LABORATORIES,
National Inst. for Water Research, Pretoria (South Africa).
R. Smith.
Talanta, Vol. 31, No. 7, p 537-545, July, 1984. 3 Fig, 5 Tab, 31 Ref.

Descriptors: *Water analysis, *Wastewater analysis, *South Africa, Interlaboratory comparisons, Quality control, Statisitical analysis, Standards.

Interlaboratory comparison studies provide a useful 'external' supplement to the various 'internal' quality-control procedures which must be employed in the water-analysis laboratory in order to maintain a high degree of reliability in the production of analytical results. Such studies have been made regularly for many years by various overseas organizations, and were introduced in South Africa in 1976. Since that time 16 studies have been made, involving more than 40 laboratories. In this paper the various factors involved in the successful organization of interlaboratory comparison studies are discussed, and details are given of the sample-preparation, analysis-instruction and result-reporting procedures used in the southern African studies. Techniques used for the statistical evaluation of the analytical results submitted are described and discussed, for example, methods for the rejection of outliers, measures of accuracy and precision, determination of total error, tests of significance. Greenberg's assessment technique, Madden's ranking technique and Youden's graphical technique. A brief review is given of the studies made to date, along with specific findings and recommendations arising from them. The need for a recognized updated set of standard methods for use by water and wastewater analysis laboratories in southern Africa is highlighted.
W85-02117

EVALUATION OF ELECTRODE METHODS FOR DETERMINING TOTAL RESIDUAL CHLORINE IN VARIOUS WATER MATRICES,
Benedict Coll., Columbia, SC. Dept. of Chemistry.
For primary bibliographic entry see Field 7B.
W85-02123

SIMULTANEOUS CONCENTRATION OF FOUR ENTEROVIRUSES FROM TAP, WASTE, AND NATURAL WATERS,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
N. Guttman-Bass, and A. Nasser.
Applied and Environmental Microbiology, Vol. 27, No. 6, p 1311-1315, June, 1984. 5 Tab, 18 Ref. EPA grant R 806588010.

Descriptors: *Enteroviruses, *Drinking water, *Wastewater analysis, *Natural waters, *Israel, Jerusalem, Lake Kinneret, Mediterranean, Coxsackie virus, Poliovirus, Echovirus, Water analysis, Virus recovery, Concentration methods.

The efficiency of virus recovery from water was investigated by using a method which enabled the concentration of a mixture of four enteroviruses with determination of their individual recovery efficiencies. The four viruses used (poliovirus 1, coxsackievirus A9, coxsackievirus B1, and echovirus 7) represented each of the four major subgroups of enteroviruses. This method, which was based on selective antibody neutralization, was used to investigate the effects of input water quality on enterovirus concentration by Balston filters (grade C; Balston, Inc., Lexington, Mass.) and organic flocculation. With tap water, the average recovery efficiency of the four viruses was 97%. Concentration from natural waters, including samples from two lakes (Lake Kinneret and the Hula Nature Reserve) and the Mediterranean Sea, resulted in similarly high average recovery efficiencies. Echovirus 7 was recovered with a slightly lower average efficiency from these types of water than were the other viruses. In comparison with other types of water, virus concentration from Jerusalem wastewater generally had a slightly lower efficiency of recovery, ranging from 63 to 75% for each of the viruses, with an overall average of 68%. The ability of each concentration step, membrane filtration or organic flocculation, to recover the viruses from water was assayed. For the filtration step, although there were not large differences in virus recoveries from tap water, echovirus 7 was recovered with the lowest efficiency (72%), and poliovirus 1 was recovered with the highest (87%) efficiency. Overall virus recovery by the filtration step was least efficient for wastewater (73%) and most efficient for seawater (107%). The organic flocculation step was highly efficient, with essentially all of the virus recovered either as individual viruses or as a mixture. Of the types of water tested, viruses were recovered from seawater with the lowest efficiency. In summary, although some differences in virus recovery were observed for various types of water and individual viruses, the range was not large. Thus, the two-step concentration method used was found to be an efficient general method for enterovirus concentration from water. (Author's abstract)
W85-02137

5B. Sources Of Pollution

GROUNDWATER QUALITY SURVEY OF AN UNSEWERED, SEMI-RURAL AREA,

Ministry of Works and Development, Christchurch (New Zealand).
L. W. Sinton.
New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 317-326, 1982. 4 Fig, 1 Tab, 35 Ref.

Descriptors: *Christchurch, *New Zealand, *Groundwater pollution, *Water quality, *Well water, Septic tanks, Ammonia, Nitrates, Chlorides, Coliforms, Sewage bacteria, Streptococcus, Bacteria, Conductivity.

A baseline groundwater quality survey of 120 household wells in an unsewered area at Yaldhurst, near Christchurch (New Zealand), was carried out between September and December, 1976. Ammonia-N levels were below the detection limit (0.02 g/cu m) in all samples. Nitrate-N, conductivity, and chloride levels tended to vary according to well depth and location, being lower in the deeper wells and in wells located in an area of shallow, stony soils. Approximately 33% of the wells contained coliform bacteria, fecal coliform bacteria or fecal streptococci. A subset of 25 wells was sampled fortnightly from January to August 1977. From January to June, mean nitrate-N and conductivity levels remained stable at approximately 1.5 g/cu m and 11.2 mS/m respectively. An increase in these levels to 3.3 g/cu m and 15.8 mS/m in July-August corresponded with a rise in the water table. Leaching losses from soils probably accounted for most of the nitrate entering the Yaldhurst aquifers, the contribution by septic tank systems being estimated at 20-30%. No direct evidence of contamination of the wells by septic tank effluent was found, although 23 of the 25 wells exhibited intermittent contamination by indicator bacteria throughout the 8 month sampling program. Although a localized health hazard may exist, septic tank systems in the area were not considered likely to constitute a health threat to the confined aquifers underlying Christchurch city. (Author's abstract)
W85-01633

WATER QUALITY OF THE WAIOHEWA STREAM, ROTORUA,
Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Science Centre.
R. B. Williamson, and J. G. Cooke.
New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 327-337, 1982. 4 Fig, 5 Tab, 32 Ref.

Descriptors: *Waiohewa Stream, *Rotorua, *New Zealand, *Water quality, Nitrogen, Ammonia, Boron, Arsenic, Nitrates, Mercury, Geothermal resources.

The chemical quality of the Waiohewa stream, Rotorua (New Zealand), was assessed from the results of 2 longitudinal surveys in summer 1978-79. In particular, changes in nitrogen concentration were examined. The quantity of ammonia increased downstream from unmonitored geothermal inputs, but, after dilution and neutralization by a larger inflow of freshwater, considerable proportions of ammonia were converted to nitrate. In the first survey ammonia concentrations decreased from 4.48 to 2.47 g/cu m and nitrate concentrations increased from 0.59 to 1.13 g/cu m in a 3-km stretch of the stream. Mass flow calculations show that nitrification could account for at least 55% of the ammonia decrease, the rest probably being lost through assimilation or denitrification. Laboratory incubation experiments showed that nitrification occurred in the stream bed. The geothermal waters contained low concentrations of boron (1.1-4.0 g/cu m), filterable mercury (0.1-0.8 mg/cu m) and arsenic (10-14 mg/cu m). (Author's abstract)
W85-01634

NITROGEN AND PHOSPHORUS IN THE NGONGOTAHA STREAM,
Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Science Centre.
R. A. Hoare.
New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 339-349, 1982. 8 Fig, 4 Tab, 13 Ref.

Descriptors: *Ngongotaha Stream, *New Zealand, *Rotorua, *Nitrogen, *Phosphorus, Base flow, Flood flow, Nitrates, Ammonia, Kjeldahl procedure, Nutrients.

The nitrogen and phosphorus loads of the Ngongotaha Stream, near Rotorua, New Zealand were determined for 1976 and 1977 and a novel way to define a flow-concentration curve was developed. There was a clear distinction between total P concentrations in base flow and in flood flow of the stream. In base flow, the concentrations were independent of flow rate, as well as being low, while in floods the concentrations became very strongly dependent on flow rate. Nitrate, ammonia, dissolved reactive phosphorus (DRP), total phosphorus (TP), and total Kjeldahl nitrogen (TKN) concentrations were measured; mean concentrations in 1976 base flow were found to be 527, 25, 32, 48, and 162 mg/cu m respectively. Nitrate concentrations showed seasonal variations, and although changes occurred during floods, they were not correlated with flow rate. DRP concentrations showed little variation, except that they dropped at the peak of the largest floods. TP was strongly correlated with flow rate during floods, and TP loads could best be calculated by allowing for a curvilinear relationship between concentration and flow rate. The logarithms of the TP load carried by a flood and the peak flow rate of the flood were highly correlated (R = 0.984). The loads of nitrate-N, ammonia-N, DRP, TP, and TKN in 1976 were estimated to be 34, 1.3, 6.0, and 26 tons. (Collier-IVI)
W85-01635

SEASONAL STUDY OF A FRESHWATER LAKE AND MIGRATORY WATERFOWL FOR CAMPYLOBACTER JEJUNI,
Wisconsin Univ.-La Crosse. Dept. of Biology.
G. A. Hill, and D. J. Grimes.
Canadian Journal of Microbiology, Vol. 30, No. 6, p 845-849, June, 1984. 1 Fig, 1 Tab, 32 Ref.

Descriptors: *Lake Onalaska, *La Crosse, *Wisconsin, *Campylobacter, *Waterfowl, Birds, Water Birds, Bacteria, Coliforms, Animal wastes, Streptococcus, Water pollution sources.

Carrier birds may contribute to water-borne transmission of Campylobacter jejuni. Water and sediment samples from Lake Onalaska (Mississippi River navigation pool No. 7), near La Crosse, Wisconsin, were quantitatively examined in the summer and fall of 1981 for C. jejuni and for standard bacterial indicators of fecal pollution. Its location within the Mississippi Flyway makes Lake Onalaska ideally suited as a temporary roosting site for several hundred thousand migratory waterfowl every year. Fifty cecal content samples, representing seven species of transient waterfowl captured during fall migration, were also assayed for C. jejuni. Fecal coliform and fecal streptococcus counts from the water and sediment samples agreed with previously established values for the pool and accurately reflected the influx of approximately 619,000 ducks and geese during fall migration. C. jejuni was not recovered from water, sediment, or fecal samples. This conflicts with previous reports which implied a cosmopolitan distribution of C. jejuni among waterfowl. Chemical and physical analyses of water samples revealed nothing remarkable and certainly offered no explanation for the absence of C. jejuni from Lake Onalaska. Other avian-borne pathogens also exhibit sporadic distribution, influenced by avian feeding habits, season, geographic differences, hunting pressure, intermingling of water fowl with nonaquatic birds and other animals, and farming practices. C. jejuni cannot be regarded as cosmopolitan among migratory waterfowl. (Collier-IVI)
W85-01639

AROMATIC HYDROCARBONS IN WATERS OF PORT PHILLIP BAY AND THE YARRA RIVER ESTUARY,
Melbourne Univ., Parkville (Australia). Marine Chemistry Lab.
J. D. Smith, and W. A. Maher.
Australian Journal of Marine and Freshwater Research, Vol. 35, No. 2, p 119-28, 1984. 4 Fig, 2 Tab, 23 Ref.

Descriptors: *Australia, *Port Phillip Bay, * River Estuary, *Corio Bay, *Hobsons Bay, drocarbons, Fluorescence emmission spectros Oil, Terphenyl, Pyrene, Water pollution so

Port Phillip Bay, Australia, is a shipping route onshore oil refineries and with major por Corio Bay (Geelong) and Hobsons Bay borne). In this environment, input of aromati drocarbons from petroleum is likely to be nant over atmospheric inputs of combustion ucts, with negligible contribution from bioche processes. Aromatic hydrocarbons provide a indicator for assessing the anthropogenic inp hydrocarbons into rivers and the sea. Water ples were taken from Port Phillip Bay, the River estuary, and Corio Bay. Determinati aromatic hydrocarbons in these waters, usin vent extraction and fluorescence emission ana showed a wide distribution of fuel oils with small contribution from crude oil. Oil conce tions were reported as equivalent amounts terphenyl (T) or pyrene (P). Observed conce tions in Port Phillip Bay were generally 0 micro g/L (T) and 0.1-0.2 micro g/L (P), higher values in Corio Bay and the Yarra estuary. All areas with elevated levels of aro hydrocarbons contained major contributions refined oils (including lubricating oils); the with aromatic hydrocarbon concentrations proaching background levels appeared to hav oil as the major source of contamination. (Co IVI)
W85-01644

OIL SPILL FOCUSES ATTENTION ON PROBLEMS OF A MAN-MADE RECREATI AL LAKE,
Toledo Univ., OH.
G. F. Bennett, G. R. Kunkle, E. J. Tramer, C. Stoops, Jr., and R. H. Scheidel.
Journal of Environmental Systems, Vol. 14, N p 31-49, 1984-85. 3 Fig, 7 Tab, 13 Ref.

Descriptors: *Holiday Lake, *Williard, * *Oil spills, *Water pollution effects, Path of po ants, Systems analysis, Costs, Cleanup, Fat pollutants.

When a runaway diesel engine fell into a turn pit at a railroad maintenance facility, its oil t ruptured releasing 4,000 gallons of No. 2 diese that subsequently flowed through sewers t agricultural stream that led to Holiday Lake, liard, Ohio, an inland, man-made lake; two later the lake residents awoke to find 'wall to oil covering the water surface. The oil qui disappeared, but not the anger of the prop owners who sued the railroad for $1.2 millio dredge the oil-containing sediments 'from the bottom,' claiming not only that the spill had ac oil to the benthic sediments but also chronic p tion from poorly designed and oper wastewater treatment units had impacted the To obtain data for the pending court suit, defense attorneys assembled a team of scien and engineers who used a systems approac evalute the lake, its water quality inputs into it, impact of the oil on it. (Author's abstract)
W85-01650

DISTRIBUTION AND PERIODICITY TOTAL, FAECAL COLIFORM BACTERIA AN AQUATIC ECOSYSTEM,
Jawaharlal Nehru Univ., New Delhi (India). crobiological Lab.
U. S. Bagde, and A. K. Varma.
International Journal of Environmental Stu Vol. 19, No. 3/4, p 215-220, 1982. 3 Fig, 1 Tab Ref.

Descriptors: *New Dehli, *India, *Colifo *Lakes, *Bacteria, Escherichia coli, Shigella monella, Vibrio, Public health.

Some strains of Escherichia coli have been re nized as pathogens in recent years and thus E. should no longer be considered as just an indic and nonpathogenic bacterium of fecal pollutio bacteriological study of the water of a lak

aharlal Nehru University, New Delhi, was car-
out during 1979-80 for the period of one year.
quality of water was assessed to establish the
ern of periodicity and seasonal variations of
l and fecal coliform bacteria. Extreme vari-
ns were found in the bacterial counts in differ-
samples collected from the lake water, at the
e time. There existed a positive correlation
veen total coliform and faecal coliforms. In
tion to the presence of E. coli and A. aero-
es in large numbers in the water, the isolation
athogenic bacteria, Vibrio, Shigella, and Sal-
ella, give a definite indication of its fecal pollu-
. The bacteriological quality of water was
h below the recommended standards for recre-
nal and drinking waters. (Collier-IVI)
5-01675

**CHASTIC MODEL FOR BOD AND DO IN
EAMS WHEN THE VELOCITY IS
NDOM AND DISTANCE-DEPENDENT,**
th Carolina Univ. at Charlotte. Dept. of Math-
tics.
. Papadopoulos.
rnational Journal of Environmental Studies,
. 19, No. 3/4, p 263-267, 1982. 5 Fig, 11 Ref.

criptors: *Biochemical oxygen demand, *Dis-
ed oxygen, *Model studies, Mathematical
lels, Path of pollutants, Wastewater pollution.

he past, several mathematical models have dis-
ed the pollution caused in rivers and streams
he discharge of organic waste materials. A new
lel was developed which more realistically pre-
s the amount of biochemical oxygen demand
D) and dissolved oxygen (DO) at any point on
eam. This stochastic model is a random differ-
al equation of the form X(t)=A(t) X(t)=Y(t), t
r = 0, with initial conditions X sub 0=X(0).
is a vector with BOD and DO at a distance t
nstream from the pollution source for compo-
s. The velocity of the stream is incorporated
the vector A(t) and is random and distance
endent. The inhomogeneous term Y(t) and the
al conditions are random vectors. Therefore,
model contains random initial conditions,
lom coefficients and random inhomogeneous
s. Simulated trajectories of the BOD and DO
e computed with their joint density assumed to
bivariate normal with correlation coeffecient
and the densities uniform. (Collier-IVI)
5-01676

**FLUENCE OF RAINFALL CHARACTERIS-
S ON THE POLLUTION EMISSION,**
V Consulting Engineers, Amersfoort (Nether-
ls).
primary bibliographic entry see Field 2E.
5-01697

**THODS FOR CALCULATION OF ANNUAL
D EXTREME OVERFLOW EVENTS FROM
MBINED SEWER SYSTEMS,**
hnical Univ. of Denmark, Lyngby. Dept. of
itary Engineering.
primary bibliographic entry see Field 2E.
5-01699

**CROORGANISM SURVIVAL IN AN ICE-
VERED RIVER,**
erta Univ., Edmonton. Dept. of Civil Engi-
ring.
Putz, D. W. Smith, and R. Gerard.
adian Journal of Civil Engineering, Vol. 11,
2, p 177-186, June, 1984. 9 Fig, 3 Tab, 11 Ref.

scriptors: *Microorganisms, *Sewage bacteria,
dicators, *Ice cover, *Slave River, *Northwest
ritories, *Survival, Coliforms, Wastewater dis-
al, Stream pollution, Bacteria, Fate of pollut-
s, Source of pollutants.

sistence of microorganisms in rivers represents
omplex situation that simultaneously involves
h transverse mixing and decay. Microorganism
ay characteristics were determined for ice-cov-
d conditions in the Slave River downstream of
Fort Smith, Northwest Territories, wastewater disposal site. The Fort Smith wastewater treatment and disposal system consists of two primary lagoon cells and a facultative cell, followed by a continuous discharge to the Slave River through a submerged near-shore outfall. Microorganism sampling and analyses for total and fecal coliforms were conducted for each sampling station. After accounting for the physical dilution the limited data showed a barely discernible microorganism die-off within the study reach for the ice-covered conditions. These conditions generally represent periods in which indicator bacteria concentrations persist the longest owing to low water temperatures, isolation from sunlight, and minumum river flow conditions. (Collier-IVI)
W85-01708

MIXING ZONE STUDIES IN THE GRAND RIVER BASIN,
Gore and Storrie Ltd., Toronto (Ontario). Water Resources Div.
T. P. H. Gowda, and L. E. Post.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 204-216, June, 1984. 8 Fig, 7 Tab, 11 Ref.

Descriptors: *Mixing zone, *Path of pollutants, *Grand River Basin, *Ontario, *Speed River, Zone of passage, Wastewater treatment, Ammonia, Chlorine, Water quality management.

In a stream that receives wastewater effluent, provincial water quality objectives require maintenance of a specific portion of the cross section of the stream termed the 'zone of passage' (ZOP) wherein the concentrations of the pollutants comply with a specified water quality objective. A steady state mathematical model based on the 'stream tube' concept was utilized to evaluate the impact of various viable management options on the mixing zone boundaries for nonionized ammonia and total residual chlorine at the Grand River below Waterloo, Kitchener, and Galt (Ontario), and the Speed River below Guelph (Ontario). The options evaluated as part of the Grand River Basin Water Management Study include various river flows and effluent flows projected for the planning period 1981-2031. The predictions indicate that a ZOP equal to 60% of river flow is attainable for chlorine in all cases except in the Speed River below Guelph beyond the year 2001, and in-plant nitrification is required at Waterloo and Kitchener under the present conditions in order to comply with the objective for nonionized ammonia. At Guelph, with in-plant nitrification, the ammonia objective will not be met for existing and future summer conditions and for winter conditions beyond the year 2001. For Galt, the ammonia objective is met with conventional secondary treatment under all options. (Collier-IVI)
W85-01710

BEACH FECAL COLIFORMS,
Gore and Storrie Ltd., Toronto (Ontario).
M. D. Palmer, and R. J. Dewey.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 217-224, June, 1984. 7 Fig, 3 Tab, 1 Append.

Descriptors: *Coliforms, *Beaches, *Ottawa River, *Ontario, Model studies, Water quality management, Rainfall-runoff relationships, Prediction, Cost analysis, Offshore momentum diffuser, Piers.

The urban beach on the Ottawa River at Britannia, in the city of Ottawa, has been closed periodically by health officials for fecal coliform levels in excess of 100 counts/100 mL. These events were generally related to rainfall events. A combination of the STORM runoff model and a two-dimensional dynamic lake type model successfully reproduced the fecal coliform levels of the beach. Elevated fecal coliform levels were associated with rainfall events and runoff from two large catchments upstream of the beach. Due to prevailing conditions in the lake, the second largest summer storm did not produce elevated fecal coliform levels while the third and fourth largest storms did. The models predicted these events. The STORM model was calibrated on a subcatchment and supplied tha runoff flow volumes and pollution levels to the dynamic lake model. The other input data for the lake model were supplied by field measurements. The models were used to assess the effectiveness of management options to improve the water quality on the beach. Options studied include extension of the Britannia Pier, installing an offshore momentum diffuser, and removing the effects of one or two of the major upstream drainage basins. The cheapest option that ensures acceptable beach water quality is the pier extension, but this option requires an affective die-off of fecal coliforms. The next best solution is the offshore momentum diffuser, which also requires a 60 m extension to the Britannia pier. (Moore-IVI)
W85-01711

ENTERIC VIRUS LEVELS IN WASTEWATER EFFLUENTS AND SURFACE WATERS IN THE SEVERN TRENT WATER AUTHORITY 1979-1981,
Severn-Trent Water Authority, Birmingham (England).
R. Morris, and D. N. Sharp.
Water Research, Vol. 18, No. 11, p 935-939, 1984. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Enteroviruses, *Effluents, *Surface waters, *England, Coxsackie virus, Echovirus, Poliovirus, Water storage, Path of pollutants.

Large volumes of wastewater effluent are being discharged into rivers, many of which are being used for potable supply. Viral surveillance of 381 wastewater effluents and 533 surface waters was carried out between January 1979 and July 1981 within the Severn Trent Water Authority's area. Enteric viruses were detected in 45% of the samples of effluents and in 48% of the samples of surface waters. Viral levels in effluents varied considerably with highest recovered being 31,000 plaque forming units per liter (pfu/l). A substantial number of effluent samples gave levels lower than the practical detection limit of 100 pfu/l. Levels were markedly lower in surface waters, the highest being 647 pfu/l. River water which had received long-term bankside storage only yielded virus infrequently. A total of 1283 isolates from 914 samples of wastewater effluents and surface waters were successfully subcultured and identified. Only three echovirus serotypes were identified. The poloviruses showed a broadly recurring pattern probably associated with vaccination programs. Coxsackie group B viruses were common than polioviruses with only type 6 not being recorded. (Moore-IVI)
W85-01718

STUDY OF THE COPPER-COMPLEXING COMPOUNDS RELEASED BY SOME SPECIES OF CYANOBACTERIA,
Liverpool Univ. (England). Dept. of Botany.
W. F. Jardim, and H. W. Pearson.
Water Research, Vol. 18, No. 8, p 985-989, 1984. 5 Fig, 1 Tab, 27 Ref.

Descriptors: *Cyanophyta, *Copper, *Metal complexing, Plectonema, Anabaena, Conditional stability constants, Heavy metals.

The production of copper-complexing extracellular material by cyanobacteria was studied by using ion specific electrodes. The species studied were Plectonema boryanum and Anabaena cylindrica. The values of the conditional stability constants for the copper complexes (K'), for the two species at pH 6.60 (+/- 0.05) were, respectively 2.8 (+/- 0.8) x 10 to the 6th and 5.9 (+/- 2.0) x 10 to the 7th. A strain of P. boryanum that was made tolerant to a concentration of 1 x 10 to the -6th M copper produced greater amounts of copper-complexing products than the normal strain although the K' value for the copper complexes was the same. When stressed with copper, P. boryanum and A. cylindrica produced more complexing material than under the usual growth conditions. (Author's abstract)
W85-01725

FORMATION OF STABLE ORGANIC CHLORAMINES DURING THE AQUEOUS CHLORIN-

ATION OF CYTOSINE AND 5-METHYLCYTOSINE,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 5F.
W85-01726

KINETICS AND PRODUCTS OF THE CHLORINATION OF CAFFEINE IN AQUEOUS SOLUTION,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
J. P. Gould, and J. T. Richards.
Water Research, Vol. 18, No. 8, p 1001-1009, 1984. 13 Fig, 2 Tab, 14 Ref.

Descriptors: *Caffeine, *Chlorination, Wastewater, Natural waters, Hypochlorous acid, Chemical reactions, Chlorocaffeine, Kinetics.

Among the low molecular weight organic compounds which have been identified in wastewaters and natural waters is the purine base caffeine. This compound is present as a direct result of the consumption of coffee. The reaction between aqueous hypochlorous acid and caffeine was found to be dependent on pH only to the extent that it influences the fraction of FAC which is in the form of HOCl. The rate constant had a value of 162 +/- 32/M sq/s. For each mol of caffeine consumed, 6.3 mol of FAC were consumed. The chlorination reaction proceeded primarily by ring cleavage and rearrangement forming nonoaromatic nitrogen heterocyles. 8-Chlorocaffeine was unequivocally identified as an aqueous chlorination product but was found to be formed only to a small extent and under rather limited conditions. No stable organic chloramines were formed. (Moore-IVI)
W85-01727

REMOVAL OF VOLATILE ORGANIC POLLUTANTS FROM RAPID STREAMS,
New Mexico State Univ., Las Cruces. Dept. of Civil Engineering.
F. Cadena, G. A. Eiceman, and V. J. Vandiver.
Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 460-463, May, 1984. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Benzene, *Chlorobenzene, *Volatilization, *Organic compounds, *Rivers, Model studies, Volatile compounds, Model studies, Fate of pollutants.

An integrated theory of volatilization of volatile organic compounds (VOCs) in rivers is presented and a volatilization model for direct use with rivers is described. Advantages and features of this model are demonstrated with theoretical applications and large-scale modeling studies. Discussion is restricted to certain volatile compounds. Thirty-one of 165 priority pollutants have been defined by the US EPA that are volatile enough to be controlled only by liquid-phase diffusion. In this study the volatilization rates of benzene and chlorobenzene and the reaeration coefficient were measured using a 1000-L closed circuit circular stream. Saturated aqueous solutions of two VOCs chosen for modeling were prepared. The reaeration rate of the stream was contolled by changing the angular velocity of the rotating walls and by varying the water depth and bottom configuration. The range of reaeration coefficient covered in this study was from 0.14 to 1.96/hr. The VOC concentration range measured in the volatilization experiments was from about 1.0 mg/L to as low as 1.0 micro g/L. A hypothetical example was selected to illustrate the simplicity of the model for prediction of toxic VOC movement in streams - an accidental discharge of methylene chloride and 1,4-dichlorobenzene at the Interstate Highway 25 bridge over the Rio Grande, immediately below Albuquerque New Mexico, with river flow at minimum flowrate conditions. The chemical spill is assumed to be immediately mixed with the river water at 20 C. The model is used to predict the expected concentration fraction remaining for the pollutants as a function of time and distance. (Baker-IVI)
W85-01738

ANALYSIS OF AQUEOUS SEDIMENTS FOR HEAVY METALS,
Texas Southern Univ., Houston. Dept. of Chemistry.
V. O. Ogugbuaja, R. R. Schwarzer, and B. L. Wilson.
Journal of Environmental Science and Health, Vol. A(19), No. 8, p 911-924, December, 1984. 3 Fig, 2 Tab, 19 Ref. DOE grant ER-78-G-05-6079.

Descriptors: *Heavy metals, *Lake sediments, *Industrial wastes, *Powerplants, *Houston, *Texas, Cadmium, Copper, Zinc, Iron, Manganese, Sediments, Spectroscopy.

Atomic absorption spectroscopy was used to determine the concentrations of Cd, Cu, Zn, Fe, and Mn in sediments from lakes around a coal-powered electric generating plant in southwest Houston, Texas. The plant had been operational for only about one year at the time of sampling. As a result, the variations of trace metals with depth are considered to be essentially unaffected by the plant. The concentrations for each trace metal within a lake remained roughly the same. An attempt was made to correlate the trace metals with percent clay and organic carbon, but no trend was evident. (Baker-IVI)
W85-01742

HEAVY METALS IN THE LOWER MISSISSIPPI RIVER,
Centre National de la Recherche Scientifique, Paris (France).
E. J. Newchurch, and I. A. Kahwa.
Journal of Environmental Science and Health, Vol. A(19), No. 8, p 973-988, December, 1984. 11 Fig, 3 Tab, 14 Ref.

Descriptors: *Heavy metals, *Fate of pollutants, *Mississippi River, *Suspended sediments, Rivers, Arsenic, Lead, Mercury, Cadmium, Chromium, Copper, Filtration, Settling, Water treatment.

Samples of water from the Mississippi River were examined regularly to determine their content of heavy metals. Between 1978 and 1983, river water concentrations at individual sampling sites exceeded the drinking water standards 1 to 3% of the time for cadmium, chromium and copper; 7 to 9 % of the time for arsenic and lead; and 18% of the time for mercury. Arsenic, cadmium and chromium appear to be carried predominantly by the total dissolved solids and should be removed in the usual water treatment steps of coagulation followed by settling and/or filtration. Copper and lead appear to be carried, at least partly, in dissolved form, while additional data are needed for mercury. (Baker-IVI)
W85-01744

MINES: A MODEL TO FORECAST MINE WASTEWATER QUALITY,
Durham Univ. (England).
J. F. Bell, and M. J. Reeves.
International Journal of Environmental Studies, Vol. 20, p 47-52, 1982. 1 Fig, 20 Ref.

Descriptors: *Mine wastes, *Forecasting, *Wastewater, Mine drainage, Acid mine drainage, Computer models, Pyrite, Water pollution sources, Weathering, Model studies.

The minerals exposed by mining operations are abruptly subjected to a major change in their chemical and physical environment and undergo mechanical and chemical degradation (weathering). As a direct consequence, large quantities of water soluble compounds may be released and dissolved in percolating groundwater and surface waters. The breakdown of the mineral pyrite is a particularly important aspect of weathering in coal and metalliferous mines since acid ferruginous drainage waters can be produced. A probability model formulation procedure is suggested, including a description of the model MINES which was developed to forecast the likelihood and type of acid and ferruginous mine drainage occurring in a specific situation. MINES was validated on the basis of its abiliity to correctly forecast mine wastewater quality in well-documented ca ries in the literature. (Moore-IVI)
W85-01750

TRACE METAL CONCENTRATIONS WATERS OF A SOUTH INDIAN RIVER
Mysore Univ. (India). Dept. of Botany.
R. K. Somashekar, S. N. Ramaswamy, and Arekal.
International Journal of Environmental Vol. 20, p 63-65, 1982. 3 Tab, 25 Ref.

Descriptors: *Heavy metals, *Path of po *Kapila River, *India, Copper, Lead, C Nickel, Cobalt, Chromium, Zinc, Water

Copper, zinc, lead, cobalt, chromium, c and nickel were analyzed in both surf bottom water samples at six sampling sta the river Kapila, Karnataka, India. Concen of the various metals varied from station to The variation was due to difference in the of pollution which are of domestic and i origin. Bottom samples had more dissolve than the surface water samples. Copper co tion was above the highest desirable lim stations which receive much domestic was and cadmium concentrations were above th mum permissible levels at all stations. Ch concentration was very low at all stations one and nickel concentration at 2 stations w compared to the other stations. At the less stations metal concentration is higher summer, followed by rainy and winter seas the more polluted stations maximum readin recorded during winter, followed by sumr rainy seasons. This variation is attributed ance in effluent load added to the river amount of discharge of water from th (Baker-IVI)
W85-01751

ROLE OF SEDIMENTS IN THE NITR BUDGET OF LOWER GREEN BAY, MICHIGAN,
Army Engineer Waterways Experiment Vicksburg, MS. Environmental Lab.
R. L. Chen, D. R. Keeney, and T. H. McInt
Journal of Great Lakes Research, Vol. 9, N 23-31, 1983. 2 Fig, 7 Tab, 27 Ref.

Descriptors: *Green Bay, *Lake Michigan sediments, *Nitrogen, Water pollution sourc cling nutrients, Limiting nutrients, Eutroph Nonpoint pollution sources, Nitrification, I fication, Water pollution control.

The extreme southern portion of Green B shallow (1 to 5 m depth), eutrophic wate which receives considerable nutrients fr Fox River and metropolitan Green Bay, W sin. Research to evaluate the effect of sedim nitrogen (N) in the bay entailed periodic sa of waters and sediments at six sites over 20 and laboratory investigations of the rates of cation, denitrification, mineralization, imm tion, and N2 fixation. The monitoring data i ed that the N concentrations, approximat and 0.8 mg/L of inorganic and organic N, tively, in the bay waters are considerably than the threshold limits that may caus bloom and aquatic weed problems. Consid of the available sediment N pool with res recognizable N inputs indicated that only 1 the yearly N loading from the Fox River is in the active sediment layer. Nitrification a sequent denitrification at the sediment-wate face as a result of intermittent wind stirring be a major sink for N, but presently it has a impact due to the high loading rate of N ecosytem. The study indicates that even if a mately 50% of the present point source loa N were eliminated by pollution abatement, input from nonpoint sources (combined with ing concentrations of phosphorus in th waters) would be sufficient to maintain eut conditions. (Author's abstract)
W85-01754

ATMOSPHERIC INPUTS OF PCBS TO ICE COVER ON LAKE HURON,
Paul Univ., Chicago, IL.
Murphy, and A. W. Schinsky.
nal of Great Lakes Research, Vol. 9, No. 1, p 6, 1983. 3 Fig., 1 Tab., 12 Ref. EPA grant 5325.

criptors: *Atmospheric deposition, *Polychlored biphenyls, *Ice cover, *Lake Huron, Water ition sources, Precipitation, Conductivity, Ice s, Snow, Great Lakes.

ected areas of the Great Lakes usually are pletely frozen over for 8-12 weeks each er. During this time, the ice surface accumu- precipitation and dry deposition, and the ma- ls they contain. When the ice melts in the g, all these material go into the lake. Measure- ts of the net atmospheric depositon of PCBs e made on ice cores collected from the frozen ice of Lake Huron late in the ice seasons of and 1979. Ice cores were separated into seg- s and melted. Based on subjective appearance specific conductivity, the segments were divid- nto a depositional layer sample (cloudy, high ific conductivity) or a frozen lake water (clear, specific conductivity) sample. Intrusions of water into the accumulated deposition layer of nd snow were not encountered. For Saginaw a net deposition rate of 2.0 gm/sq km/mo of s to the ice was found for the winters of 1977- and 1978-1979. Upon ice break-up and thaw e spring, all of the PCBs accumulated on the re likely to enter the bay. For inner Saginaw this would have been 8 kg in March 1978 and g in March 1979. The analysis of ice cores, a od which had been tried but not found to be l for determining accumulated atmospheric sition on small lakes, worked very well for n areas of the Great Lakes. (Moore-IVI)
-01759

AVY METALS IN ULVA LACTUCA COLTED WITHIN TOLO HARBOUR, AN MOST LANDLOCKED SEA,
ese Univ. of Hong Kong, Shatin. Dept. of gy.
I. Wong, T. T. Kwok, and K. C. Ho.
robiological Bulletin, Vol. 16, No. 2-3, p 223- December, 1982. 2 Fig, 3 Tab, 32 Ref.

criptors: *Heavy metals, *Harbors, *Path of tants, *Tolo Harbor, *Hong Kong, Copper, , Lead, Iron, Aquatic plants, Bioindicators.

Harbor is an almost land locked sea with only row outlet. The size and volume of the harbor constantly decreased since the construction he Plover Cover Reservoir in the late 1960s. large scale reclamation due to the expansion development of two satellite cities, Tai Po and in as well as the construction of a race-course circular roads in the late 1970s have further ced the size and volume of the harbor, and ted the natural habitats of the shore-lines. The ion effect of the tides and waves within Tolo or has become minimal. There is a high con- of heavy metals in the coastal water disged from various industries including textile, and electroplating factories. Samples of sear, sediment and U. lactuca were collected different localities within, as well as far away Tolo Harbor, in order to gain an understandof the metal content of the alga and seafood ected within the harbor. Water and sediment yses revealed higher concentrations of metals per, iron, lead, and zinc) within the harbor. ples of algae from the most polluted area, n Chau Tsai, had the highest contents of all d metals with 134 micro g/g of copper. The nt of metal contamination was emphasized in findings in the tissue of U. lactuca. Use of U. uca, one of the most common marine algae in g Kong, as a biological indicator would be able. (Baker-IVI)
-01762

TISTICAL ANALYSIS AND EVALUATION WATER-QUALITY DATA FOR SELECTED EAMS IN THE COAL AREA OF EASTNTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
J. H. Lambing.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4224, 1983. 89 p, 15 Fig, 8 Tab, 29 Ref.

Descriptors: *Water quality, *Statistical analysis, Regression, Flow duration, *Sediment load, Sediment yield, *Dissolved solids, *Montana, Fort Union coal region.

To document and evaluate existing conditions of water quality prior to proposed coal development in east-central Montana, water-quality data were collected at 23 sites on selected streams from October 1975 through September 1981. The data were statistically summarized and regression equations were developed to define relationships between water-quality variables. Where applicable, measured water-quality conditions were compared to various water-use standards. Measured concentrations of dissolved solids ranged from 145 to 12,200 milligrams per liter. Concentrations commonly exceeded 1,000 milligrams per liter and thereby present a high to very high salinity hazard for irrigation. Streamflow of the area contains predominantly sodium and sulfate ions and generally constitutes a medium to very high sodium hazard for irrigation during base flow. The water in most streams is generally adequate for livestock consumption during base flow. Concentrations of suspended sediment were extremely variable and had a direct correlation to water discharge. Measured suspended-sediment concentrations ranged from 4 to 23,000 milligrams per liter. Sediment-transport curves were developed for 18 of the study sites. Mean annual suspended-sediment loads were determined at five sites using the flow-duration, sediment-transport curve method. Mean annual sediment loads ranged from 1,010 to 72,7000 tons. (USGS)
W85-01770

ORIGINS AND DISTRIBUTION OF SALINE GROUND WATERS IN THE FLORIDAN AQUIFER IN COASTAL SOUTHWEST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2K.
W85-01778

HYDROLOGIC RESPONSES OF STREAM'S TO MINING OF THE MULBERRY COAL RESERVES IN EASTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01782

GROUND-WATER QUALITY IN THE WESTERN SNAKE RIVER BASIN, SWAN FALLS TO GLENNS FERRY, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01784

MUNICIPAL SOLID-WASTE DISPOSAL AND GROUND-WATER QUALITY IN A COASTAL ENVIRONMENT, WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5E.
W85-01789

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE BLOOMFIELD COAL TRACT, DAWSON COUNTY, EASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01791

USE OF FIXED-BED ADSORBER MODELS TO PREDICT THE FLUXES OF TOXIC SUBSTANCES IN GROUNDWATERS AND SOIL ENVIRONMENTS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
W. J. Weber, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202563, Price codes: A05 in paper copy, A01 in microfiche. Institute of Water Research Completion Report, Michigan State Univ., East Lansing, January 1984. 92 p, 44 Fig, 2 Tab, 40 Ref. Project No. OWRT A-12-MICH(1), Contract/Grant No. 14-34-0001-2124.

Descriptors: *Mathematical models, *Soil, *Toxic substances, *Groundwater, Kinetics, Organic carbon, Model studies, *Path of pollutants, *Sorption, Sands, Lindane, *Freundlich isotherms, *Solute transport, Mass transport.

Effective management of a ground water system requires description and prediction of the transport and fate of contaminants in that system. This can be facilitated by using mathematical models which accurately represent the physical phenomena operative in the system. One of the most significant phenomena impacting the transport of many organic pollutants is partitioning between the solid (soil) and aqueous (groundwater) phases. The tendency of a contaminant to partition may be roughly approximated from measurements of such constitutive properties as the octanol: water partition coefficient of the contaminant and organic carbon content of the soil. Such rough approximations provide a basis for cursory appraisal, but are inadequate for quantitative system descriptions, particulary where nonlinear equilibrium sorption, kinetically dependent partitioning, or irreversible and/or hysteretic phase distribution phenomena are operative. Accurate simulation of solute transport frequently requires the incorporation of kinetic parameters and/or a nonlinear isotherm relationship to define transport phenomena in the fundamental equations governing mass transport. Data collected for four sands and lindane indicates that equilibrium sorption is a nonlinear function best fit by the Freundlich isotherm. Results collected from completely mixed batch reactors of the bottle and stirred type indicate that sorption of lindane on the soils investigated is a kinetically controlled phenomena. These kinetic sorption data may be mathematically modeled in a number of ways with the Michigan Adsorption Design and Applications Model (MADAM) demonstrating good agreement with measured data.
W85-01793

EFFECTS OF PHOSPHATE FERTILIZER APPLICATIONS AND CHEMISTRY-MINERALOGY OF THE IRON OXIDE SYSTEM ON PHOSPHATE ADSORPTION-DESORPTION BY STREAM SEDIMENTS,
Ohio State Univ., Columbus. Dept. of Agronomy.
T. J. Logan, J. M. Bigham, K. S. Brady, and P. S. Nair.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202571, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Center, Columbus, Project Completion Report No. 712429, (1984). 102 p, 12 Fig, 19 Tab, 93 Ref. Project No. OWRT B-080-OHIO(1), Contract/Grant No. 14-34-0001-0242.

Descriptors: Eutrophication, *Acid mine water, Sulfates, Sediments, *Ohio, *Iron oxides, Pyrite, Anion adsorption, Prototype tests, *Mine drainage, *Phosphate adsorption, Phosphorus adsorption procedure, Muskingum River basin.

Suspended sediments from the Muskingum River and its tributaries were remarkably uniform in mineralogy and size distribution. Black Fork Creek, a tributary to Moxahala Creek which receives acid drainage from abandoned coal mines was chosen for detailed water quality and bottom sediment studies. Marked increases in dissolved SO4, Fe, and Al, and decreased pH were observed in sections of the stream affected by acid mine drainage. In addition, a gelatinous yellow iron precipitate was abundant in the bottom sediments below sources of pollution. This Fe-oxide or oxyhydrox-

ide precipitate greatly increased surface area and reactivity of bottom sediments and added to the overall sediment load. A standard P absorption procedure was proposed and the ability of four laboratories to produce consistent results over a wide range of soils was determined. Soil (0.5 or 1.0 g) was shaken in 0.01 mol/l CaCl2 at a soil:solution ratio of 1:25 in containers allowing a 50% head space for 24 hours at 24 to 26 degrees C on an end-over-end shaker. Initial dissolved inorganic P concentrations of 0 to 323 micronmol PL/l as (KH2PO4 or NaH2PO4) were used and microbial activity inhibited by 20 g/l chloroform. Excellent agreement between the four laboratories was obtained for P absorbed by the 12 soils studied, with a mean coefficient of variation over all P levels and soils of 0.91%. The laboratories also exhibited a high degree of replication of individual treatments with no laboratory showing a strong consistent bias across all soils and P levels in terms of P adsorption. The proposed method has the potential to produce consistent results which can be used to predict partitioning of dissolved inorganic P between solid and solution phases.
W85-01794

ACCUMULATION OF THE TRACE ELEMENTS LEAD AND ZINC BY ASELLUS COMMUNIS AT THREE DIFFERENT PH LEVELS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
T. Lewis, and A. McIntosh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202514, Price codes: A03 in paper copy, A01 in microfiche. Center for Coastal and Environmental Studies Completion Report, February 1984. 21 p, 19 Fig, 15 Tab, 17 Ref. Project No. OWRT A-068-NJ(1), Contract/Grant No. 14-34-0001-1132.

Descriptors: *Heavy metals, *Zinc, *Lead, *Sediments, *Bioaccumulation, *Hydrogen ion concentration, Isopods, Asellus communis, Trace elements.

The freshwater isopod Asellus communis was exposed to lead (Pb) and zinc (Zn) contaminated sediments at three different pH levels: 7.6, 5.5 and 4.5. Significant releases of trace elements occurred at pH 4.5 (Pb and Zn) and pH 5.5 (Zn only). Patterns of accumulation of the two trace elements by Asellus differed dramatically; there was little accumulation of Zn at any pH level, while significant increases in Pb concentrations were noted at the two lower pH levels. Both water and sediment appeared capable of acting as significant sources of Pb for the organisms.
W85-01795

FLUXES OF HEAVY METALS IN DELAWARE RIVER FRESHWATER TIDAL WETLANDS,
Rider Coll., Lawrenceville, NJ. Dept. of Biology.
R. L. Simpsom, R. E. Good, B. J. Dubinski, J. J. Pasquale, and K. R. Philipp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190057, Price codes: A05 in paper copy, A01 in microfiche. Center for Coastal and Environmental Studies Completion Report, Rutgers Univ., New Brunswick, NJ, December, 1983. 79 p, 22 Fig, 22 Tab, 54 Ref, 1 Append. Project No. OWRT A-060-NJ(1), Contract/Grant No. 14-34-0001-1132.

Descriptors: *Tidal marshes, *Marsh plants, *Litter, Aquatic soils, Cadmium, Copper, Lead, Nickel, Zinc, Activated sludge, Water pollution control, *Heavy metals, *Wetlands, *New Jersey, Woodbury Creek Marsh, Freshwater tidal wetlands, *Delaware River, Allocation patterns, Heavy metal retention.

A survey of ten wetlands showed soil heavy metals were generally lowest in rural areas and highest in urbanized and industrialized areas. Cr, Cu, and Cd levels were highest at transects nearest the Delaware River while Ni and Pb were highest near the tidal boundary indicating a differential importance of riverine and upstream inputs to these wetlands. Regression analysis showed significant ($P < or = .05$) positive relationships between % silt and Cr, Cd, Ni, and Pb. The high marsh through sites with the highest % silt likewise had the highest metal concentrations. Extensive studies at Woodbury Creek Marsh showed little seasonal pattern in soil metal concentrations, but distinct concentration gradients with depth and distance from a storm drain discharging nonpoint source runoff. The vegetation, while accumulating metals especially below ground, had much lower metal levels than the soil although the pattern of accumulation, Zn > Pb > Cu nearly = Ni > Cd, closely paralleled soil metal levels. Litter was enriched up to 20-fold as it decomposed with Cd and Ni levels reaching ambient soil levels while Cu and Pb were half to two-thirds those in the soil. Except for increases in Cr, the vegetation did not respond to the application of sewage sludge enriched with heavy metals. The soils of the high treatment sites (100 g/sq m/wk sludge) retained Cd (43%), Cr (53%), Cu (52%), Pb (31%), and Zn (51%) in the sludge at the end of the application period in October, but only Cd (15%) and Cr (12%) were still present the following March. The soils of the low treatment sites (25 g/sq m/wk sludge) retained only Cd (43%) and Cr (28%) in October, but these metals remained in the soil at the same level through the next March. Delaware River freshwater tidal wetlands have the capacity to sequester additional metals, but at a slow rate. Direct sedimentation and the litter are the major pathways for a long-term accumulation of heavy metals in these wetlands.
W85-01805

CHEMICAL STUDY OF THE INTERSTITIAL WATER DISSOLVED ORGANIC MATTER AND GASES IN LAKE ERIE, CLEVELAND HARBOR, AND HAMILTON HARBOUR BOTTOM SEDIMENTS--COMPOSITION AND FLUXES TO OVERLYING WATERS,
Wright State Univ., Dayton, OH. Brehm Lab.
D. D. Adams, G. G. Hess, N. J. Fendinger, D. A. Deis, and D. J. Wagel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-195783, Price codes: A09 in paper copy, A01 in microfiche. Ohio Water Resources Center, Ohio State Univ., Columbus, Report No. 712433, (1984). 187 p, 36 Fig, 32 Tab, 248 Ref, 1 Append. Project No. OWRT A-059-OHIO(1).

Descriptors: *Sediments, *Interstitial gases, Dissolved organic carbon, Methane, Nitrogen, Carbon dioxide, SOD chambers, *Lake Erie basins, Cleveland Harbor, Hamilton Harbour, *Dissolved organic compounds, Sediment porosity, Volatile solids, *Ohio, Water quality, Water pollution sources, Chemical analysis.

During 14 cruises in 1979 and 1980 SCUBA-collected sediment cores were obtained from the three basins of Lake Erie, Cleveland Harbor and Hamilton Harbour for determining interstitial water dissolved organic carbon (DOC) and dissolved gases (methane, nitrogen and total carbon dioxide). Sediments were also measured for volatile solids and water content, while EPA organic priority pollutants (purgeable, base/neutral and acid extractable) and molecular size ranges of dissolved organic matter (DOM) were evaluated in selected interstitial water samples. Because of high sediment concentrations, calculated diffusive losses of CH4 and sigma CO2 approximated 2-16% of the C influx to open lake sediments while 13-44% of the N sedimentation could be lost by denitrified N2 gas production. Diffusion of CH4 could account for up to 30% of the sediment oxygen demand. N2 gas was supersaturated in numerous interstitial water samples. Sediment interstitial water DOC ranged from an average of 6 mg/L in Lake Erie's central basin to 91 mg/L in Hamilton Harbour. DOM in open lake sediments consisted of high (> 20,000) molecular weight substances with few compounds indentified by GC/MS. A greater percentage of Hamilton Harbour DOM was less than 20,000 molecular weight with heterocyclic, aromatic and polynuclear (or unidentified and unresolved) type compounds suggestive of anthropogenic sources; some were identified as potentially hazardous. A significant linear relationship existed between DOC and CH4 in open lake and Cleveland Harbor sediments; this was not the case for Hamilton Harbour suggesting complex substances not decomposed by methanogens.
W85-01814

EFFECT OF VARIOUS HYDROLOGIC RAMETERS ON THE QUALITY OF ST WATER RUNOFF FROM A WEST LA ETTE, INDIANA URBAN WATERSHED,
Purdue Univ., Lafayette, IN. Dept. of En mental Engineering.
M. S. Blumberg, and J. M. Bell.
Available from the National Technical Inform Service, Springfield, VA 22161 as PB84-2 Price codes: A07 in paper copy, A01 in micro Water Resources Research Center Tec Report No. 162, January 1984. 121 p, 26 F Tab, 44 Ref, 2 Append. Project No. OWR 00090-U-IND(2), Contract/Grant No. 14-34- 0498.

Descriptors: *Wastewater effluents, Waste treatment, *Stormwater runoff, Water quality gression analysis, *Indiana, *Urban wate West Lafayette.

Increasingly stringent quality standards wastewater effluents, and increased efficien wastewater treatment plant operations, have the pollution due to stormwater runoff more ous. This study investigated the quality of st water runoff from a 29 acre, fully developed, dential watershed. The importance of variou drologic activities (average intensity of rai peak intensity of rainfall, total rainfall, peak ra runoff, total runoff, and duration of precipit event) on stormwater pollutant concentrat total mass (or number), and peak rates was eva ed by multiple regression analyses. One has confidence in the regression models develope total mass (or number) and peak rate of all po ants studied, and 97% confidence in the mo developed for average and peak concentratio total coliforms. The hydrologic activities acc ed for 33-87% of the variance in the pollutant Several postulated relationships were exam using data collected during this study. No rela ship was apparent between the quantity of pr ous rainfall or the length of the antecedent period and the quality of stormwater runoff. ther was an overall trend apparent between time elapsed since street cleaning and the qualit stormwater runoff.
W85-01822

POTENTIAL FOR ACIDIFICATION OF REMOTE PONDS IN THE WHITE MOU TAINS OF NEW HAMPHIRE,
Northeastern Forest Experiment Station, Durh NH.
D. C. Buso, C. W. Martin, and J. W. Hornbeck.
Available from the National Technical Informat Service, Springfield, VA 22161 as PB84-207 Price codes: A08 in paper copy, A01 in microfic Water Resource Research Center Research Rep No. 43, Univ. of New Hampshire, Durham, Feb ary, 1984. 157 p, 60 Fig, 71 Tab, 59 Ref, 2 Appe Project No. OWRT A-060-NH(1), Contract 14-34-0001-2131.

Descriptors: *Alkalinity, Sulfate, Aluminu *Acid rain, *Acid precipitation, *Acidificati Ponds, White Mountains, *New Hampshire, Po chemistry, Hydrogen ion concentration.

Six remote ponds and their watersheds in White Mountains of New Hampshire w mapped, and chemical characteristics of the por and inlet streams were measured to estimate s ceptibility to acid precipitation. The methods us and data collected during 1980-82 are included possible comparisons with future studies or alternative analyses and interpretations. Althou the ponds are within a 20 km radius of each oth and seemingly have similar watershed character tics and precipitation chemistry, the volum weighted pH between ponds ranged from 4.5 6.4. Volume-weighted alkalinity ranged from 0 144 micro-eq/l. Alkalinity was related to pH, bas morphology, production of hypolimnetic alkali ty, and chemistry of inlet streams. Historic pH a alkalinity data from these ponds are inadequate f determining if they are acidifying. Volume-weigh ed S04(2-) ranged from 70 to 170 micro-eq among the ponds. The ratios of divalent catio countering S04(2-) suggest that weathering with

atersheds of the various ponds is an impor-
ctor in buffering acid precipitation and pond
. Volume-weighted total aluminum ranged
.10 to 0.60 mg/l. The most acidic ponds had
ost total aluminum. The less acidic ponds
to produce enough alkalinity and dissolved
c carbon to allow complexing of inorganic,
forms of aluminum. All ponds experienced
erm acidification in the upper water as a
of snowmelt events. Four models for pre-
the susceptibility of the six study ponds to
cation worked poorly. Each of the six ponds
ue and a broad approach at grouping them
only on one or two parameters is inadequate.
1834

R ELBE: PROCESSES AFFECTING THE VIOUR OF METALS AND ORGANOCH-NES DURING ESTUARINE MIXING,
lands Inst. voor Onderzoek der Zee, Texel.
Duinker, M. T. J. Hillebrand, R. F. Nolting,
Wellershaus.
rlands Journal of Sea Research, Vol. 15, No.
41-169, July, 1982. 20 Fig, 1 Tab, 26 Ref.

ptors: *Elbe Estuary, *Fate of pollutants,
of pollutants, *Metals, *Polychlorinated bi-
a, Estuarine environment, Sedimentation,
n, Resuspension, Suspended solids, Dis-
solids, Particulate matter.

Elbe Estuary is a coastal plain estuary. It
ches into the North Sea (Wadden Sea) near
ven, with the mouth being bordered by tidal
Attempts were made to determine the rela-
portance of chemical or physico-chemical
ses, and sedimentation and resuspension
ses on the behavior of metals (Cd, Zn, Cu,
, Mn, Fe, Ca, Al, Si, Ti, Mg), organic C and
organochlorine compounds in the estuarine
of the River Elbe in summer 1976. Sedimen-
and resuspension seemed to be relatively less
ant than in some other estuaries. This may
from a much less pronounced mud shoal in
be estuary. Alternating sedimentation and
resulted in systematic variations in the
sition of suspended matter in terms of the
e contributions of two fractions: permanent-
pended small and low-density particles
higher contents (w/w) of Cd, Zn, Pb, Mg
ganic C and N; and resuspended larger and
(mud) particles having higher contents of
e, Al, Si and Ti. In addition to Al silicates,
c matter and Fe and Mn oxides may be
ant sites for trace elements in both fractions,
rticularly so in the permanently suspended
n. Cd, Zn, Cu, Mn and Fe may have been
ed from solution into suspended particles
the initial phases of estuarine mixing. Estua-
ud, acting as sink for particulate pollutants,
ccumulate originally dissolved componenets.
e range of PCB components with high and
grees of chlorination was present in solution
ll as in suspension. Water was the most
ant carrier for components with a low
of chlorination, and seston for components
high degree of chlorination. Concentrations
vidual PCB components ranged from pico-
to nanograms per liter. (Moore-IVI)
1836

R WESER PROCESSES AFFECTING THE VIOUR OF METALS AND ORGANOCH-NES DURING ESTUARINE MIXING,
lands Inst. voor Onderzoek der Zee, Texel.
Duinker, M. T. J. Hillebrand, and R. F.
g.
rlands Journal of Sea Research, Vol. 15, No.
70-195, July, 1982. 16 Fig, 1 Tab, 16 Ref.

ptors: *Estuaries, *Metals, *Fate of pollut-
River Weser, Mixing, Chlorinated hydrocar-
Particulates, Resuspension, Dissolved solids,
ic compounds, Polychlorinated biphenyls.

rements of dissolved and particulate sus-
d metals and organochlorine compounds
made along with studies on hydrographic
edimentation-resuspension processes in the
water and the estuarine mixing zone of the
iver Weser during typical spring tide condi-
tions. The position of the mixing zone was 20 km upstream of its normal position as a result of the extremely low river discharge in the dry summer of 1976. Concentrations of Cd, Zn, Cu Pb, Mn, and Fe in solution in the mixing zone increased by contributions from interstitially dissolved components during resuspension of bottom sediments. Variations in the contents of metals in seston is interpreted in terms of varying contributions of different fractions that had different sedimentation and resuspension characteristics as well as different chemical composition. A wide range of PCB components with high and low degree of chlorination was present in solution and in suspension. Suspended particles were the most important carriers for components with higher degrees of chlorination. Concentrations of individual PCB components in fresh water varied between a few picograms per litre and the nanogram per litre range. The only compounds present in the estuary and the Wadden Sea above the detection limit in 1 liter samples were alpha- and gamma-hexachlorocyclohexane in the low and sub ng/liter range. (Baker-IVI)
W85-01837

ONE-DIMENSIONAL MIXING AND FLUSHING MODEL OF THE EMS-DOLLARD ESTUARY: CALCULATION OF TIME SCALES AT DIFFERENT RIVER DISCHARGES,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 2L.
W85-01838

USE OF A MODEL TO ASSESS FACTORS AFFECTING THE OXYGEN BALANCE IN THE WATER OF THE DOLLARD,
Biologisch Centrum, Haren (Netherlands).
For primary bibliographic entry see Field 2L.
W85-01839

BEHAVIOUR OF POLYCYCLIC AROMATIC HYDROCARBONS IN THE EXE ESTUARY, DEVON,
Bayreuth Univ. (Germany, F.R.). Lehrstuhl fuer Hydrologie.
R. Herrmann, and D. Hubner.
Netherlands Journal of Sea Research, Vol. 15, No. 3/4, p 362-390, December, 1982. 18 Fig, 3 Tab, 50 Ref.

Descriptors: *Polycyclic aromatic hydrocarbons, *Estuaries, *Sediments, *Runoff, Fate of pollutants, Path of pollutants, Model studies, Hydrocarbons, Suspended sediments.

Polycyclic aromatic hydrocarbon (PAH) pollution resulting from river runoff to a receiving estuary is associated with suspended sediments. This is due to the high sorption coefficients on suspended and bottom sediments. Thus, the highest concentrations of PAH are found along the tidal channel within the mixing zone. The regional and temporal variation of suspended PAH, which was measured at 4 anchor stations during complete tidal cycles and at 4 traverses along the main tidal channel, is characterized by an increase of suspended PAH concentration and net positive fluxes from the river into the mixing zone and a subsequent decrease toward the sea. In the upper water column higher concentrations per weight of suspended sediment have been observed than in the lower one. This may be explained by a greater adsorption coefficient of the upper fine suspended sediments and a dilution by landward transport of marine suspended sediments near the bottom. A lab experiment involving short term (2 hrs) interaction of suspended PAH with increasing salinities did not show significant removal of PAH from suspension. In a long term (a few hours) interaction, the importance of sea water electrolytes for the removal of suspended PAH could be proved. The connection between regional distribution of suspended PAH and estuarine circulation was demonstrated by a two-dimensional box model. (Baker-IVI)
W85-01841

KEPONE CONCENTRATION IN JUVENILE ANADROMOUS FISHES,
Virginia Inst. of Marine Science, Gloucester Point.
J. G. Loesch, R. J. Huggett, and E. J. Foell.
Estuaries, Vol. 5, No. 3, p. 175-181, September, 1982. 1 Fig, 3 Tab, 25 Ref.

Descriptors: *Kepone, *Fish, *Potomac River, *Rappahannock River, *Pamunkey River, *Mattaponi River, *Chickahominy River, *James River, *Virginia, Alewife, Shad, Herring, Bass, Pesticides, Path of pollutants, Aeolian contamination.

The James River was closed to all forms of fishing in December 1975 as a result of Kepone contamination. The ban was later modified to allow fishing for American shad, alewife, blueback herring, and catfishes. Young-of-the year alewife, American shad, blueback herring, and striped bass were analyzed for Kepone contamination. Samples were collected from the Potomac, Rappahannock, Pamunkey, Mattaponi, Chickahominy, and James rivers during the period 1977-79. Concentrations of Kepone $>$ or $=$ 0.03 ppm occurred in all four species collected in the James River nursery zone between km 65 and 120, and in the lower Chickahominy River. Kepone was not detectable in samples from the Rappahannock and Potomac rivers. Concentrations of Kepone $<$ 0.3 ppm were also present in samples from the Mattaponi and Pamunkey rivers. Possible explanations for the occurrence of Kepone in these samples from the upper York River system (Mattaponi and Pamunkey rivers) include: sample contamination or misidentification; migration of juveniles from the James River; migration of adults to the York River system from the James River after contamination but prior to spawning; and aeolian contamination of the upper York river watershed due to its juxtaposition to the James River. Aeolian transport is believed to be most likely. (Moore-IVI)
W85-01847

TIDAL AND SEASONAL VARIATIONS OF SULFATE ION IN A NEW JERSEY MARSH SYSTEM,
Kean Coll. of New Jersey, Union. Dept. of Chemistry-Physics.
G. W. Luther, III, A. L. Meyerson, K. Rogers, and F. Hall.
Estuaries, Vol. 5, No. 3, p 189-196, September, 1982. 5 Fig, 1 Tab, 31 Ref. NOAA grants 04-6-158-44042 and 04-7-158-44-042.

Descriptors: *Piles Creek Marsh, *New Jersey, *Sulfates, *Tidal effects, *Seasonal variation, Estuarine environment, Chlorides, Water temperature, Dissolved oxygen, Hydrogen ion concentration, Rainfall, Productivity, Metals, Fate of pollutants.

In order to investigate possible sulfate reactions in a polluted system, Piles Creek Marsh off Newark Bay in New Jersey was chosen as a study site. The entire estuarine system is surrounded by highly industrialized areas and has become highly polluted. Sulfate variations during a tidal cycle were investigated at three sites. Sulfate-chlorinity relationships were determined in the light of fluctuations in temperature, dissolved oxygen and pH. The relationships were seasonal in nature, being affected by temperature and rainfall effects on biologic productivity. Both reduction of sulfate ion to a sulfide species and oxidation of sulfide species to the sulfate ion were found to occur. The sulfate ion concentration is not conservative in the tidal marsh system. As high tide waters flow through the sediment, sulfate reduction occurs. This reduction process will produce a sulfide species capable of precipitating many metal ions, especially in highly polluted environments. At low tide waters, sulfide minerals in creek sediments may be oxidized during high pH and dissolved oxygen events such as biological productivity. In Piles Creek Marsh, the large differences in the magnitude of the oxidation and reduction processes might cause a net export of sulfate ion from the marsh to the Arthur Kill. Such an export of sulfate ion might also cause a mobilization of metals which had precipitated as sulfides. (Moore-IVI)
W85-01848

ORIGIN OF NITRATES IN GROUNDWATER OF THE BUNZ VALLEY (WOHER STAMMEN

DIE NITRATE IM GRUNWASSER DES BUNZTALES),
Kanton Aargau, Aarau (Switzerland). Informations- und Dokumentations-dienst.
W. Fricker.
Wasser, Energie, Luft, Vol. 75, No. 3, p 75-77, 1983.

Descriptors: *Groundwater pollution, *Nitrates, *Bunz valley, *Switzerland, Water pollution sources, Animal wastes, Fertilizers, Sludge disposal, Water pollution control, Water treatment.

A study was ordered in 1975 to determine the origins of nitrates in the groundwater of the Bunz valley, Aargau Canton, Switzerland. This followed the discovery of increasing nitrate concentrations in groundwater wells in the region between 1970 and 1975, occasionally exceeding the Swiss maximum permissible level of 40 mg/l. The Bunz valley covers 8,600 ha, of which 53% is used agriculturally. The main source of nitrate was the agricultural application of nitrogen to the soil, which totals about 430 kg/yr. Half of this is applied as direct manuring (73.8% farmyard manure, 23.8% mineral fertilizer and 2.4% sludge from wastewater treatment plants). About 2.3% of this appears in runoff as nitrate. Increased nitrate concentrations can be expected when a large proportion of land is fallow, when fallow land is fertilized with nitrogen at times other than the growing season, and when fertilization is performed at the incorrect time. Short-term measures to combat this are to educate farmers in correct fertilization and planting practices, to institute fertilization restrictions in ground water conservation areas, and to reduce nitrates in drinking water by ion exchange or reverse osmosis. Intermediate measures are to dilute nitrate-rich wells with water from nearby wells with low nitrate levels and to cultivate only those crops (grass alone in extreme cases) that prevent excessive runoff of nitrates. (Gish-IVI)
W85-01856

HEAVY METAL MIGRATION IN SOIL-LEACHATE SYSTEMS,
Miami Univ., Coral Gables, FL. Dept. of Mechanical Engineering.
K. V. Wong, S. Sengupta, D. Dasgupta, E. L. Daly, Jr., and N. Nemerow.
BioCycle, Vol. 24, No. 1, p 30-33, January/February, 1983. 3 Fig, 8 Tab, 10 Ref.

Descriptors: *Heavy metals, *Soil properties, *Migration, *Permeability, Groundwater pollution, Mathematical model, Leachates.

Prediction of heavy metal migration in soil-leachate systems requires an understanding of the various mechanisms governing the behavior of the soil and the leachate. Four specific soils from Pomano Beach, Florida were studied: Hallandale fine sand, Plantation muck top layer, Plantation muck middle layer, and Plantation muck bottom layer. The first two are sandy in nature while the last two are clayey. Experiments were conducted to determine the manner in which the cations distributed themselves between the characteristic liquid and the four types of soil studied in the present work. The distribution coefficients of eight cations (Cu, Fe, Mn, Ni, Cd, Cr, Ca, Zn) between a complex mixture and the four soil types were determined. The Lapidus-Amundson model and the Langmuir model were used to predict the migration of the heavy metal ions in soil-leachate systems. The relative mobilities of the eight cations have been quantitatively measured in terms of the length of time taken by each cation to reach steady state under a fixed set of initial and boundary conditions. The relative mobility of a cation in the mixture as predicted by the Lapidus-Amundson model is different from that predicted by the Langmuir model. (Baker-IVI)
W85-01868

UPTAKE OF KEPONE FROM SEDIMENT SUSPENSIONS AND SUBSEQUENT LOSS BY THE OYSTER CRASSOSTREA VIRGINIA,
Virginia Inst. of Marine Science, Gloucester Point.
R. Morales-Alamo, and D. S. Haven.
Marine Biology, Vol. 74, No. 2, p 187-201, 1983. 11 Fig, 3 Tab, 59 Ref. EPA grant R804993010.

Descriptors: *Kepone, *Oysters, *Suspended sediments, *James River, *Virginia, Path of pollutants, Sediment contamination, Pesticides, Bioaccumulation, Concentration factor.

Oysters in laboratory trays received sediment suspensions prepared with sediments contaminated with Kepone from the James River, Virginia, USA. Oysters in trays were also exposed to water pumped directly out of two tributary creeks of the James River and in wire trays on the bottom of the James River. Oysters took up Kepone from the sediment suspensions very rapidly and the steady state in uptake appeared to be attained within one week. Loss of Kepone by oysters was also rapid. An average of 70% (95% confidence interval = 51-90%) of the Kepone in their tissues was eliminated during the first week, but a small residue was still present in the oysters after four weeks. The computed biological half-life of Kepone in oysters ranged between 3 and 10 d, with a mean of 5.2 d. Computation of concentration factors in the tissues of the experimental oysters included the volume of water in which the sediment particles were suspended. Concentration factors in laboratory experiments ranged from 574 to 4 167 and in field experiments from 28 000 to 56 000. Concentration factors were inversely related to concentrations in the sediment suspensions. It is suggested that this relationship may have resulted from interference of uptake by increasing concentrations of suspended matter or from a significant uptake of Kepone from solution. It is also suggested that Kepone available to oysters in solution may be of a magnitude similar to that available from sediments in suspension when the density of those sediments in the water is taken into consideration. (Author's abstract)
W85-01897

STATISTICAL ANALYSIS OF ESTUARINE PROFILES: II APPLICATION TO ARSENIC IN THE TAMAR ESTUARY (S.W. ENGLAND),
Marine Biological Association of the United Kingdom, Plymouth (England).
S. Knox, W. J. Langston, M. Whitfield, D. R. Turner, and M. I. Liddicoat.
Estuarine, Coastal and Shelf Science, Vol. 18, No. 6, p 623-638, June, 1984. 6 Fig, 5 Tab, 28 Ref.

Descriptors: *Tamar Estuary, *England, *Arsenic, *Estuaries, Statistical analysis, Sediments, Interstitial water, Manganese, Fate of pollutants, Iron oxyhydroxide, Oxidation.

By combining field observations with a statistical approach and a simple but effective estuarine analogue, the main features of the cycling of arsenic in the Tamar estuary have been elucidated. As(III) and As(V) enrichment in the water column is due to a combination of localized inputs and effective recycling of sediment interstitial waters. The profiles of As(V) are similar to those of NH4(+) and are dominated by an estuarine maximum resulting from an input from the sediments. As(III) profiles are correlated with those of dissolved manganese and exhibit both fresh water and estuarine maxima. As(III) appears to be effectively removed at the freshwater/brackish water interface by a combination of heterogenous oxidation, catalyzed by hydrous manganese dioxide, and adsorption on to iron oxyhydroxide. The estuarine distribution of As(III) within the water column is consistent with the published rates of oxidation of As(III) to As(V) by both inorganic and microbiological processes. The reduction of As(V) to As(III) in the sediments is incomplete. On the basis of the observations a tentative estuarine arsenic cycle is presented. (Author's abstract)
W85-01914

HYDROCARBONS IN WASHINGTON COASTAL SEDIMENTS,
Washington Univ., Seattle. School of Oceanography.
F. G. Prahl, and R. Carpenter.
Estuarine, Coastal and Shelf Science, Vol. 18, No. 6, p 703-720, June, 1984. 4 Fig, 4 Tab, 45 Ref. DOE contracts EY76-S-06-0225-TA40 and EY76-S-06-0225-T24.

Descriptors: *Hydrocarbons, *Sediments, *Washington, *Coastal waters, Aliphatic hydrocarbons, Polycyclic aromatic hydrocarbons, Fate of p ants, Particulates.

The sources and distributions of polycylic ar ic hydrocarbons (PAH) and aliphatic hyd bons are characterized in seventeen sediments a highly river-influenced sedimentary enviro off the southwestern coast of Washington major hydrocarbons are land-derived, intro as preformed compounds and display long stability in sediment cores. A series of PA anthropogenic origin and two naturally de compounds, retene and perylene, dominat PAH composition in these sediments. Plantw alkanes are the major aliphatic hydrocarbon stituents. Aliphatic hydrocarbons of marine o pristane and a series of four acyclic, mutibra C25 polyolefins, are also observed in many ments. The concentrations of these marine-de hydrocarbons decrease to negligible levels ra with sediment depth from the sea-sediment face, suggesting degradation. In general, the land-derived hydrocarbons are concentrated mid-shelf silt deposit which extends westward along the continental shelf fro Columbia River mouth. A quantitatively minor, natural series of phenanthrene homo also of terrestrial origin, is preferentially adv further offshore and deposited in continental sediments. These distributions are consistent recognized particle associations for these pounds and sediment dispersal processes in coastal environment. Sediment core records gest the present pattern of dispersal has per for at least the past century and possibly sinc Late Pleistocene. (Author's abstract)
W85-01915

SHORT-TERM CHANGES IN THE BASE N TRALIZING CAPACITY OF AN ACID RONDACK LAKE, NEW YORK,
Syracuse Univ., NY. Dept. of Civil Enginee
C. T. Driscoll, and G. C. Schafran.
Nature, Vol. 310, No. 5795, p 308-310, July, 1 2 Fig, 2 Tab, 29 Ref.

Descriptors: *Acid lakes, *Base neutralizing ca ity, *Acid rain, *Dart Lake, *New York, Al num, Nitrates, Carbonates, Sulfates, Hydroge concentration, Snowmelt, Acidification, At pheric deposition.

The source of base neutralizing capacity (B within acid surface waters has been attribute atmospheric deposition of H2SO4 (or SO2 HNO3, as well as production of soluble org acids from soils. Aluminum is often a very sig cant component of BNC in acidic waters. Sh term changes in the BNC of Dart Lake, an ac clearwater lake, were evaluated. Samples were lected for water quality analysis at the inlet, ou and at seven depths, approximately evey weeks over an annual cycle. Although H2CO3 the major component of BNC in Dart Lake, le of hydrogen ion and aluminum BNC in acid l are generally of more interest because of pote toxicity to organisms. Much of the variatio hydrogen ion and aluminum BNC can be att uted to changes in nitrate concentration, ra than to variations in sulfate, chloride, or org anion concentrations. Sulfate is usually the do nant anion in Adirondack surface waters an atmopheric inputs to the region. Additions NO3(-) during snowmelt and depletions of NO associated with assimilation and reduction proc es appear to be very inportant in regulating sh term changes in hydrogen ion and aluminum c centrations. (Moore-IVI)
W85-01917

EFFECTS OF CHANNEL EXCAVATION WATER-QUALITY CHARACTERISTICS THE BLACK RIVER AND ON GROU WATER LEVELS NEAR DUNN, NOR CAROLINA,
Geological Survey, Raleigh, NC. Water Resour Div.
For primary bibliographic entry see Field 2A.
W85-01924

OUND-WATER HYDROLOGY AND QUAL-
Y BEFORE AND AFTER STRIP MINING OF
SMALL WATERSHED IN JEFFERSON
UNTY, OHIO,
ological Survey, Columbus, OH. Water Re-
rces Div.
r primary bibliographic entry see Field 4C.
5-01943

DROGEOLOGY AND WATER QUALITY
SIX LANDFILL SITES IN HILLSBOR-
GH COUNTY, FLORIDA,
ological Survey, Tallahassee, FL. Water Re-
rces Div.
W. Stewart, A. D. Duerr, and M. Fernandez, Jr.
ailable from the OFSS, USGS, Box 25425, Fed.
. Denver, CO 80225. USGS Water-Resources
estigations Report 83-4810, 1983. 112 p, 52 Fig,
Tab, 55 Ref.

scriptors: *Solid-waste disposal, *Landfills,
roundwater movement, *Groundwater pollu-
n, *Karst hydrology, *Florida, Hillsborough
unty.

hydrogeologic study of six landfills in Hillsbor-
gh County, Florida, showed that refuse was
posited in trenches constructed in the upper part
the surficial aquifer. Use of the trench method
ulted in increased decomposition of refuse in
ter and accelerated degradation of water in the
ficial aquifer because as much as 50 percent of
refuse was deposited in the saturated zone. Use
oxidation ponds to store water pumped from
nches that contained refuse, and refuse and
ris that collected in perimeter ditches, affected
quality of water in the surficial aquifer. The
nch method of landfilling has restricted use in
lsborough County and other areas of Florida
ere high water levels occur. The potential for
gradation of water in the surficial and Floridan
ifers may increase after a landfill is closed be-
se maintenance generally is discontinued. Con-
ued monitoring of surface- and ground-water
s would help to assess the long-term movement
leachate from a landfill and its effect on water
ality. (USGS)
5-01946

PLICATION OF REMOTE-SENSING TECH-
QUES TO HYDROLOGIC STUDIES IN SE-
CTED COAL-MINED AREAS OF SOUTH-
STERN KANSAS,
ological Survey, Lawrence, KS. Water Re-
rces Div.
F. Kenny, and J. R. McCauley.
ailable from OFSS, USGS, Box 25425, Fed.
r. Denver, CO 80225. USGS Water-Resources
estigations Report 83-4007, 1983. 33 p, 10 Fig, 3
b, 19 Ref.

scriptors: *Acid mine drainage, *Subsidence,
rosion, Mine wastes, *Remote sensing, *Recla-
tion, *Revegetation, Aerial photography,
ater quality, Coal mines, Cherry Creek,
ansas.

sturbances resulting from intensive coal mining
the Cherry Creek basin of southeastern Kansas
re investigated using color and color-infrared
ial photography in conjunction with water-
ality data from simultaneously acquired samples.
agery was used to identify the type and extent
vegetative cover on strip-mined lands and the
ent and success of reclamation practices. Drain-
e patterns, point sources of acid mine drainage,
d recharge areas for underground mines were
cated for onsite inspection. Comparison of these
erpretations with water-quality data illustrated
ferences between the eastern and western parts
the Cherry Creek basin. Contamination in the
stern part is due largely to circulation of water
om unreclaimed strip mines and collapse features
rough the network of underground mines and
bsequent discharge of acidic drainage through
eps. Contamination in the western part is primar-
caused by runoff and seepage from strip-mined
nds in which surfaces have frequently been
aded and limed but are generally devoid of
ature stands of soil-anchoring vegetation. The
ccessful use of aerial photography in the study of Cherry Creek basin indicates the potential of using remote-sensing techniques in studies of other coal-mined regions. (USGS)
W85-01947

INTEGRATED METHODOLOGY FOR IN-STREAM FLOW STRATEGIES,
Duke Univ., Durham, NC. Dept. of Civil and Environmental Engineering.
M. A. Medina, Jr.
Water Resources Research Institute Completion Report, North Carolina State Univ., Raleigh, September, 1983. 142 p, 91 Fig, 19 Tab, 79 Ref.

Descriptors: Flow control, Stream fisheries, Streamflow, *Pollution load, Water quality, *Instream flow, Model studies, *Computer models, Simulation, *Computer programs, *North Carolina, Salem Creek, Path of pollutants, Water pollution sources, *Microcomputer programs.

An integrated methodology for instream flow strategies is presented, based on hierarchical package of computer models ranging from simple microcomputer programs to more complex mainframe simulation. The microcomputer programs are statistically based, and assume that both flows and pollutant concentrations are lognormally distributed for upstream sources, non-point sources and point sources. An extensive statistical analysis of nationwide data collected under the National Urban Runoff Program (NURP), as well as at the study site for the selected time series (Salem Creek, Winston-Salem, N.C.--November 1980 to August 1981), supports this assumption. The level of analysis progresses to an intermediate level: steady-state, continuous deterministic simulation. This level allows the representation of cause/effect (pollutant/water quality), coupled reactions.
W85-01951

FATE OF EPSILON-CAPROLACTAM IN THE AQUATIC ENVIRONMENT,
Syracuse Research Corp., NY.
L. Fortmann, and A. Rosenberg.
Chemosphere, Vol. 13, No. 1, p 53-65, 1984. 8 Fig, 2 Tab, 19 Ref.

Descriptors: *Fate of pollutants, *Degradation, *Caprolactam, Organic compounds, Temperature effects, *Nutrients, *Microorganisms, Industrial wastes, Solvents.

The rate and extent of caprolactam degradation in aquatic systems are dependent on the nutrient availability, indigenous microbial population and activity, chemical concentration, and water temperature. The labeled chemical evolved C-14 labeled CO2 indicating ring cleavage with between 35 and 80% of the radioactivity evolved as C-14 carbon dioxide after 21 days in yeast extract-supplemented waters. The percent of caprolactam degraded was indirectly related to the concentration in the water, suggesting microbial inhibition at high caprolactam concentrations. The addition of yeast extract or sediment to water significantly enhanced the rate and extent of caprolactam degradation. Most likely yeast extract acted by increasing the numbers of microorganisms capable of degrading the chemical. The influence of sediment may have been due to the possibility that in the sediment there is a much greater inoculum of caprolactam degrading microorganisms than in the lake or stream water. The sediment also provides a steady source of extra nutrients which are readily used up in the initial days of incubation. An increase in incubation temperature enhanced caprolactam biotransformation. Maximum degradation of caprolactam should be expected in warm, nutrient rich waters where microbial growth and metabolic activity can be maximized and caprolactam concentration is not toxic, thus enabling the microbial population to utilize the chemical as a carbon and/or nitrogen source. Primary degradation appears to be more easily mediated by microorganisms than mineralization, suggesting the buildup of potentially aromatically-intact metabolites of caprolactam. (Baker-IVI)
W85-01956

BIODEGRADABILITY TESTING OF POORLY WATER SOLUBLE COMPOUNDS,
Henkel K.G.a.A., Duesseldorf (Germany, F.R.). Dept. of Ecology.
P. Gerike.
Chemosphere, Vol. 13, No. 1, p 169-190, 1984. 5 Tab, 23 Ref. Umweltbundesamt grant 10602010.

Descriptors: *Organic compounds, *Biodegradation, Industrial wastes, Solubility, Chemical reactions, Fate of pollutants.

The biodegradability testing of poorly water soluble compounds is methodologically much less developed than it is for soluble substances. A few prerequisites for the biodegradability evaluation of poorly water soluble compounds such as the selection of suitable biological and analytical parameters, dispersion techniques, introduction of the test compound into the culture medium, and the choice of suitable inoculum were elucidated. Furthermore, various published and established tests were scrutinized for their suitability for the purpose under discussion. It is suggested that a modified Blok method holds presently the most promise as a screening test for the biodegradability testing of poorly water soluble organic compounds. Also examined were the UK-MITI Test, the closed bottle test, the Sturm test, and the Muller-Tittizer test. (Baker-IVI)
W85-01957

PREDICTION OF ECOTOXICOLOGICAL BEHAVIOUR OF CHEMICALS: RELATIONSHIP BETWEEN N-OCTANOL/WATER PARTITION COEFFICIENT AND BIOACCUMULATION OF ORGANIC CHEMICALS BY ALGA CHLORELLA,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Okologische Chemie.
H. Geyer, G. Politzki, and D. Freitag.
Chemosphere, Vol. 13, No. 2, p 269-284, 1984. 4 Fig, 1 Tab, 34 Ref.

Descriptors: *Fate of pollutants, *Organic compounds, *Bioaccumulation, *Algae, Chemical properties, Lipophilicity, Lipids.

The bioaccumulation potential of the green alga Chlorella fusca for organic chemicals was determined. Chemicals of different structures and physico-chemical properties were investigated to determine if there exists a relationship between the bioaccumulation factors of these compounds and their physicochemical properties. A quantitative relation was found between the lipophilicity (n-octanol/water partition coefficient) of the chemicals and the bioaccumulation factor. (Baker-IVI)
W85-01959

CONTRIBUTION OF LEACHING OF DIAZINON, PARATHION, TETRACHORVINPHOS AND TRIAZOPHOS FROM GLASSHOUSE SOILS TO THEIR CONCENTRATIONS IN WATER COURSES,
Institute for Pesticide Research, Wageningin (Netherlands).
M. Leistra, L. G. M. Th. Tuinstra, A. M. M. van der Burg, and S. J. H. Crum.
Chemosphere, Vol. 13, No. 3, p 403-413, 1984. 1 Fig, 3 Tab, 25 Ref.

Descriptors: *Pesticides, *Leaching, *Water pollution sources, Diazinon, Parathion, Tetrachlorvinphos, Triazophos, Organophosphates, Pesticide residues.

Data on the adsorption and transformation rates of diazinon, parathion, tetrachlorvinphos and triazophos in soils were collected from a survey of the literature. As little information is available on their mobility, the adsorption of tetrachlorvinphos and triazophos on three soils was measured in a slurry experiment. Properties of diazinon were introduced into a computer model simulating glasshouse soil systems in a simplified way. The leaching of diazinon from the root zone was calculated to be zero. The properties of the other three organophosphates indicate that in similar computations

leaching from the root zone would have been even lower. Samples from tile drains and water courses in areas with many glasshouses were analyzed by gas-liquid chromatography. The concentration of the four organophosphate insecticides in almost all the samples of water from the tile drains was below the detectable limit. However, in samples from the water courses, pesticide residues were found regularly, sometimes at fairly high concentrations. Thus contamination of water courses would seem to be produced not by leaching of pesticides through the soil but by other pathways. (Baker-IVI)
W85-01961

DISTRIBUTION OF NITRATES IN THE POTABLE WATERS OF SRI LANKA,
Sri Lanka Univ., Peradeniya. Dept. of Geology.
C. B. Dissanayake, S. V. R. Weerasooriya, and A. Senaratne.
Aqua, No. 1, p 43-50, 1984. 8 Fig, 2 Tab, 20 Ref.

Descriptors: *Nitrates, *Sri Lanka, *Potable water, Water analysis, Monitoring Water pollution sources, Fertilizers, Public health, Wastewater pollution.

An island wide survey of the nitrate levels in the potable waters of Sri Lanka has been carried out. In general the nitrate levels in the drinking water supplies are below the danger limits specified by the World Health Organization. However, there appears to be an increasing tendency for nitrates to accumulate in the groundwater in regions of high population density. The wet zone of Sri Lanka has higher nitrate levels possibly due to the shallow water table into which nitrates percolate easily from the surface. In the dry zone of Sri Lanka, even though the use of agricultural fertilizer is higher, due to the deeper water table observed nitrate levels are low. Infant mortality rates though not caused solely by the high nitrate levels, are also highest in the highlands of the wet zone. The Jaffna peninsula represents a very special case and this region contains the highest nitrate levels observed in Sri Lanka. The large usage of nitrogeneous fertilizer such as urea, discharge of human excreta into the shallow water table and the presence of highly fractured limestones as an aquifer are the chief reasons for the observed abundance. In other parts of Sri Lanka, densely populated areas contain higher nitrate contents and the island-wide distribution is influenced by climatic factors and fertilizer use as well. (Baker-IVI)
W85-02015

PESTICIDES IN GROUNDWATER BENEATH THE CENTRAL SAND PLAIN OF WISCONSIN,
Wisconsin Univ.-Madison. Water Resources Center.
J. M. Harkin, F. A. Jones, F. Fathulla, E. K. Dzantor, and E. J. O'Neil.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-212372. Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. WIS WRC 84-01, 1984. 46 p, 9 Fig, 5 Tab, 24 Ref. Project No. OWRT A-094-WIS(1), Contract/Grant No. 14-34-0001-2153.

Descriptors: *Agricultural chemicals, Groundwater, Groundwater movement, *Groundwater pollution, *Pesticides, Soil properties, *Wisconsin, Central Sand Plain, Path of pollutants, Water pollution sources.

Groundwater samples were collected periodically from monitoring wells and multilevel samplers installed in nine 160-acre fields in the Central Sand Plain of Wisconsin. Potatoes were grown under irrigation in sandy soils over high water tables in each of these fields. All samples were tested for content of residues of aldicarb, a water-soluble systemic insecticide incorporated into soil once a year either with potatoes at planting at a rate of 3 lb/A or at shoot emergence at a rate of 2 lb/A. Regardless of application rate, timing or frequency (single or repeated applications in consecutive or alternate years) residues were found at some but not all locations tested within every field. Zones of contamination occurred only close to the water table and principally at locations where the soil and groundwater pH and alkalinity were low. As contaminated water sank with time to lower depths in the aquifer (10 to 12 feet below the water table), the concentrations of aldicarb residues fell dramatically or disappeared altogether, apparently as a result of alkali-catalyzed hydrolysis and bacterial metabolism superimposed upon physical dilution and dispersion. Samples of groundwater and aquifer sediments collected aseptically contained surprisingly high numbers of a large diversity of facultative anaerobic bacteria. These organisms can totally degrade aldicarb sulfoxide and aldicarb sulfone, the major metabolites of aldicarb which occur in groundwater, at a rate which suggests a half-life of about 1.3 years for aldicarb residues in Wisconsin groundwater.
W85-02025

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE CORRAL CREEK AREA, HANGING WOMAN CREEK COAL FIELD, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
N. E. McClymonds.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4260, 1984. 53 p, 9 Fig, 7 Tab, 22 Ref.

Descriptors: Hydrology, *Coal mines, Reclamation, *Montana, *Powder River Basin, Corral Creek, Hanging Woman Creek.

The Corral Creek area of the Hanging Woman Creek coal field, 9 miles east of the Decker coal mines near the Tongue River, contains large reserves of Federal coal that have been identified for potential lease sale. A hydrologic study was conducted in the area to describe existing hydrologic systems and to study assess potential impacts of surface coal mining on local water resources. Hydrogeologic data collected indicate that aquifers are coal and sandstone beds within the Tongue River Member of the Fort Union Formation (Paleocene age) and sand and gravel in valley alluvium (Pleistocene and Holocene age). Surface-water resources are limited to a few spring-fed stock ponds in the higher parts of the area and the intermittent flow of Corral Creek near the mouth. Most of the stock ponds in the area become dry by midsummer. Mining of the Anderson coal bed would remove three stock wells and would lower the potentiometric surface within the coal and sandstone aquifers. The alluvial aquifer beneath Corral Creek and South Fork would be removed. Although mining would alter the existing hydrologic systems and remove several shallow wells, alternative ground-water supplies are available that could be developed to replace those lost by mining. (USGS)
W85-02040

HYDROLOGY OF AN ABANDONED COAL-MINING AREA NEAR MCCURTAIN, HASKELL COUNTY, OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
L. J. Slack.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4202, 1983. 117 p, 12 Fig, 25 Tab, 43 Ref.

Descriptors: *Strip mines, Strip mine wastes, Mine drainage, Coal mines, Water quality, Land reclamation, *Oklahoma, Mule Creek, Hartshorne, McCurtain, Haskell County.

Bedrock in the area is shale, siltstone, sandstone, and coals of the McAlester and Hartshone Formations of Pennsylvanian age. The main avenues of water entry and movement are the exposed bedding plane openings, partings between laminae of shale, fractures and joints, and openings caused by surface mining. Water table conditions exist in bedrock and spoil in the area. Mine pond water is in direct hydraulic connection with water in the spoil piles and the underlying Hartshone Formation. For both surface water and ground water, in the McCurtain area, Sulfate is the best indic coal mine drainage. Median sulfate concent for four sites on Mule Creek range from 26 milligrams per liter. Median sulfate concent increase with increased drainage from unrec (abandoned) mined areas. Reclamation would result in decreased concentrations solved solids, calcium, magnesium, sodium, and alkalinity for Mule Creek in the vicinity reclaimed area. Water in the mine ponds i similar to the shallow ground water. Wate ponds and ground water are unlikely in th run to be changed by reclamation in the (USGS)
W85-02041

CALIBRATION AND VERIFICATION RAINFALL-RUNOFF MODEL AND RUNOFF-QUALITY MODEL FOR SEV URBAN BASINS IN THE DENVER ME POLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Wate sources Div.
For primary bibliographic entry see Field 2A.
W85-02044

SEDIMENTATION IN FLUVIAL AND LA TRINE ENVIRONMENTS,
Ottawa Univ. (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 2J.
W85-02057

GEOCHEMISTRY OF THE RHINE AND RHONE AND HUMAN IMPACT (LA GEO MIE DU RHIN ET DU RHONE ET L'IMP HUMAIN),
Centre d'Ecologie de Camargue (France).
For primary bibliographic entry see Field 2H.
W85-02059

WHOLE-LAKE LEAD BURDENS IN S MENTS OF LAKES IN SOUTHERN ONTA CANADA,
Ontario Ministry of the Environment, Rex
P. J. Dillion, and R. D. Evans.
Hydrobiologia, Vol. 91, p 121-130, July, 198 Fig, 3 Tab, 18 Ref.

Descriptors: *Lead, *Ontario, *Lake sedim Path of pollutants, Lakes, Sediments, H metals, Atmospheric deposition, Deposition, W pollution sources.

The anthropogenic stable lead content of the s ments of eight softwater Precambrian lake southern Ontario was measured at 34-92 sites lake. Whole-lake anthropogenic lead bur varied between only 610 and 770 mg/sq m. T was no relationship between lead burden either water replenishment time of the lake (or the ratio of watershed area to lake area (A d/A sub 0), which varied by factors of 4 and respectively. These results can be explained i the lead deposition in this region is uniform, an the only significant input of lead to the lakes is deposition from the atmosphere directly on lakes' surfaces. Therefore spatial differences in thropogenic lead within a lake represent the re tribution of focusing pattern of the sediments. (thor's abstract)
W85-02062

HISTORICAL CHANGES IN ANTHROPOGE IC LEAD FALLOUT IN SOUTHERN ONTA IO, CANADA,
Trent Univ., Peterborough (Ontario).
R. D. Evans, and P. J. Dillion.
Hydrobiologia, Vol. 91, p 131-137, July, 1982 Fig, 19 Ref.

Descriptors: *Ontario, *Lead, *Found Lake, *R Chalk Lake, *Bob Lake, Lake sediments, Wa pollution sources, Path of pollutants, Sedimen Meromictic lakes, Dimictic lakes.

By combining the relative change in lead fall through time, as observed in a meromictic la

he total atmospheric deposition of lead, a cal record of lead deposition for remote can be developed. Sediment cores were col- in 1978 from meromictic Found Lake and dimictic Red Chalk and Bob Lakes, in the oka-Haliburton area of Ontario. For each of sediment cores, a historical record of lead tion at the sampling station was calculated. leposition rose late in the nineteenth century ached a maximum in the most recent sedi- Total lead deposition was assumed to be the e of that measured for eight other lakes in dy area; approximately 680 mg of anthropo- ead per sq m have been deposited there. The y of this historical record was tested on nt cores from the two nearby dimictic lakes. olistic mixing model was used to predict lead s in the dimictic lakes. Predicted lead con- ion profile closely resembled observed pro- The historical record suggests that the pri- ource of anthropogenic lead in Haliburton is on-local sources. (Collier-IVI)
2063

IN WATER AND SEDIMENTS OF TWO SH LAKES,
re Univ. of Technology (Finland).
vo, and R. Oravainen.
biologia, Vol. 91, p 155-160, July, 1982. 1 Tab, 14 Ref.

otors: *Lake Vanajavesi, *Lake Mallasvesi, d, *Zinc, *Path of pollutants, Water pollu- ects, Lake sediments, Industrial wastewater, industry, Industrial plants, Water pollution , Heavy metals, Metals.

curence, distribution, and sedimentation of as studied in water and sediment samples ake Vanajavesi and Lake Mallasvesi, in the aenjoki watercourse, South Finland. Lake vesi is one of the most polluted of large lakes in Finland. The zinc load comes from industrial sources. Lake Mallasvesi, near Vanajavesi, is in an almost natural on. The zinc concentrations in water (mi- ns/L) vary between < 10 and 4,000 in vesi and < 10 in Mallasvesi. Sediment con- ons of zinc (g/kg DW) ranged from 0.2 to Vanajavesi and from 0.2 to 0.5 in Mallas- close correlation between sedimentation of l waste discharge from a textile factory was During several winters, zinc has spread aste water to different parts of Vanajavesi the main course of flow. The flow is due to vement of contaminated bottom water series of depressions in the lake bed. The nent is probably caused by great differ- n density. The maximum zinc concentra- served in Lake Vanajavesi are high enough both acute and sublethal effects on lacus- ganisms. (Collier-IVI)
065

L FOR INSTREAM REGULATION OF ISOTOPES AND HEAVY METALS IN INE WATERS SUBJECTED TO A URA- MILL DISCHARGE,
onsultants Ltd., Mississauga (Ontario).
oran.
iologia, Vol. 91, p 175-188, July, 1982. 9 ab, 10 Ref.

tors: *Saskatchewan, *Uranium mills, *In- wastewater, *Radioisotopes, *Radioactive Heavy metals, Thorium, Mathematical Nickel, Lead, Radium, Interstital water, sediments, Path of pollutants, Mine wastes.

Athabaska sandstone region of northern ewan, mining and milling of uranium- ore is subjecting, and will continue to surface waters to inputs of soluble heavy d uranium and thorium decay series radioi- A mathematical simulation model was de- to assess the role of riverine sediments in g soluble concentrations of heavy metals lioisotopes released to the environment treated mining and milling process ef- Specific elements studied included As, Ni, and Ra-226. The model considered that diffusion into sediment porewater and adsorption by sediment particulates from sediment porewater were the two dominant mechanisms regulating sediment loading. Experiments indicated that the equilibrium adsorption behavior of the heavy metals and radioisotopes studied could be adequately explained using a linear adsorption isotherm, over the range of concentrations expected in the environment. Experimentally determined linear isotherm slopes ranged from 200 ml/g to 21,000 ml/g. Diffusion into the effective depth of the sediments (20 cm) was modelled using a quadratic (second order) driving force and a corresponding mass transfer coefficient. The model coefficients were calibrated using field and laboratory data. Results of the modelling suggested that the sediments have a small effect on instream concentrations during the active phases of mining and milling. The sediments were predicted to accumulate sufficient adsorbed mass, during the operational phase of mining and milling, to act as a distributed instream source after completion of milling activities. The significance of this post-operational source was a function of the initial effluent loading, elapsed time and site specific river characteristics. (Author's abstract)
W85-02068

EXPERIMENTAL MEASUREMENT OF SEDIMENT NITRIFICATION AND DENITRIFICATION IN HAMILTON HARBOUR, CANADA,
McMaster Univ., Hamilton (Ontario).
For primary bibliographic entry see Field 2H.
W85-02070

PARTITIONING OF PHOSPHORUS BETWEEN PARTICLES AND WATER IN A RIVER OUTFLOW,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Ecology and Systematics Section.
For primary bibliographic entry see Field 2H.
W85-02075

ACCUMULATIVE PHASES FOR HEAVY METALS IN LIMNIC SEDIMENTS,
Technische Univ., Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik.
U. Forstner.
Hydrobiologia, Vol. 91, p 269-284, July, 1982. 5 Fig, 5 Tab, 87 Ref.

Descriptors: *Heavy metals, *Lake sediments, *Clays, Acid rain, Zinc, Cobalt, Nickel, Lead, Copper, Cadmium, Iron oxides, Magnesium oxides, Carbonates, Sulfides, Fate of pollutants, Lakes.

Data from mechanical concentrates of recent sediments indicate that clay minerals, clay-rich aggregates and heavy minerals are the major carriers of heavy metals in detrital sediment fractions. Hydrous Fe/Mn oxides and carbonates and sulfides, in their specific environments, are the predominant accumulative phases for heavy metals in autochthonous fractions. Sequential chemical extraction techniques permit the estimation of characteristic heavy metal bonding forms: exchangeable metal cations, easily reducible, moderately reducible, organic and residual metal fractions, whereby both diagenetic processes and the potential availability of toxic compounds can be studied. The data from lakes affected by acid precipitation indicate that zinc, cobalt and nickel are mainly released from the easily reducible sediment fractions and cadmium from organic phases. In contrast at pH 4.4, neither lead nor copper seem to be remobilized to any significant extent. Immobilization by carbonate precipitation seems to provide an effective mechanism for the reduction of dissolved inputs of metals such as zinc and cadmium in pH-buffered, hard water systems. (Author's abstract)
W85-02077

HYDROCARBON ACCUMULATION IN FRESHWATER SEDIMENTS OF AN URBAN CATCHMENT,
Middlesex Polytechnic, London (England). Urban Stormwater Pollution Research Group.
A. Gavens, D. M. Revitt, and J. B. Ellis.
Hydrobiologia, Vol. 91, p 285-292, July, 1982. 6 Fig, 2 Tab, 16 Ref.

Descriptors: *London, *England, *Hydrocarbons, *Sediments, Aliphatic hydrocarbons, Phytane, Pristane, Urban watersheds, Path of pollutants.

The top and bottom of two sediment cores collected from an urban receiving basin in NW London, and stormwater samples from the attendant catchment, have been analyzed for their hydrocarbon content. In surface sediments, basal sediments and stormwater, total aliphatic hydrocarbon levels are 445-690 micro g/g dry wt., 43-224 micro g/g and 0.36-1.10 mg/L, respectively; and total levels of polyaromatic hydrocarbons (PAHs) are 780-1,100 micro g/g, 310-640 micro g/g and 5.83-18.21 mg/L, respectively. Biodegradation of aliphatics is assessed by phytane:n-C18 and pristane:n-C17 ratios. Hydrocarbon sources are determined from phytane:pristane ratios, odd:even carbon chain length ratios, the presence of an unresolved complex mixture, and by comparison of the amount of methyl-substituted PAHs with that of the parent compounds. Comparison of total levels between surface and basal sediments shows a 1 to 3 fold increase in total PAHs and a 3 to 10 fold increase in aliphatic hydrocarbons over a 120 year period. (Author's abstract)
W85-02078

DYNAMICS AND MECHANISMS OF ARSENITE OXIDATION BY FRESHWATER LAKE SEDIMENTS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
P. M. Huang, D. W. Oscarson, W. K. Liaw, and U. T. Hammer.
Hydrobiologia, Vol. 91, p 315-322, July, 1982. 2 Fig, 5 Tab, 30 Ref. Natural Sciences and Engineering Research Council of Canada grants A3248, G0042, and G0515.

Descriptors: *Arsenic, *Lake sediments, *Oxidation, Adsorption, Arsenite, Lakes, Arsenate, Magnesium, Carbonates, Silicates, Saskatchewan, Sediments, Fate of pollutants.

There has been increasing concern over As in freshwater environments from sources such as arsenical pesticides, smelters, coal-fired power plants, and erosion caused by intensive land use. Arsenic in the reduced state, As (III) (arsenite) is much more toxic, more soluble and mobile, than when in the oxidized state, As (V) (arsenate). This paper summarizes the dynamics and mechanisms involved in the oxidation of As (III) to As (V) by freshwater lake sediments. Sediments from selected freshwater lakes in southern Saskatchewan oxidize As (III) to As (V) predominantly through an abiotic process. Solution analysis of As (III) and As (V) by colorimetry, and examination of the oxidation state of surface-sorbed As species by X-ray photoelectron spectroscopy, indicate that Mn present in the sediment is the primary electron acceptor in the oxidation of As (III). The transformation of As (III) to As (V) by carbonate and silicate minerals, common in sediments, is not evident. The heat of activation, delta H sub a, for the depletion (oxidation plus sorption) of As (III) by the sediments, varies from 3.3 to 8.5 kcal/mole, indicating that the process is predominantly diffusion-controlled. The Mn present in a series of particle size fractions (<2 - >20 um) of the sediments may potentially detoxify As (III) in aquatic systems, by converting it to As (V). (Author's abstract)
W85-02080

DISTRIBUTION AND CONCENTRATIONS OF NATURALLY-OCCURRING RADIONUCLIDES IN SEDIMENTS IN A URANIUM MINING AREA OF NORTHERN SASKATCHEWAN, CANADA,
Monenco Consultants Ltd., Calgary (Alberta).
P. A. Neame, J. R. Dean, and B. G. Zytaruk.
Hydrobiologia, Vol. 91, p 355-361, July, 1982. 3 Fig, 4 Tab, 18 Tab.

Descriptors: *Saskatchewan, *Radionuclides, *Sediments, *Uranium mining, Thorium, Radium, Polonium, Lead, Adsorption, Industrial wastes, Mine wastes, Path of pollutants.

Uranium mining and milling operations can contribute to environmental degradation through the increased release of naturally-occurring radionuclides. However, studies of the interactions of these radionuclides with freshwater sediments have been limited. The present study examined the vertical distribution of uranium, thorium, radium-226, polonium-210 and lead-210 in undisturbed sediment cores collected in the vicinity of mining, milling and exploration activities. Uranium levels in surface sediments ranged from 1.9 to 5650 micro g/g, Ra-226 from < 0.1 to 480 pCi/g and Pb-210 from 0.8 to 931 pCi/g in the samples reported here, with the highest values occurring downstream of waste rock disposal areas. Concentrations usually decreased with depth, and there was little evidence of any strong effect of bioturbation on radionuclide profiles at the scale examined here. Mathematical models of uranium and radium-226 adsorption on and movement into the sediment were constructed, based on expected adsorption coefficients and estimated loading. The model predictions of radionuclide distribution with depth were qualitatively similar to those actually measured, but the predicted concentrations were generally lower than those observed, both in unaffected areas and in areas adjacent to uranium extraction activities. (Author's abstract)
W85-02083

INFLUENCE OF WITHIN-STREAM DISTURBANCE ON DISSOLVED NUTRIENT LEVELS DURING SPATES,
Freshwater Biological Association, Wareham (England). River Lab.
For primary bibliographic entry see Field 2E.
W85-02089

DISSOLVED AND SUSPENDED MERCURY SPECIES IN THE WABIGOON RIVER (ONTARIO, CANADA): SEASONAL AND REGIONAL VARIATIONS,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
T. A. Jackson, J. W. Parks, P. D. Jones, R. N. Woychuk, and J. A. Sutton.
Hydrobiologia, Vol. 92, p 473-487, July, 1982. 13 Fig, 2 Tab, 29 Ref.

Descriptors: *Speciation, *Mercury, *Fate of pollutants, *Wabigoon River, *Ontario, Seasonal variation, Regional variation, Heavy metals, Organic compounds, Particulates, Sediment erosion.

Seasonal and regional variations in the speciation, sediment-water partitioning, and dynamics of mercury were studied at selected sites along the Hg-polluted Wabigoon River, and at unpolluted headwater and tributary sites, during April-September, 1979. CH3Hg(+) and inorganic Hg in Wabigoon River Water are predominantly particulate during the spring flood. In summer, particulate forms decline sharply while dissolved forms increase. In spring, transfer of Hg species from bottom sediments to water is due chiefly to physical erosion and resuspension of sediments by current action. Particulate Hg species are not readily solubilized, and are probably not readily available to organisms. Thus, the particulate Hg species mobilized in the spring are probably less bioavailable than the dissolved forms mobilized in the summer. Hg bound to wood-chip deposits blanketing the riverbed near the source of pollution appears to be less readily desorbed and methylated, and therefore less bioavailable than Hg bound to the silt clay mud. In the mid-summer, the dissolved Ch3Hg(+) level was a function of total dissolved Hg concentration. Hg species in particulates are associated with sulfide, iron and manganese oxides, organic and selenium. Any program for pollution control short of total removal of Hg from bottom sediments, would have to include immobilization, removal, or detoxification of the dissolved as well as the suspended forms of Ch3Hg(+) and inorganic Hg in the Wabigoon River water upstream from the lakes through which the contaminated water flows. (Baker-IVI)
W85-02091

MECHANISMS FOR RELEASE OF SEDIMENT-BOUND PHOSPHATE TO WATER AND THE EFFECTS OF AGRICULTURAL LAND MANAGEMENT ON FLUVIAL TRANSPORT OF PARTICULATE AND DISSOLVED PHOSPHATE,
Ohio State Univ., Columbus. Dept. of Agronomy.
T. J. Logan.
Hydrobiologia, Vol. 92, p 519-530, July, 1982. 6 Fig, 50 Ref.

Descriptors: *Phosphates, *Lake sediments, *Particulates, Dissolved solids, Fate of pollutants, Water pollution sources, Water pollution control, Adsorption, Desorption.

The bulk of the phosphate load to lakes is from land drainage, and includes varying proportions of sediment-bound P and dissolved P. P sources which may enter a lake through land drainage include native soil phosphate, fertilizer P, and livestock and municipal wastes. Sediment-bound phosphate includes organic and inorganic forms, but the inorganic fraction contains most of the P that can be released into water. The non-apatite inorganic P (NAIP) fraction of sediment-bound phosphate varies considerably with geochemistry and anthropogenic additions. A small fraction of the NAIP is sufficiently labile to desorb into water, and this release can be described by dissolution or adsorption/desorption mechanisms. Agricultural practices, such as phosphate fertility management and conservation tillage, which affect the levels of phosphate and sediment leaving the land, will determine the partition of sediment-bound P and dissolved P in water draining into lakes. The response of algae to dissolved P must be different than to particulate P sources, which may settle out of the photic zone before thay can be completely utilized. Phosphorus control strategies for deep lakes, with little sediment resuspension or lake overturn, must emphasize dissolved P sources more than for shallower lakes, where sediments are continuously resuspended and lake overturn can bring P released from bottom sediments to the surface. (Moore-IVI)
W85-02095

SUMMER PEAK OF NUTRIENT CONCENTRATIONS IN LAKE WATER,
Japan Bottom Sediment Management Association, Tokyo.
T. Yoshida.
Hydrobiologia, Vol. 92, p 571-578, July, 1982. 15 Fig, 2 Tab, 1 Ref.

Descriptors: *Nutrients, *Lake sediments, *Lake Suwa, *Lake Koyamaike, *Japan, Seasonal variation, Water pollution sources, Water pollution control, Mathematical studies, Simulation, Lakes.

Lake water nutrient concentrations are strongly influenced by both inflowing nutrients and nutrients released from lake sediments. The problem of how the summer peak may be generated is considered, using actual data from two lakes in Japan. Lake Suwa is situated in the mountain district near the Nippon Alps. Three cities are located around it, and the district has a number of manufacturing industries and a large tourist industry. Lake Koyamaike is situated in the western district facing the Nippon Sea, which has the lowest population density in Japan. Although no factories and no big cities are located around it, the lake is polluted. A mathematical simulation indicates that the summer peak may be generated largely from nutrient material released from sediment. Using this approach, release rates have been calculated for the two lakes. Sediment removal seems to be an effective and immediate way to release the summer peak. (Moore-IVI)
W85-02098

URBAN RUNOFF AS A SOURCE OF POLYCYCLIC AROMATIC HYDROCARBONS TO COASTAL WATERS,
E. J. Hoffman, G. L. Mills, J. S. Latimer, and J. G. Quinn.
Environmental Science and Technology, Vol. 18, No. 8, p 580-587, August, 1984. 2 Fig, 6 Tab, 31 Ref. NOAA grant NA80RAD00047.

Descriptors: *Urban runoff, *Polycyclic aromatic hydrocarbons, *Water pollution sources, *Narragansett Bay, Coastal waters, Land use, Aromatic compounds, Hydrocarbons, Particulates, Rainfall, Storm runoff, Highways, Industrial areas, Residential areas.

Urban runoff samples collected from four st drains, each serving a different land use, w analyzed for selected polycyclic aromatic hy carbons (PAHs) by gas chromatography. PAH concentrations varied widely during the tory of each storm and appeared to be most c centrated in first or second flushes. Higher mol lar weight PAHs were mostly found associa with the particulates and were enriched on different particle sizes, a small particle fraction a larger particle fraction, perhaps from diffe sources. The annual input of PAHs to the up Narragansett Bay watershed was calculated using storm loads with local rainfall and land data. The loads of PAHs (mass/(drainage are year) in urban runoff were higher at the highl and industrial land uses in comparison to the c mercial and residential areas. Urban runoff PA are similar in composition to that found in atm pheric fallout but unlike the PAHs in munic effluents. Comparison of urban runoff PAH inp to other sources entering Narragansett showed that urban runoff accounted for 71% the total inputs for higher molecular weight PA and 36% of the total PAHs. (Author's abstr
W85-02108

SOLUBILITY OF ORGANIC MIXTURES WATER,
Syracuse Research Corp., NY. Life and Envir mental Sciences Div.
S. Banerjee.
Environmental Science and Technology, Vol. No. 8, August, 1984. 9 Tab, 22 Ref. EPA gr R808613.

Descriptors: *Organic compounds, *Solubil *Toxicity, Chlorobenzenes, Phase, Hydrophilic UNIFAC equation, Mixtures.

Environmental contaminants are frequently countered as mixtures, and the behavior of a c pound in a mixture may not correspond to predicted from pure component data. The solu ties of several chlorobenzenes and other mixtu in water were determined. The results varied w the phase of the solute mixture and the hydropl city of the components and were interpre through activity coefficients calculated by UNIFAC equation. Mixtures of structurally re ed hydrophobic liquids were near ideal in organic phase; in the aqueous phase the activ coefficient of a component was unaffected by presence of cosolutes. Increasing hydrophilicity the solutes led to deviations from ideality in organic phase, but these could be largely accou ed for by the UNIFAC equation. For mixtures solids which did not interact, the compone tended to behave independently of one anoth and their solubilities were approximately additi The behavior of mixtures of liquids and solids w intermediate between that of liquid mixtures that of mixtures of solids. These conclusions are particular relevance to toxicity studies in that t can be used to estimate limiting toxicities of m tures. In the absence of biological interaction, toxicity of a saturated solution derived from mixture of liquids will be less than that of a cor sponding saturated solution obtained from its m toxic component. The opposite argument appl for solids since their solubilities are roughly ad tive. (Moore-IVI)
W85-02109

CHARACTERISTICS OF LEACHATES FRO HAZARDOUS WASTE LANDFILLS,
Multidisciplinary Energy and Environmental S tems and Applications, San Pedro, CA.
M. Ghassemi, S. Quinlivan, and J. Bachmaier.
Journal of Environmental Science and Heal Vol. A19, No. 5, p 579-620, 1984. 12 Tab, 9 R EPA contract 68-02-3174.

Descriptors: *Leachates, *Landfills, *Hazardo materials, Data base, Organic compounds, In

compounds, Land disposal, Liners, Water
ion sources.

ardous waste landfill leachate data base cov-
some thirty leachates from eleven disposal
as been developed. The sites cover a range
es, liner designs, waste types and leachate
tion systems and the leachate data cover a
of organic and inorganic constituents. For
ses included, the inorganic constituents ap-
g in highest concentrations in the leachate
on, calcium, magnesium, cadmium, and ar-
and the organic constituents appearing in
t concentrations are acetic acid, methylene
de, butyric acid, 1,1-dichloroethane, and
rofluoromethane. The constituent concen-
s in the leachate from hazardous waste land-
ll within the reported ranges for municipal
l leachate. Based on preliminary data, only
correlations could be made between leachate
and waste input. (Author's abstract)
2118

OBIAL DEGRADATION OF 2,4,6-TRICH-
ANILINE IN AQUATIC SAMPLES AND
RATORY ENRICHMENT CULTURES,
Medical Bioengineering Research and De-
ent Lab., Fort Detrick, MD.
Mitchell, S. H. Hoke, and A. B.
rance.
l of Environmental Science and Health,
19, No. 6, p 679-696, 1984. 2 Fig, 2 Tab, 28

ptors: *Trichloroaniline, *Microbial degra-
*Canal Creek, *Maryland, Fate of pollut-
nilines, Stream sediments, Microorganisms,
ation.

Creek is a small stream at the Aberdeen
g ground, MD, the sediments of which were
d to be contaminated with 2,4,6-trichloroan-
(2,4,6-TCA). Water samples containing
sediments were collected from Canal
near the mouth of its outflow to the Gun-
r River, and from four other sites near Fred-
MD, for purposes of comparison. Microor-
s present in water samples obtained from
Creek degraded 2,4,6-TCA following a pro-
acclimation period. Creek water sediments,
the co-substrate aniline, reduced the lag
ior to degradation. The microorganisms in
mples could be enriched to grow on 2,4,6-
s indicated by increases in carbon dioxide,
e, and adenosine triphosphate and by slight
increases accompanying the degradation
compound. Uptake of 2,4,6-TCA by the
ent population was as rapid as that of the
sample population but was without an
t lag. Similar enrichment cultures could
developed from five other sites. The
acclimation period prior to 2,4,6-TCA
ation in the original creek water samples
ndicate that the microorganisms present had
en exposed to the compound in sufficient
y to bring about their adaption and enrich-
a natural population. (Moore-IVI)
:120

OBSERVATIONS ON THE CHEMICAL
OSITION OF PRECIPITATION IN AN
TRIAL AREA AND IT'S USE IN AIR
TY ASSESSMENT,
Atomic Research Centre, Bombay (India).
nitoring Section.
Mahadevan, V. Meenakshy, and A. P. Sathe.
n, Vol. 35, No. 1, p 87-90, 1984. 4 Fig, 1
Ref.

ptors: *Precipitation scavenging, *Pollutant
cation, *Air pollution, *Chemical composi-
ndia, *Chemistry of precipitation, *Fallout,
rain, Monitoring, Sulfur compounds, Sto-
Process, Sampling network.

ation samples collected from seven sites
in a major industrial region in Bombay
the 1980 monsoon period were analyzed for
, Cl, NO3, NH4, and F ion concentrations.
one site which showed predominately acid
amples from other sites were found to be
alkaline in nature. Data obtained suggest a predominant SO4 excess at two of the sites where the prime source is SO2. Higher levels of fluoride and nitrate were found at four of the sites indicating a local source. SO4 and NH4 excesses are estimated with reference to their stoichiometric ratios. Fluoride deposition due to precipitation washout around the fertilizer industry is assessed and the overall results of the study discussed. (Author's abstract)
W85-02129

EFFECT OF SUBSTRATE CONCENTRATION AND ORGANIC AND INORGANIC COMPOUNDS ON THE OCCURRENCE AND RATE OF MINERALIZATION AND COMETABOLISM,
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
Y.-S. Wang, R. V. Subba-Rao, and M. Alexander.
Applied and Environmental Microbiology, Vol. 27, No. 6, p 1195-1200, June, 1984. 3 Fig, 3 Tab, 22 Ref.

Descriptors: *Mineralization, *Cometabolism, *Fate of pollutants, Metabolism, Organic compounds, Inorganic compounds, Natural waters, Carbamates, Chlorinated hydrocarbons.

Isopropyl N-phenylcarbamate (IPC) at 400 pg and 1 micro g/ml was mineralized in samples of sewage, but only the lower concentration was mineralized in lake water samples in a 50-day period. IPC at 1 micro g/ml disappeared from lake water, but it was converted to organic products. Mineralization of IPC at 400 pg/ml in lake water was enhanced by additions of inorganic nutrients or a mixture of nonchlorinated water pollutants but not by yeast extract of mixtures containing aromatic compounds or excretions of primary producers. The mineralization of 200 pg of 2,4-dichlorophenoxyacetate per ml of lake water was not affected by additions of low levels of yeast extract or compounds excreted by primary producers but was enhanced by low concentrations of mixtures of water pollutants. It is suggested that some chemicals that are found to be converted only to organic products, presumably by cometabolism, in tests using the concentrations commonly employed in laboratory evaluations may be mineralized at the lower concentrations prevailing in natural waters. (Author's abstract)
W85-02132

EFFECTS OF URBANIZATION ON FREQUENCIES OF OVERFLOWS AND POLLUTANT LOADINGS FROM STORM SEWER OVERFLOWS: A DERIVED DISTRIBUTION APPROACH,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
G. V. Loganathan, and J. W. Delleur.
Water Resources Research, Vol. 20, No. 7, p 857-865, July, 1984. 7 Fig, 4 Tab, 23 Ref, 1 Append.
OWRT project OWRT-A-057 IND.

Descriptors: *Urban runoff, *Storm wastewater, *Water pollution sources, Storm sewer overflows, Storm runoff, River flow, Analytical models, Distribution, Urbanization, Biochemical oxygen demand.

On the basis of exponential density functions for volume of runoff, interevent time, and duration of runoff event and beta density for the rescaled pollutant (biochemical oxygen demand) concentration, and gamma density for river flow volumes during a critical period, new distributions are derived for overflow volumes and for quality of pollutant in the river after mixing with the untreated overflows of the overtaxed system. This is accomplished by means of hydrological relationships between different variables. The current data on runoff volume, duration of runoff events, etc., are transformed to account for future urbanization activities. The newly formed variables are used in the derivation of probability distributions for overflows and receiving body pollutant concentration after urbanization. The analytical model is compared with the simulation model 'STORM.' (Author's abstract)
W85-02152

FLUX-AVERAGED AND VOLUME-AVERAGED CONCENTRATIONS IN CONTINUUM APPROACHES TO SOLUTE TRANSPORT,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
For primary bibliographic entry see Field 2F.
W85-02153

CONTAMINANT TRANSPORT IN FRACTURED POROUS MEDIA: ANALYTICAL SOLUTION FOR A TWO-MEMBER DECAY CHAIN IN A SINGLE FRACTURE,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
E. A. Sudicky, and E. O. Frind.
Water Resources Research, Vol. 20, No. 7, p 1021-1029, July, 1984. 4 Fig, 14 Ref.

Descriptors: *Path of pollutants, *Geologic fractures, *Radioactive decay, *Porous media, *Chain decay, Advection, Diffusion, Adsorption, Radioisotopes, Radioactive half-life.

An analytical solution is presented for the problem of radionuclide chain decay during transport through a discrete fracture situated in a porous rock matrix. The solution takes into account advection along the fracture, molecular diffusion from the fracture to the porous matrix, adsorption on the fracture face, adsorption in the rock matrix, and radioactive decay. The solution for the daughter product is in the form of a double integal which is evaluated by Gauss-Legendre quadrature. Results show that the daughter product tends to advance ahead of the parent nuclide even when the half-life of the parent is larger. This is attributed to the effect of chain decay in the matrix, which tends to reduce the diffusive loss of the daughter along the fracture. The examples also demonstrate the neglecting the parent nuclide and modeling its daughter as a single species can result in significant overestimation of arrival times at some point along the fracture. Although the analytical solution is restricted to a two-member chain for practical reasons, it represents a more realistic description of nuclide transport along a fracture than available single-species models. The solution may be of use for application to other contaminants undergoing different types of first-order transformation reactions. (Author's abstract)
W85-02170

EFFECT OF CLEAR-CUT SILVICULTURE ON DISSOLVED ION EXPORT AND WATER YIELD IN THE PIEDMONT,
Georgia Univ., Athens. School of Forest Resources.
J. D. Hewlett, H. E. Post, and R. Doss.
Water Resources Research, Vol. 20, No. 7. p 1030-1038, July, 1984. 5 Fig, 5 Tab, 31 Ref.

Descriptors: *Clear-cutting, *Solute transport, *Water yield, *Piedmont, *Georgia, Water quality, Water pollution sources, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sodium.

A paired watershed experiment on Putnam County, Georgia, was carried out from 1973 to 1980 to determine the effects of a typical southern clear-cut operation on water quality, timing, and yield. This report shows that increases in monthly exports of dissolved N, P, K, Ca, Mg, Na, TKN, and total electrolytes were short-lived and less than 0.5 kg/ha/month and may therefore be considered minor for practical purposes. Stream water concentrations were mostly diluted by clear-cutting, but a monthly water yield increase of 1 to 2 cm flushed an extra 0.15 kg/ha/month of nitrate-nitrogen from the basin during a 2-year period following harvest. Twenty surrounding forested basins (7 to 165 ha in area) were sampled monthly for 1 year, showing that the experimental pair was representative of the general levels of dissolved ions in forested Piedmont streams. Results suggest that clear-cut silviculture in this region will neither reduce soil fertility by flushing ions into streams nor eutrophy stream water. (Author's abstract)
W85-02171

5C. Effects Of Pollution

ORGANIC WASTEWATER EFFECTS ON BENTHIC INVERTEBRATES IN THE MANAWATU RIVER,
Massey Univ., Palmerston North (New Zealand). Dept. of Biotechnology.
D. M. Suckling.
New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 263-270, 1982. 4 Fig, 1 Tab, 13 Ref.

Descriptors: *New Zealand, *Manawatu River, *Water pollution effects, *Benthos, *Invertebrates, Aquatic insects, Midges, Mayflies, Species diversity, Species composition, Agricultural runoff, Organic loading.

The effects of the 3 main wastewater discharges on the benthic fauna of the Manawatu River (New Zealand) were studied between March 1979 and January 1980. At least 4 replicate Surber samples were taken from each of 6 sites, on 5 occasions during this period. Deleatidium sp. (Ephemeroptera), Hydora sp. (Coleoptera), and the Chironomidae were the most useful indicator organisms, according to a ranking system based on the occurrence of significant differences ($P < 0.05$) between populations at different sites. These taxa exhibited significant differences between sites in about 70% of all inter-site comparisons, using Mann-Whitney U-tests. The Coefficient of Similarity was successful at summarizing the comparisons between the clean-water and down-stream sites, ranging between 95% similarity to the clean-water site for a recovery site in winter, and less than 10% similarity to the clean water site for the lower reaches in summer. It is suggested that relative indices may be more appropriate than absolute indices for measuring water pollution. Water quality, indicated by species diversity, was generally good (allowing for the effects of agricultural runoff), although midsummer organic loading induced marked changes in benthic species composition, including the disappearance of Deleatidium sp, from several sites. (Author's abstract)
W85-01632

IMPACT OF AN OIL FIELD EFFLUENT ON MICROBIAL ACTIVITIES IN A WYOMING RIVER,
National Fishery Research Lab., La Crosse, WI.
M. A. Heitkamp, and B. T. Johnson.
Canadian Journal of Microbiology, Vol. 30, No. 6, p 786-792, June, 1984. 2 Fig, 4 Tab, 19 Ref.

Descriptors: *Wyoming, *Little Popo Agie River, *Ecological effects, *Oil wastes *Oil fields, *Microbial studies, Hydrocarbons, Wastewater pollution, Species composition, Sediments, Water pollution effects.

The survival, functions, and physiological diversity of autochthonous sediment microbiota were examined in situ at five stations along the Little Popo Agie River, WY; one station above, one at, and three below a discharge point for oil wastewater from Union Oil Company's Dallas Field. Below the oil wastewater discharge point there were increases in electron-transport activity, carbon dioxide production, and microbial populations of heterotrophs, ammonifiers, hexadecane degraders, starch hydrolyzers, protein hydrolyzers, and sulfate reducers. At a station 1420 m below the discharge point, however, overall sediment microbial activities and all of the physiological groups of bacteria, except hexadecane-degrading microbiota, were at levels comparable with those at the control station above the discharge point. Similarly, mineralization of glucose, amino acids, hexanoic acid, and hexadecane was elevated at stations directly below the discharge point, but appeared to subside rapidly. Xenobiotic biodegradation potential of the sediments varied with the chemical and the sample location and was not directly related to oil residue levels in the sediment. Microorganisms thus appeared to maintain physiological diversity and increased in numbers and activity in a riverine environment that contained petroleum hydrocarbon concentrations known to be deleterious to freshwater fish and macrobenthic communities. (Author's abstract)
W85-01640

ACID PRECIPITATION AND SCIENTIFIC UNCERTAINTY PROBLEMS IN PROBABILITY,
Vermont Law School, South Royalton. Environmental Law Center.
F. C. Reed.
International Journal of Environmental Studies, Vol. 18, No. 2, p 77-84, 1982. 2 Fig, 60 Ref.

Descriptors: *Acid rain, *Ecosystems, *Environmental effects, Fuels, Public opinion, Education, Power plants, Industrial wastes.

Acid precipitation, for the purposes of this study, refers to man made acid precipitation resulting from fossil fuel combustion by power plants, automobiles, smelters and refineries. Through a series of logical steps and questions, various generally accepted facts about acid precipitation are presented. The burning of fossil fuel has produced acid rain at levels sufficient to allow rainfall to reach a very low pH in many global areas. This low pH rainfall contributes to changes in man-made areas and natural areas. The extent to which these changes are attributable to man-made acid rain is not easily separated from other man-made or natural inducers of change. The best attack on curing the problem is to treat the source, fossil fuel burning. Remedies such as lake liming, acid resistant fish breeding programs, genetic engineering programs to give species adapted to acid conditions, are at best only stop-gap measures. (Baker-IVI)
W85-01665

ECONOMICS OF ACID RAIN: AN INVISIBLE HAND OF CONTROL,
Vermont Law School, South Royalton. Environmental Law Center.
A. H. Gilbert.
International Journal of Environmental Studies, Vol. 18, No. 2, p 85-90, 1982. 1 Fig, 18 Ref.

Descriptors: *Acid rain, *Economic analysis, *Electric powerplants, *Electric power costs, Costs, Economic aspects, Air pollution, Electric power production.

Economics currently plays an insignificant role in the control of acid rain. Economists have fallen into the old familiar pattern of evaluating the impacts of acid rain instead of developing economic techniques for controlling the source of its emission. Power generating plants and other major producers of acid rain discharge their oxide wastes into the air in order to reduce production costs. This cost saving enables the producer to increase profits and expand production at the expense of those who suffer from acid rain. The solution to this misallocation requires the internalization of all production costs. The price of the product will then reflect its true cost. Acid rain will be eliminated and resources will be more efficiently allocated. Economists will not have to attempt to evaluate the impossible nor trace its untraceable origin. Acid rain will no longer threaten our survival. (Author's abstract)
W85-01666

POLLUTION EFFECTS MONITORING WITH FORAMINIFERA AS INDICES IN THE THANA CREEK, BOMBAY AREA,
National Inst. of Oceanography, Panaji (India).
M. G. A. P. Setty.
International Journal of Environmental Studies, Vol. 18, No. 3/4, p 205-209, 1982. 1 Fig, 1 Tab, 5 Ref.

Descriptors: *Thana Creek, *Bombay, *India, *Foraminifera, *Bioindicators, *Water pollution effects, Protozoa, Benthic fauna, Benthos, Aquatic life.

Thana Creek, which flows through Bombay, India, into the Arabian Sea, has a very low fresh water inflow. The creek's temperature, salinity, depth, and tidal range are drastically affected by heavy discharges of effluents from factories located on either side of the creek. Benthonic foramini sediments from the most upstream samplir tions are very small, embryonic and dul appear to be highly corroded having a ver (5-10 taxa in 1 gram dry weight sediment) di tion. The species diversity and the total for feral number is high at the lower stations, pared to the upper stations, and include bo bryonic and adult forms. Ostracoda are rare most upstream station and are common down stream stations. In the study area, the tion effect on the foraminiferids is intense, highly reliable and measurable. The relative tivity of tolerance of the biota is sharply va and dependent upon the nature of the poll discharged. The degree of pollution of this ronment can be monitored through delineat zones of effects of pollution. (Collier-IVI)
W85-01671

INFLUENCE OF PHYSICO-CHEMICAL TORS ON THE COLIFORM BACTERIA CLOSED-LAKE WATER SYSTEM,
Jawaharlal Nehru Univ., New Delhi (India crobiological Lab.
For primary bibliographic entry see Field 2H
W85-01672

GEOCHEMISTRY OF WELL WATER CARDIOVASCULAR DISEASES IN LANKA,
Sri Lanka Univ., Peradeniya. Dept. of Geo
C. B. Dissanayake, A. Senaratne, and S. V. R. Weerasooriya.
International Journal of Environmental St Vol. 19, No. 3/4, p 195-203, 1982. 9 Fig, 1 T Ref.

Descriptors: *Sri Lanka, *Cardiovascular dis *Geochemistry, *Well water, Hardness, Epi ology, Public health, Hypertensive diseases, elements.

Clear correlations between water hardness heart diseases have been observed in many tries. A survey carried out on the inciden cardiovascular diseases in Sri Lanka in relati the hardness of drinking water reveals that a c lation exists which is geographically related. is a broad correlation indicating a low inciden cardiovascular diseases when the water har reaches appreciable values. A clear-cut associ cannot be expected, since other factors also a to be involved. A case in point are the high h tensive diseases and death rates in the North tral Province, even though the water hardn high enough to prevent such a high incidence. broad correlation cannot be considered as a c relationship and other factors possibly exist could also play a major role in the inciden cardiovascular diseases, e.g. type and quanti trace elements in the water. (Collier-IVI)
W85-01674

DISTRIBUTION AND PERIODICITY TOTAL, FAECAL COLIFORM BACTERIA AN AQUATIC ECOSYSTEM,
Jawaharlal Nehru Univ., New Delhi (India). crobiological Lab.
For primary bibliographic entry see Field 5B.
W85-01675

MODELING ALGAL BEHAVIOUR IN RIVER THAMES,
Institute of Hydrology, Wallingford (England)
For primary bibliographic entry see Field
W85-01720

GROWTH OF CLADOPHORA GLOMER IN A RIVER RECEIVING SEWAGE EFF ENT,
Southern Water Authority, Chatham (Engla Kent Div.
J. R. Wharfe, K. S. Taylor, and H. A. C. Montgomery.
Water Research, Vol. 18, No. 8, p 971-979, 198 Fig, 3 Tab, 12 Ref.

criptors: *River Great Stour, *England, *Cla-
nora, *Phosphorus, Effluents, Water pollution
ts, Limiting nutrients, Aquatic plants,
tewater treatment, Phosphorus removal.

River Great Stour is one of the principal
s in Kent, England and provides a valuable
ry and amenity asset. There was a deteriora-
of the flora in the 1950s, with dense growths
Cladophora and the disappearance of some
ed macrophytes. A considerable improvement
e natural flora of the River Great Stour has
rred since the mid-1960s when a new sewage
ment works was commissioned at Ashford. A
tation mapping program undertaken from
to 1982 to assess the influence of the sewage
ment works discharge on the growth of the
entous alga. Observation on the growth of
ophora in the river suggest that dissolved
phorus concentration are not normally limit-
especially as vigorous growths occurred on
occasions at location upstream from the
ge treatment works discharge. Previous rec-
endations to reduce dissolved phosphorus
ntrations in the final effluent of the Ashford
y need not be implemented. The amenities of
iver will be better preserved by maintaining
resent practices in weed cutting and by con-
g to provide a high standard of conventional
nent at Ashford sewage treatment works.
re-IVI)
01723

**ICITY OF CHLORINE TO A COMMON
CULAR AQUATIC PLANT,**
nal Park Service, Washington, DC. Ecologi-
rvices Lab.
Watkins, and R. S. Hammerschlag.
r Research, Vol. 18, No. 8, p 1037-1043, 1984.
3 Tab, 19 Ref.

riptors: *Myriophyllum, *Chlorine, *Phyto-
y, Aquatic plants, Chlorophyll a, Effluents,
ination, Water pollution effects.

phyllum spicatum was exposed to various
ne concentrations on a continuous and inter-
t basis in 96-h toxicity studies utilizing a
rtional diluter. Continuous exposure to chlo-
oncentrations as low as 0.05 mg/l total resid-
lorine (TRC) depressed shoot and total plant
veights approx. 30% relative to controls.
length was depressed approx. 16% at this
ntration. Chlorophyll a was depressed 25%
mg/l TRC. However, intermittent exposure
nts to chlorine for three 2-h periods daily for
indicated an insensitivity to repeated short
chlorine exposure at all concentrations but 1.0
TRC. These results indicate that high level
ne discharges from waste water facilities and
c generating plants could be a contributing
impacting nearby submerged aquatic vegeta-
Author's abstract)
01731

**URRENCE OF THE ASIATIC CLAM COR-
LA FLUMINEA IN THE MAUMEE
R AND WESTERN LAKE ERIE,**
o Edison Co., OH.
tt-Wasilk, G. G. Downing, and J. S.
w.
l of Great Lakes Research, Vol. 9, No. 1, p
983. 2 Fig, 2 Tab, 23 Ref.

iptors: *Corbicula, *Maumee River, *Lake
*Thermal pollution, Clams, Powerplants,
l water, Effluents, Ecological distribution,
ling.

certain conditions the Asiatic clam may
significant biofouling threat to powerplants
colonization and subsequent blocking of
ater systems. Surveys of the occurrence of
m were conducted in the thermal plumes of
electric generating facilities in western Lake
The Asiatic clam was found in only two
ns along the southern shore of the western
f Lake Erie: the thermal plume areas of the
oal-fired power plants with once-through
ser cooling systems. Three sewage treat-
plant outfalls were sampled, but Corbicula were found only in the sewage treatment plant outfall that was within the thermal plume of a power plant. No Corbicula were found in the vicinity of the nuclear power plant which had a closed-cycle natural draft cooling tower, and hence no significant thermal plume. The oldest specimens are at least 3 yr old, indicating that the clam probably has been established in in the region since 1978. The Great Lakes are farther north than the natural range of this clam, and prolonged cold temperatures in this region may be responsible for the confinement of this clam to baseload power plants with continuous thermal plumes. Those industries or municipalities which have a continuous discharge of water which is always above 4.5 C may find it useful to determine if the clam is present in their plume areas. (Moore-IVI)
W85-01753

ACCUMULATION OF THE TRACE ELEMENTS LEAD AND ZINC BY ASELLUS COMMUNIS AT THREE DIFFERENT PH LEVELS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5B.
W85-01795

RESPONSE OF ALGAL POPULATIONS TO CHANGES IN STREAM WATER QUALITY,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Biological Sciences.
F. B. Trama.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202464, Price codes: A02 in paper copy, A01 in microfiche. Center for Coastal and Environmental Studies Completion Report, February 1984. 15 p, 5 Fig, 7 Tab, 11 Ref. Project No. OWRT A-061-NJ(1), Contract/Grant No. 14-34-0001-1132.

Descriptors: *Bioassay, *Selenastrum, Eutrophication, Streams, Stream pollution, *Algal assay, Dialysis cells, Semipermeable membranes, *Biomonitoring, *Chlorophyta.

A custom-made dialysis cell and a commercially available clear plastic chamber (Biomonitor) with a semipermeable membrane were tested as potentially more useful and reliable than the closed flasks employed in the widely adopted EPA Algal Assay: Bottle Test procedure. The dialysis cell failed to attain equilibrium with an external medium within a 60 hour period. The Biomonitor attained equilibrium within 60 hours but not with respect to soluble inorganic phosphorus. The growth response of natural plankton or a green alga, Selanastrum capricornutum, in Biomonitors under laboratory and in situ conditions showed that the Biomonitor produced results which were more variable and erratic than those obtained using a modified Algal Assay: Bottle Test procedure. Use of chlorophyll a to estimate algal biomass increased the variance by an order of magnitude in comparison to estimates from cell counts and mean cell volumes. Biomonitors proved to be more costly to use, less reliable, and subject to greater variation than the closed flask procedure. No significant improvement was found by employing semipermeable test chambers under laboratory or field conditions when compared to results from the modified EPA Algal Assay: Bottle Test procedure.
W85-01797

ANALYSIS OF POLLUTANT ENHANCED BACTERIAL BLUE-GREEN ALGAL INTERRELATIONSHIPS POTENTIATING SURFACE WATER CONTAMINATION BY NOXIOUS BLUE-GREEN ALGAL BLOOMS,
Nevada Univ., Reno. Dept. of Biology.
G. W. Bedell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202498, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center Completion Report, February 1984. 10 p, 1 Tab, 8 Ref. Project No. OWRT A-102-NEV(1), Contract/Grant No. 14-34-0001-2130.

Descriptors: *Algae, Bacteria, *Sulfur bacteria, *Eutrophication, Reservoirs, Alkaline water, Cyanophyta, Anabaena, Desulfovibro.

Sulfate-reducing bacteria from the genus Desulfovibro can stimulate the blue-green alga (Cyanobacterium) Anabaena variabilis (Strain 6411) into increasing its dry weight biomass production by more than 200 percent over that of the control as the total phosphate in the medium approaches zero. Methods which utilize total nitrogen to phosphorus ratios in waters as predictors of blue-green algal 'blooms' may be unreliable when the waters are very low in phosphorus yet remain high in sulfate with conditions favorable for sulfate-reducing bacterial growth in benthic sediments. In high sulfate containing waters that are alkaline and that are low in both nitrogen and phosphate, blue-green algal blooms will prevail unless some steps are taken to control the growth of the bacteria. Otherwise, if the phosphate levels alone in the aqueous systems are reduced below threshold levels under these conditions, the magnitude of the blue-green algal blooms may be increased substantially. These data should be considered by those who will be making policy at the federal, state, or local levels, regarding the total removal of phosphorus from wastewaters or from certain aqueous systems. The data may be important for considering the effects of acid rain as well.
W85-01803

INFLUENCE OF ACID PRECIPITATION ON STREAM INVERTEBRATES,
Michigan State Univ., East Lansing. Dept. of Zoology.
T. M. Burton, and J. W. Allan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190073, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research Completion Report, September, 1983. 25 p, 4 Fig, 4 Tab, 19 Ref. Project No. OWRT A-120-MICH(1), Contract/Grant No. 14-34-0001-2124.

Descriptors: *Invertebrates, Caddisflies, Isopods, Snails, Stoneflies, Acid streams, *Aluminum, *Toxicity, Asella, Lepidostoma, Pycnopsyche, Physa, Nemoura, *Acid rain, Water pollution effects, *Hydrogen ion concentration.

Five species of invertebrates, Asellus intermedius an isopod, Lepidostoma liba and Pycnopsyche sp., two species of caddisflies, Physa heterostropha, a snail, and a Nemoura sp., a stonefly, were tested for 30 days in 5 separate experiments for susceptibility to acidification to pH 4.0 and pH 5.0 alone or in combination with 250 to 500 micrograms Al/l. The effects of organic matter on the susceptibility of these invertebrates to acidification and aluminum toxicity were also tested. Acidification alone of natural stream water to pH 4.0 resulted in significant mortality for all 5 species. The addition of 500 micrograms Al/l significantly increased this mortality. Experiments with distilled water with inorganic chemistry adjusted to simulate natural stream water demonstrated that the absence of organic matter strongly resulted in much greater aluminum toxicity at low pH's and in somewhat greater susceptibility to acidification alone. The addition of citrate as an organic ligand decreased this effect. Experiments conducted at pH 5.0 with 250 micrograms Al/l added to natural stream water demonstrated that no significant mortality occurred. Thus, acidification effects for these 5 species for 30-day exposure periods only occurred at pH levels less than pH 5 and at aluminum levels greater than 250 micrograms Al/l. The threshold for effects, thus, was between pH 5 and pH 4 and between 250 and 500 micrograms Al/l.
W85-01807

EFFECTS OF THE HERBICIDE ATRAZINE ON AN OYSTER-FOOD ORGANISM,
Maryland Univ., College Park. Dept. of Botany.
E. P. Karlander, J. M. Mayasich, and D. E. Terlizzi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190172, Price codes: A03 in paper copy, A01 in microfiche. Maryland Water Resources Research Center Publication No. 73, August 1983. 20 p, 3 Tab, 35 Ref. Project No. OWRT A-060-MD(1), Contract/Grant No. 14-34-0001-2122.

Descriptors: *Triazine pesticides, *Temperature, *Light intensity, *Herbicides, *Atrazine, Oysters, Algae, *Growth rates, Phytoplankton, Algal growth, Chesapeake Bay, *Maryland, Agricultural runoff, *Nannochloris oculata, Fish food organisms, Toxicity.

Growth rates of semicontinuous cultures of Nannochloris oculata (Chesapeake Bay clone) were determined in repeated experiments each featuring 27 treatment combinations of temperature, light, and the herbicide atrazine. All interactions two-way and three-way, were significant. This indicated the main effects did not act independently to produce the response for a given treatment. Further analysis of the interactions showed that they were largely linear in nature. Atrazine's toxicity was maximized when temperature and light conditions were optimal for rapid growth. The percent inhibition for atrazine at 100 ppb ranged from 46.2% at low temperature (15 C) and low light (0.208 mW/cm) to 54% at high temperature (25 C) and high light (1.352 mW/cm). The dependency of atrazine's toxicity on temperature and light stresses the need for incorporating these and other important environmental variables into future laboratory and field studies which investigate the effects of herbicide runoff on non-target organisms in the Chesapeake Bay.
W85-01808

EFFECTS OF RUNOFF FROM UNDEVELOPED VERSUS LIGHTLY DEVELOPED WATERSHEDS ON TROPICAL PLANKTONIC ECOSYSTEM,
Caribbean Research Inst., St. Thomas, VI.
T. W. Purcell, III, and M. J. Canoy.
Technical Report No. 17, September 1983. 56 p, 2 Append. Project No. OWRT A-013-VI(1), Contract/Grant No. 14-34-0001-1150.

Descriptors: Runoff, Tropical waters, Plankton, *Marine water quality, Mangroves, *Virgin Islands, St. Thomas, Watershed development, Ecological impact, Water pollution control, Great Cruz Bay.

Two watersheds on the island of St. Thomas were studied to determine the effects of development on the quality of runoff water into the bays and to assess the effects of this runoff on the bay waters and plankton communities. The plankton communities studies were phytoplankton, zooplankton, and Ichthyoplankton. It was found that PO4 and NO3 were key nutrients, and turbidity a limiting physical effect. These, where they reached the bays, had a notable but not direct effect on the plankton production and dynamics. A key element in controlling the effect was whether or not the normal salt pond mangrove system was left intact.
W85-01810

LIMNOLOGY IN RESERVOIRS ON THE COLORADO RIVER,
Nevada Univ., Las Vegas. Lake Mead Limnological Research Center.
For primary bibliographic entry see Field 2H.
W85-01812

POTENTIAL FOR ACIDIFICATION OF SIX REMOTE PONDS IN THE WHITE MOUNTAINS OF NEW HAMPHIRE,
Northeastern Forest Experiment Station, Durham, NH.
For primary bibliographic entry see Field 5B.
W85-01834

EFFECTS OF AMMONIUM EFFLUENTS ON PLANKTONIC PRIMARY PRODUCTION AND DECOMPOSITION IN A COASTAL BRACKISH WATER ENVIRONMENT. I. INTERRELATIONS BETWEEN ABIOTIC AND BIOTIC COMPONENTS OF THE PLANKTONIC ECOSYSTEM,
Helsinki Water District (Finland).
T. Tamminen.
Netherlands Journal of Research, Vol. 15, No. 3/4, p 349-361, December, 1982. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Water pollution effects, *Ammonium, *Estuaries, *Finland, *Baltic Sea, Ecosystems, Plankton, Chlorophyll, Primary productivity, Brackish water, Heterotrophic activity.

The study area was located at the southern coast of Finland, the Baltic Sea. Interactions between abiotic and biotic components of the planktonic ecosystem in the ammonium-loaded archipelago area were studied. Gradients of chlorophyll a, primary productivity and heterotrophic activity evolved around the discharge site. Multivariate analyses described typical stages in the succession of the planktonic community. A pronounced heterotrophic phase was observed, which referred especially to the innermost research area. Since acute stimulations of heterotrophic activity were observed only exceptionally in effluent tests, planktonic and benthic primary production and sediment metabolism were considered as mediators of effluent effects on heterotrophy. (Baker-IVI)
W85-01840

ANNUAL CYCLE OF KEPONE RESIDUE AND LIPID CONTENT OF THE ESTUARINE CLAM, RANGIA CUNEATA,
Virginia State Water Control Board, Richmond. Div. of Ecological Studies.
C. A. Lunsford, and C. R. Blem.
Estuaries, Vol. 5, No. 2, p 121-130, June, 1982. 5 Fig, 4 Tab, 17 Ref.

Descriptors: *Kepone, *Lipids, *Clams, *Rappahannock River, *James River, *Virginia, Water pollution effects, Pesticides, Salinity, Hydrogen ion concentration, Water temperature.

Factors affecting Kepone uptake and lipid content of the clam, Rangia cuneata, were tested over a 12 month study. Clams obtained from the Rappahannock and James Rivers were held in submersible live boxes at two sites in the James River estuary and were sampled monthly from September 1978 through August 1979. Clams held in the freshwater zone near the source of Kepone contamination (Hopewell, Virginia) generally had higher Kepone and lipid content than those held downstream in the oligohaline zone. Significant differences in Kepone content between test sites and months are largely, but not entirely, a function of ambient water temperature, dissolved oxygen, amount of lipid in the clam, turbidity, Kepone content of the water column and duration of exposure. Lipid content of clams varied significantly between test sites, river of origin and months and is significantly related to salinity, ambient water temperature, pH and duration of exposure. Kepone content was more closely correlated with total lipid stores of clams than any other real variable. This association may be due to lipid reserves acting as a storage site for Kepone, but may also be interpreted as the result of selection against clams lacking lipid stores that might act as reservoirs for Kepone thus protecting more delicate tissues. (Author's abstract)
W85-01844

RESPONSES OF DEVELOPING ESTUARINE MACROBENTHIC COMMMUNITIES TO DRILLING MUDS,
Environmental Research Lab., Gulf Breeze, FL.
M. E. Tagatz, J. M. Ivey, C. E. DalBo, and J. L. Oglesby.
Estuaries, Vol. 5, No. 2, p 131-137, June, 1982. 2 Fig, 3 Tab, 18 Ref.

Descriptors: *Benthic animals, *Estuarine environment, *Drilling muds, Water pollution effects, Zooplankton, Tunicates, Mollusks, Annelids, Growth.

The effects of drilling mud, used in oil drilling operations, on development of estuarine macrobenthic communities from settling planktonic larvae were assessed by comparing numbers and species of animals that grew in uncontaminated and contaminated aquaria for 8 weeks. Aquaria contained sand and were continuously supplied unfiltered seawater. Seven lignosulfonate-type drilling muds obtained from an active exploratory platform in estuarine waters were tested consecutively at nominal concentrations of 0.5, 5, and 50 parts per million (ppm) in the water colum
bers of tunicates, mollusks, and annelids per
um were significantly (alpha = 0.05) de
from control numbers in 50 ppm. Structura
ences in communities exposed to 50 pp
those in the control and lower concentratio
indicated by a decrease in Spearman's mea
rank correlation of species abundance and
crease in the Shannon-Weaver index of
diversity. A total of 13 species occurred in
compared to 23 species in each of the othe
tions. Growth in diameter of Molgula manh
was significantly affected in all concentrat
mud. (Author's abstract)
W85-01845

**ACUTE TOXICITY OF KEPONE TO SE
ED FRESHWATER FISHES,**
Virginia Inst. of Marine Science, Gloucester
M. H. Roberts, Jr., and R. E. Bendl.
Estuaries, Vol. 5, No. 3, p 158-164, Sept
1982. 1 Fig, 5 Tab, 14 Ref.

Descriptors: *Kepone, *Pesticide toxicity,
*James River, *Virginia, Toxicity, Eel,
Immature growth stages, Catfish, Bluegill,
cumulation.

The maximum concentration of a con
which can occur dissolved in water withou
ing long-term effects for various species, cal
maximum acceptable toxicant concen
(MATC), can be estimated for the 96-h LC5
application factor is known for at least one s
The acute toxicity of Kepone in freshwat
determined with three fish species occurring
James River; Ictalurus punctatus (channel c
Lepomis macrochirus (bluegills), and Anguil
trata (American eel). Elvers of A. rostrata
most sensitive with a 96 h lethal concentrati
50% of the animals tested (LC50) of 35 m
per l. Bluegills were slightly less sensitive wi
h LC50 of 50 micro g per l. Catfish were
tolerant with a 96 h LC50 of 514 micro g
Bluegills and catfish exposed to comparabl
centrations of Kepone accumulated equ
amounts in 96 h. Using an application fac
0.004, the calculated MATC's for elvers, bu
and channel catfish are estimated to be 0.14
and 2.0 micro g per liter or above, respec
These values are all well above the 5 ng
observed in water samples for the James
near Skiff's Creek. (Moore-IVI)
W85-01846

**DEVELOPMENT OF THE CONDITION
THE BALDEGGERSEE (1900 TO 1980)
THE EFFECT OF INTRALAKE PROCED
(DIE ZUSTANDSENTWICKLUNG DIS
DEGGERSEES (1900 BIS 1980) UND DIE
WIRKUNG VON SEEINTERNEN MASS
MEN),**
P. Stadelmann.
Wasser, Energie, Luft, Vol. 76, No. 5/6, p
1984. 15 Fig, 7 Tab, 70 Ref.

Descriptors: *Baldeggersee, *Switzerland, *E
phication, Fish, Phytoplankton, Destratific
Lake restoration, Fishkills, Supersaturation,
solved oxygen, Limnology, Aeration, Water
lation, Aerobic conditions.

The eutrophication of the Baldeggersee in Sw
land is demonstrated by changes in the fis
phytoplankton populations and by the resu
limnological studies. In 1900, the lake was
trophic and contained many fish. By 1940,
were the predominant species of fish. Sinc
1950s, episodes of fish mortality have demon
ed oxygen supersaturation in the surface lay
the lake and oxygen deprivation in the de
Oscillatoria rubescens was predominant from
to 1965 but disappeared with increasing eutr
cation. Eutrophication reached a maximum ar
1975. Phosphorus concentration in spring rea
500 mg total P/cu m, and primary production
420 g C/sq m/yr. Increased levels of ammon
sulfide, methane, and manganese were found i
hypolimnion. External measures were abl
reduce phosphorus input only by 50% and a

ate. Artificial circulation of the lake in achieve destratification and oxygen aer- summer were therefore carried out. The icial circulation was performed in Febru- and lasted 2 mo; after 2 wk, an even on of temperature and oxygen was Sulfide disappeared in deep water after circulation. The introduction of 4.5 tonnes nto deep water in summer 1983 resulted c conditions year-round throughout the e. In fall, the highest oxygen levels ever were found. Sulfide and methane could easured, and ammonium and manganese nd in lower concentrations. External pro- rought phosphorus input down to 250 the following spring. (Gish-IVI)
5

S OF THE HERBICIDE ATRAZINE NINE NUCLEOTIDE LEVELS IN ZOS- ARINA L. (EELGRASS),
Inst. of Marine Science, Gloucester Point.
listraty, and C. Hershner.
Botany, Vol. 18, No. 4, p 353-369, June, ig, 4 Tab, 32 Ref. EPA grants R805953 245.

rs: *Adenine nucleotides, *Eelgrass, , *Phytotoxicity, Water pollution effects, s, Adenylates, Productivity, Plant physi- crophytes.

of adenine nucleotides (ATP, ADP, d adenylate energy charge (EC) to atra- riazine herbicide, was evaluated as an of metabolic state in Zostera marina L. , a submerged marine angiosperm. Short-) atrazine stress reduced ATP and total s (AT) at both 10 and 100 ppb, but EC constant. Net productivity decreased at ot at 10 ppb atrazine over 6 h. Long-term atrazine stress was evidenced by growth and 50% mortality near 100 ppb. EC ced at 0.1, 1.0 and 10 ppb atrazine, but d EC increased with physiological re- severe stress (100 ppb) after 21 days. y, ATP and AT decrease over the short- rebound over the long-term with severe tress, increasing beyond control levels nt death results. Supplementing adenine e and EC results with more conventional ve analyses should afford greater knowl- hysiological response to environmental Author's abstract)
8

OF ACIDIFICATION AND EUTRO- ON ON MACROPHYTE COMMUN- SOFT WATERS. II. EXPERIMENTAL
,
e Univ. Nijmegen (Netherlands). Lab. of cology.
Roelofs, J. A. A. R. Schuurkes, and A. J.
Botany, Vol. 18, No. 4, p 389-411, June, g, 10 Tab, 27 Ref.

rs: *Acidification, *Eutrophication, *Ma- , *Soft water, *Netherlands, Nutrients, lants, Phosphates, Nitrogen, Carbon di- alinity, Ammonium.

Netherlands, there has been a dramatic ring the last 30 years in the number of onging to the phytosociological alliance n. Generally, the communities classified s alliance occur in poorly buffered, oligo- aters, with very low phosphate, nitrogen n dioxide levels in the water layer and ly higher nutrient levels in the sediment. species dominating these communities ids such as Littorella uniflora (L.) Lobelia dortmanna L. and Isoetes lacus- hich show various adaptations to make growth possible under these conditions. ervations showed that the waters where uniflora had disappeared or strongly de- uld be divided into two groups. A major %) was characterized by the presence of d Juncus bulbosus L. and/or Sphagnum hese waters appeared to be strongly acidified (pH < 4.5) and had increased nitrogen levels with ammonium as the dominant N-source. Within this group, the waters with luxuriant growth of J. bulbosus and/or Sphagnum spp. had strongly increased carbon dioxide levels in both sediment and water. Different types of experiments proved casual relationships between the observed changes in macrophytes and the changed physico-chemical parameters. Ecophysiological experiments showed that J. bulbosus lacks the typical adaptations of the isoetid plant species, i.e. it uses very low amounts of sediment-CO2 and releases only a little oxygen from the roots. However, J. bulbosus is more able than Littorella uniflora to use CO2 from the water layer. From the nutrient-uptake experiments, the decreased nitrate and increased ammonium levels seem to be favorable to J. bulbosus. The culture experiments clearly demonstrated that the biomass of J. bulbosus only increased strongly when the sediment was poorly buffered and the pH of the water was low. When combining factors like CO2 enrichment of the sediment, with and without phosphate, and/or ammonium enrichment of the water in the culture experiments, it is clearly shown that phosphate and/or ammonium enrichment without CO2 enrichment do not lead to an increase in biomass of J. bulbosus. Therefore, it is obvious that the changes in the macrophyte community can be ascribed primarily to changes in the carbon budget as a result of acidification. A minor group of waters (23%) was characterized by the absence of submerged J. bulbosus and/or Sphagnum spp. In most of these waters, submerged plant species occurred, such as Myriophyllum alterniflorum DC or non-rooted species such as Riccia fluitans L. These waters were not acidified, and generally had an increased alkalinity and higher nitrogen and phosphate levels of sediment and/or water. Culture experiments showed that phosphate enrichment of the sediment alone leads to luxuriant growth of submerged macrophyte species such as M. alterniflorum, whereas phosphate enrichment of both sediment and water leads to mass development of non-rooted plant species such as R. fluitans. (Author's abstract)
W85-01889

TROPHIC RESPONSE OF FISHES TO HABITAT VARIABILITY IN COASTAL SEAGRASS SYSTEMS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
For primary bibliographic entry see Field 2L.
W85-01890

TERRESTRIAL RUNOFF AS A CAUSE OF OUTBREAKS OF ACANTHASTER PLANCI (ECHINODERMATA: ASTEROIDEA),
Guam Univ., Agana. Marine Lab.
C. Birkeland.
Marine Biology, Vol. 69, No. 2, p 175-185, August, 1982. 2 Fig, 4 Tab, 75 Ref.

Descriptors: *Runoff, *Acanthaster, *Marine environment, *Phytoplankton, Eutrophication, Typhoons, Drought, Guam, Micronesia, Polynesia, Nutrients, Bays, Rainfall.

Outbreaks of adult Acanthaster planci (Linnaeus) have appeared at irregular intervals, arriving 3 yrs after heavy rains (> 100 cm in 3 months) following droughts (< 25 cm in 4 months) or 3 yrs after rains exceeding intensities of 30 cm in 24 h. Outbreaks of A. planci follow typhoons that bring heavy rains, but do not follow 'dry' typhoons of equivalent wind force. Outbreaks occur around the high islands in Micronesia and Polynesia, but not around the atolls at intermediate locations. Phytoplankton blooms appear off high islands at the beginning of the rainy season in bays with large watersheds and with sufficient residence time of the waters: these are the initial sites of A. planci abundance on Guam. The spawning seasons of A. planci occur at the beginning of the rainy season on both sides of the equator. It is hypothesized that, on rare occasions, terrestrial runoff from heavy rains (following the dry season or a record drought) may provide enough nutrients to stimulate phytoplankton blooms of sufficient size to produce enough food for the larvae of A. planci. The increased survival of larvae results in an outbreak of adults 3 yrs later. This hypothesis can be tested by predicting future outbreaks. An outbreak of A. planci on Saipan in the summer of 1981 was predicted on the basis of heavy rains in August 1978. (Author's abstract)
W85-01893

HEPATIC MIXED-FUNCTION OXIDASES IN CALIFORNIA FLATFISHES ARE INCREASED IN CONTAMINATED ENVIRONMENTS AND BY OIL AND PCB INGESTION,
Lawrence Livermore National Lab., CA.
For primary bibliographic entry see Field 5A.
W85-01894

ENVIRONMENTAL AND BIOCHEMICAL INVESTIGATION OF SOME EFFECTS OF ORGANIC POLLUTION IN INNER OSLOFJORD, NORWAY,
Dunstaffnage Marine Research Lab., Oban (Scotland).
J. Blackstock, and C. Filion-Myklebust.
Marine Biology, Vol. 73, No. 2, p 155-163, 1983. 2 Fig, 5 Tab, 22 Ref.

Descriptors: *Oslofjord, *Norway, *Polychaetes, *Water pollution effects, Enzymes, Dissolved oxygen, Carbon, Nitrogen, Redox potential, Monitoring, Organic compounds, Sediments, Fjords.

Coordinated environmental monitoring and biochemical studies of the polychaete Glycera alba (Muller) have been applied to the assessment of the impact of inputs of organically rich waste material into Inner Oslofjord. Six sampling stations at intervals of 5 km on a transect extending from Lysakerfjord, 5 km from Oslo harbor, to Vollengropen, a few kilometers from the Drobak sill were used in the investigation. Samples of water, sediment and biological material were collected from these sampling stations on one occasion, in September 1980. On the basis of dissolved oxygen content of the water column near the sediment surface, carbon and nitrogen contents and redox potential (Eh) in the sediments, the greatest impact of organic enrichment was found at Lysakerfjord. Localized variations in sediment condition were, however, pronounced in the transect. Maximal activities of 4 enzymes associated with energy-yielding metabolism were estimated in 7 to 11 individual G. alba from each sampling station. Relatively low activities of the glycolytic enzyme phosphofructokinase in the group of G. alba from Lysakerfjord may constitute a biochemical response to the effects of organic enrichment in this area. In G. alba from the sampling station at Slemmestad, it is suggested that low phosphofructokinase and malate dehydrogenase activities may reflect a biochemical response to effects of predominantly inorganic waste material from a nearby cement factory. In groups of G. alba from 5 sampling stations, i.e., excluding Slemmestad, mean phosphofructokinase activity is correlated with redox potential at 4 to 5 cm depth in the sediments. The results are discussed with reference to earlier biological studies and it is shown that low phosphofructokinase activities are found in the groups of G. alba from those areas where low diversity of macrobenthic fauna have been reported. It is concluded that the changes in phosphofructokinase activity may consistently reflect effects of environment changes that are characteristically associated with inputs of waste material. (Author's abstract)
W85-01896

IMPACT OF DOMESTIC SEWAGE POLLUTION ON ENZYMATIC ACTIVITIES OF TWO PLANKTONIC COPEPODS (ACARTIA CLAUSI AND CENTROPAGES TYPICUS) (IMPACT D'UNE POLLUTION D'ORIGINE URBAINE SUR LES ACTIVITES ENZYMATIQUES DE DEUX COPEPODES PLANCTONIQUES (ACARTIA CLAUSI ET CENTROPAGES TYPICUS)),
Centre Univ. de Luminy, Marseille (France). Lab. d'Hydrobiologie Marine.
D. Riviere, and P. Kerambrun.
Marine Biology, Vol. 75, No. 23-35, p 25-35, 1983. 10 Fig, 4 Tab, 28 Ref.

Descriptors: *Copepods, *Enzymes, *Wastewater pollution, *Water pollution effects, Marseille, France, Municipal wastes, Effluents, Esterase, Aminopeptidase, Dehydrogenase.

The effect of urban pollution on the enzymatic activities of two copepod species, Acartia clausi and Centropages typicus, was studies in the Marseille area (main sewage output of Cortiou) from May 1980 through June 1981. By means of electrophoresis on polyacrylamide gel, activities of esterases, leucine aminopeptidase (LAP), malate dehydrogenase (MDH) and malic enzyme (ME) were studied. The results are based on 124 analyses of A. clausi and 127 of C. typicus. The zymograms revealed important changes in enzyme activities connected with pollution which were either qualitative or quantitative in nature; the most distinct and frequent changes were displayed by the esterases, whose general activity considerably decreased at the most polluted stations; also, the relative activity of the different esterase fractions changed, and certain fractions did not appear at all. Leucine aminopeptidase zymograms displayed little change; those of MDH and ME often exhibited an additional fraction in the polluted area. The results clearly show the impact of urban pollution at the enzymatic level. The changes appear to be a physiological response of the organisms to environmental conditions, and demonstrate the profound effects that an ecological perturbation can have on the physiology of organisms. (Author's abstract)
W85-01898

EFFECTS OF COPPER AND CADMIUM ON GROWTH, SWIMMING AND PREDATOR AVOIDANCE IN EURYTEMORA AFFINIS (COPEPODA),

Rhode Island Univ., Kingston. Graduate School of Oceanography.
B. K. Sullivan, E. Buskey, D. C. Miller, and P. J. Ritacco.

Marine Biology, Vol. 77, No. 3, p 299-306, December, 1983. 7 Fig, 3 Tab, 32 Ref.

Descriptors: *Behavior, *Copper, *Cadmium, *Copepods, *Toxicity, Swimming, Predation, Immature growth stages, Heavy metals, Computers.

In the aquatic environment, pollutants typically occur at concentrations well below levels which directly cause death of organisms. The sensitivity of swimming behavior and predator-escape responses of nauplii of the estuarine copepod Eurytemora affinis to sublethal doses of Cu and Cd was studied in laboratory experiments. Average swimming speed of the nauplii were observed using computer analysis of video recordings. The responsiveness to mechanical stimuli designed to mimic a predator was tested. The importance of the modified behaviors to the outcome of actual encounters with predators was evaluated by measuring predation rates of one vertebrate and one invertebrate predator on nauplii. Behavior was generally altered at metal doses below those affecting growth rates or survival of the copepods. Swimming velocities of Cu-dosed nauplii were different from controls at all concentrations of Cu tested (10-50 micro g/l total Cu) after 24- to 48-h exposure; the development rate of nauplii was significantly reduced only after 96 h at 25 micro g/l. The 96 h LC50 for Cu was approximately 30 micro g/l Cu. Naupliar swimming velocity was also affected by Cd. Swimming speeds were reduced after 24 h at 130 micro g/l, the development was slowed after 48 h at 116 micro g Cd/l. The 96-h LC50 was > 120 micro g/l. Nauplii exposed to Cu for 24 h were generally hyperactive, a condition which could increase their encounter frequency with predators. Reduced numbers of escape responses of nauplii to a simulated predator were observed only after 48-h exposure to Cu. Feeding rates of non-dosed larval striped bass on dosed nauplii (24 h at 25 micro g Cu/l) were significantly higher than on control nauplii. Feeding rates of larval mysid shrimp were not higher on similarly dosed nauplii; 24 h exposure of nauplii to > 30 micro g Cu/l did result in increased predation by mysids. (Moore-IVI)
W85-01900

LOGGING IMPACTS AND SOME MECHANISMS THAT DETERMINE THE SIZE OF SPRING AND SUMMER POPULATIONS OF COHO SALMON FRY (ONCORHYNCHUS KISUTCH) IN CARNATION CREEK, BRITISH COLUMBIA,

Department of Fisheries and Oceans, Nanaimo (British Columbia). Pacific Biological Station.
J. C. Scrivener, and B. C. Andersen.

Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 7, p 1097-1105, 1984. 7 Fig, 2 Tab, 33 Ref.

Descriptors: *Salmon, *Logging, *Environmental effects, *Fry, *Carnation Creek, *British Columbia, Water temperature, Freshets, Fish behavior, Debris, Growth, Fish migration.

Natural patterns in emergence times, seaward movements, instream distributions, densities, and growth of coho salmon fry (Oncorhynchus kisutch) between March and September are contrasted with patterns observed during and after logging in the Carnation Creek watershed. After streamside logging in 1976-77, fry emerged up to 6 wk earlier and moved seaward more quickly than during years before logging. These observations are attributed to higher water temperatures during the winter and to emergence during a period of more frequent freshets. Increased fry movement from the stream could result in habitat being underutilized. In sections affected by intense streamside logging, the deposition of 'fine' logging debris led to increased fry densities during the summers of 1977 and 1978. After major freshets in November 1978, which removed this fine debris and affected channel morphology in these sections, fry densities declined below those observed prior to logging. Growth rate of fry was inversely correlated with density in all stream sections. Growth rates, after correction for density, tended to be greater in all sections after the adjacent streamside was logged. Larger fry and more variable numbers of fry remained in the stream in September after logging than before logging. Their increased size is attributed to the longer growing season afforded by earlier emergence. This complex of interacting factors determines the number and size of fry in autumn and it can influence the production of smolts the following spring. (Author's abstract)
W85-01919

TOXICITY OF ORGANIC MIXTURES SATURATED IN WATER TO DAPHNIA MAGNA. EFFECT OF COMPOSITIONAL CHANGES,

Syracuse Research Corp., NY. Life and Environmental Sciences Div.
R. H. Sugatt, D. P. O'Grady, and S. Banerjee.

Chemosphere, Vol. 13, No. 1, p 11-18, 1984. 4 Tab, 10 Ref. EPA Grant R8 086 13.

Descriptors: *Toxicity, *Solutions, *Organic compounds, *Daphnia, Water pollution effects.

The toxicity of aqueous solutions saturated with mixtures of hydrophobic organic liquids is contrasted to that of solutions prepared from solids. Data for a variety of mixtures are presented and are related to the solubilities of the components. The toxicities of compounds in liquid mixtures are influenced by the composition of the mixtures, whereas those of solids are relatively independent of composition. If biological interactions are neglected, then the toxicity of a component in a saturated liquid mixture will tend to be lowered by the presence of other less toxic components, and the toxicity of a saturated solution of the mixture will equal or be less than that of the corresponding solution of its most toxic component. In contrast, the toxicity of a saturated solution derived from a mixture of solids will tend to equal or exceed that of a corresponding saturated solution of its most toxic component, and will tend to increase with the complexity of the mixture. These conclusions are broad generalities, incorporating numerous assumptions and should be used with caution. Nevertheless, they do illustrate the utility of simple physicochemical relationships in environmental hazard assessment. (Baker-IVI)
W85-01953

ANALYSIS OF AQUATIC TOXICITY WATER SOLUBILITY AND ACUTE LC5 DATA,

W. B. Neely.

Chemosphere, Vol. 13, No. 7, p 813-819, Fig, 2 Tab, 15 Ref.

Descriptors: *Organic compounds, *Sol *Fish, *Toxicity, Water pollution effects.

A theoretical relation has been established b the water solubility of an organic chemical ratio of the acute fish LC50 at two differe periods. The theory was tested by examining base of 24 chemicals. The finding of a correlation between the observed and cal ratio of the 96 hr LC50 to the 24 hr LC50 to substantiate the theory. In addition to ind a procedure for reducing LC50 values common time interval, the study has identifi groups of chemicals. If a chemical is soluble extent of 100 micrograms/L or less and poss low toxicity, then 96 hrs will not be long to accumulate a toxic dose. Examples a chlorinated biphenyls, where the earliest achieve a 50% kill has been shown to be 1 Spillage of such a chemical would be no imm concern from an acute point of view, as th will disperse much faster than the chemic accumulate in the organism, causing the concentration to never be reached. The group are the more soluble materials, which have a high probability of accumulating organism in a very short period of time. agent was sufficiently toxic then a partial kil result from a spill. Such categorization allo investigator to make some early decisions potential problems resulting from the relea chemical into an aquatic environment. (Bak
W85-01966

LONGTERM EFFECTS OF THE HERBI ATRAZINE AND DICHLOBENIL UPON PHYTOPLANKTON DENSITY AND PHY CHEMICAL CONDITIONS IN COM MENTS OF A FRESHWATER POND,

Gesellschaft fuer Strahlen- und Umweltfors m.b.H. Muenchen, Neuherberg (Germany,
J. P. Lay, A. Muller, L. Peichl, W. Klein, an Korte.

Chemosphere, Vol. 13, No. 7, p 821-832, 19 Fig, 1 Tab, 22 Ref. Commission of the Eu Communities contract ENVD-572-D (B).

Descriptors: *Herbicides, *Water pollution *Phytoplankton, Population dynamics, At Dichlobenil, Physicochemical properties.

The effects of two herbicides on the phytopl community and on physicochemical conditi the water under outdoor conditions were s Atrazine and dichlobenil were dosed in tri into the water of a compartmentalized pond. mum concentrations of the chemicals de were 200 micro g/l atrazine and 4.2 mg/l D days 3 to 5 after dosing. Residues were mor for 55 days, amounting to 60 microg Atrazi 1.5 mg DBN per liter at the end of the Oxygen and hydrogen ion concentrations significantly lower for 35 and 30 days, resp ly, in treated as compared to control wate conductivity of the dosed water was signifi higher for at least 65 (DBN) and 120 days zine) than in the untreated compartments. ences in phytoplankton abundance and di could be evaluated between controls and t biotypes. (Baker-IVI)
W85-01967

COMPARISON OF THE CARCINO RISKS FROM FISH VS. GROUNDW CONTAMINATION BY ORGANIC POUNDS,

Harvard School of Public Health, Boston Interdisciplinary Programs in Health.
M. S. Conner.

Environmental Science and Technology, V No. 8, August, 1984. 1 Fig, 1 Tab, 34 Ref grant CR-807809.

riptors: *Carcinogens, *Risks, *Fish, undwater pollution, *Organic compounds, r pollution effects, Public health, Drinking r.

r pollution can affect the general public's e of organic carcinogens through two major ways: drinking contaminated groundwater and ming fish from contaminated surface waters. 's carcinogenesis risk assessment methodology ed to compare the risks from trace organic minants in groundwater to those in freshwa- nd marine fishes. Carcinogenic risks from con- ng freshwater fish are several time greater for most marine fish. In general, freshwater estuarine fish from industrialized regions nt similar orders of magnitude of risk, about nes greater than less-developed estuaries and 0 times greater than offshore fisheries. Lipo-, biologically refractory organics are most found in fish and soluble, volatile compounds oundwater. Nationwide, known carcinogenic from fish consumption are at least as impor- as those from groundwater consumption, but vary widely with location and consumption rns. The risks reported range between a life- risk of cancer of 10 to the -4 to 10 to the -6. ore-IVI)
-02110

ECTS OF ACIDIFICATION ON THE LOGY OF STREAMS IN THE UPPER I CATCHMENT IN WEST WALES,
h Water Authority, Powys (Wales).
Stoner.
ronmental Pollution, Vol. 84, p 125-157, 1984. , 6 Tab, 55 Ref.

riptors: *Acidification, *Water pollution ef- , *Tiwi, *Wales, Sulfates, *Acid rain, Atmos- ic deposition, Aluminum, Hardness, Land use, etation, Stream pollution, Trout, Invertebrates.

r quality data for three rainwater sites and een streams were collected during the period uary 1981-January 1983. Although rainfall in upper Tywi is, on average, amongst the least c in the United Kingdom, episodic depositions idity do occur. 'Excess' sulfate concentrations reams were elevated in comparison with those infall, possibly as a result of the collection of and 'occult' deposition by vegetation, evapo- piration and the oxidation of sulfur in drained Stream acidity and aluminium concentrations , therefore, determined by the combination of m buffering capacity and vegetation within catchment. Consequently, the study streams d be classified on the basis of water hardness land use. Stream surveys and survival studies caged fish showed that unafforested streams an average hardness of >8 mg/l can support populations and a reasonably diverse inverte- fauna. Unafforested streams with mean hard- of <8 mg/l can support only sparse fish lations and limited invertebrate diversity. Af- sted streams with an average hardness of <10 l are incapable of supporting trout and the rtebrate fauna is very restricted. It is likely areas with similar soils and geology, receiving ar deposition, can be classified on this basis water quality data used to predict the fishery invertebrate status of streams and the likely cts of changed land use. (Author's abstract) -02116

BORATORY ASSESSMENT OF THE TOX- TY OF URBAN RUNOFF ON THE FAT- AD MINNOW (PIMEPHALES PROMELAS),
sachusetts Univ., Amherst. Dept. of Environ- tal Sciences.
Medeiros, R. A. Coler, and E. J. Calabrese.
rnal of Environmental Science and Health, A19, No. 7, p 847-861, 1984. 2 Fig, 3 Tab, 18 Dept. of Interior project 126-MASS.

criptors: *Urban runoff, *Fathead minnows, xicity, Growth, Hatching, Survival, Water pol- n effects, Snowmelt, Seasonal variation.

early life stage effects of urban runoff (rain snowmelt) on hatching, growth and survival of the fathead minnow (Pimephales promelas) was assessed in static and flow-through systems. The data indicate a Maximum Allowable Toxicant Concentration (MATC) and a reduction of growth to 50% of controls at 28% and 60% runoff, respectively. Hatchability and average lengths were not as sensitive indicators of stress as millimeters produced per treatment. The data indicate a maximum toxicity in the fall which coincided with the reported drop in macroinvertebrate diversity during the same period, when untreated runoff events can contribute up to 1/4 of the river flow. (Author's abstract)
W85-02124

5D. Waste Treatment Processes

COMPUTER CONTROLLED OPERATION OF AN ACTIVATED SLUDGE PLANT,
Milwaukee Metropolitan Sewerage District, WI. Treatment Services Div.
J. R. Grinker, and R. F. Meagher.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 823-829, July, 1984. 11 Fig, 4 Ref.

Descriptors: *Computers, *Automation, *Activated sludge process, Wastewater treatment facilities, Wastewater treatment, Process control, Effluents, Maintenance, Wisconsin.

Use of a computer to improve final effluent quality directly and indirectly through better control of the treatment process at the South Shore Wastewater Treatment Plant of the Milwaukee Metropolitan Sewerage District is described. The South Shore Plant is a conventional activated sludge plant consisting of bar screens, grit chambers, primary clarifiers, aeration basins, final clarifiers and chlorination facilities for disinfection. Methane gas from the digestion process is collected and used as fuel for electrical generation, process air blower engines, incineration and boilers, which provide over $1 million in energy savings per year. The value of automation was demonstrated by benefits in each of the control loops. These general advantages of computer control include reduced operator interface, more stable process control trains, reduced chemical and energy requirements, and improved final effluent quality. To make the entire concept work effectively it is essential to begin with pre-qualified field sensor selection when possible, develop simple control logic based on tested process control techniques and loops with sufficient fail-safe devices for backup, hire or train personnel with strong technical capabilities, establish a sound instrumental maintenance program, and have a commitment to stick with the fine tuning and debugging of each loop when its successful operation predicts sufficient benefits. Each treatment plant should be evaluated individually for the types of control logic and instruments that can best be applied. Once a sound control scheme is established it can continue to work well as long as reliable instruments are used and backed up with a routine schedule of calibration and preventive maintenance. (Baker-IVI)
W85-01652

EFFECT OF LOW DISSOLVED OXYGEN CONCENTRATION ON EFFLUENT TURBIDITY,
Gold Kist, Inc., Atlanta, GA.
J. E. Starkey, and P. R. Karr.
Water Pollution Control Federation Journal, Vol. 56, No. 7, p 837-843, July, 1984. 5 Fig, 3 Tab, 14 Ref.

Descriptors: *Dissolved oxygen, *Turbidity, *Effluents, *Wastewater treatment, Activated sludge process, Aeration, Atlanta, Georgia, Biochemical oxygen demand.

Turbid effluents have been observed at full-scale activated sludge plants operated with low dissolved oxygen (DO) concentrations in their aeration basins. An activated sludge plant in Atlanta, Ga. was operated with average DO concentrations of less than 1 mg/L in the aeration basins as a result of aeration equipment failure. During this period, plant effluent was turbid regardless of changes in sludge age, aeration basin contacting pattern, amount of solids recycled from sludge handling facilities, and seasonal variations. Once the aeration equipment was repaired and the DO concentration increased to more than 2 or 3 mg/L, plant effluent cleared and effluent suspended solids concentration was reduced. This condition was reproduced in the laboratory with bench-scale reactors fed synthetic wastewater. Increased effluent turbidity at low DO concentrations was the result of inhibition of exocellular polymer production and a reduction in the number of eucaryotic microorganisms. For a food to microorganism (F/M) ratio of 0.3 mg biochemical oxygen demand (BOD sub 5)/day/mg mixed liquor volatile suspended sludge (MLVSS), polymer production seemed to be responsible for approximately two-thirds and eucaryote activity for one-third of the changes in effluent turbidiy. Substantial increases in filtrate BOD sub 5 concentrations occurred when the DO concentration was lowered. This effect was greater at higher organic loading rates. The magnitude of change in suspended solids and BOD sub 5 was such that full-scale plants could be forced out of compliance with discharge permits by operating with insufficient DO concentrations. (Collier-IVI)
W85-01653

ULTRAVIOLET DISINFECTION OF SECONDARY EFFLUENT,
Trojan Technologies, Inc., London (Ontario).
G. E. Whitby, G. Palmateer, W. G. Cook, J. Maarschalkerweerd, and D. Huber.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 844-850, July, 1984. 5 Fig, 9 Tab, 27 Ref.

Descriptors: *Wastewater treatment, *Disinfection, *Ultraviolet radiation, Bacteria, Chlorination, Economic aspects, Water quality control.

The operational aspects were assessed and efficiency monitored of a full scale UV device designed specifically for disinfecting wastewater. A description of the UV unit indicates that a modular system was designed to require little maintenance and remain versatile. The system consists of a series of modules comprised of four quartz sheath-enclosed UV lamps. Two sets of 10 modules for a total of 8 lamps are located in one effluent channel, Unit A; the second channel is 40 cm wider and contains 2 sets of 15 modules for a total of 120 lamps, Unit B. The average flows over the lamps of Units A and B are 0.03 cu m/s and 0.02 cu m/s, respectively. Pumps and related maintenance are obviated because it is a gravity flow system. All of the major components are modular to prevent a major shutdown if one component requires maintenance or repair. Results show that UV disinfection of treated wastewater is a viable alternative to chlorination if the UV unit is designed specifically for this purpose. UV irradiation of wastewater can reduce the bacterial concentrations to safe levels without introducing a toxicant to fish in the receiving waters. (Baker-IVI)
W85-01654

TWO-STAGE BIOLOGICAL FLUIDIZED BED TREATMENT OF COKE PLANT WASTEWATER FOR NITROGEN CONTROL,
Canviro Consultants Ltd., Kitchener (Ontario).
S. G. Nutt, H. Melcer, and J. H. Pries.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 851-857, July, 1984. 4 Fig, 6 Tab, 26 Ref.

Descriptors: *Steel industry, *Coke plants, *Industrial wastes, *Wastewater treatment, *Nitrogen, *Fluidized bed process, Fluidized beds, Denitrification, Nitrification, Cyanide, Thiocyanates, Phenols.

To assess the technical feasibility of treating coke plant wastewaters in a two stage fluidized bed system operated in the denitrification-nitrification mode, a pilot scale investigation of the process was conducted. The pilot scale system consisted of two fluidized bed reactors in series, coupled to provide carbon oxidation, nitrification, and denitrification in the pre-denitrification operating mode. The flu-

idized bed process was capable of achieving complete nitrification and denitrification of undiluted coke plant wastewater without the addition of powdered activated carbon to the system. Total nitrogen removal efficiencies in excess of 90% were maintained in the fluidized bed process at a total system HRT of about 16 hr. The process consistently attained in excess of 90% removal of organic carbon thiocyanate, and phenolic compounds despite step changes in loading conditions and periodic reductions in the efficiency of nitrification. The removal efficiency of total cyanide in the process depended on the fraction of cyanide which was biodegradeable. Operation of the coupled process in the pre-denitrification mode reduced the theoretical oxygen demand of the wastewater by about 66% because of the removal of a substantial fraction of the degradable organic carbon under anoxic conditions in the denitrification reactor. Oxygen requirements for complete nitrification were about 1.0 g oxygen/liter wastewater treated. Flow distribution was a critical factor in achieving high biomass concentrations in the nitrification reactor. (Baker-IVI)
W85-01655

RESTORATION OF FAILING ON-SITE WASTEWATER DISPOSAL SYSTEMS USING WATER CONSERVATION,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
W. E. Sharpe, C. A. Cole, and D. D. Fritton.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 858-866, July, 1984. 5 Fig, 9 Tab, 17 Ref.

Descriptors: *Water conservation, *Wastewater disposal, *On-site disposal, Soil properties, Soil absorption capacity, Water quality control, Public opinion, Clogging, Permeability, Septic tanks.

The wastewater reduction possible with water conservation hardware was documented under conditions of actual use along with changes in wastewater quality and homeowner acceptance of the devices. Maximum level water conservation devices consisting of air assisted toilets, front loading automatic washers, low flow shower heads and faucet flow control aerators successfully reduced the severity of septic tank-soil absorption system malfunctions. Water conservation devices producing lower levels of wasteflow reduction were not successful by themselves in correcting malfunctions, but in three cases where the most inexpensive water conservation hardware was used in conjunction with an alternate soil absorption system the malfunctions were completely eliminated. Malfunctions of septic tank-soil absorption systems appeared to be closely related to peak waste loadings, precipitation events, and local drainage characteristics. Effluent levels in the malfunctioning soil absorption areas fluctuated widely in response to loading, with surface discharge occurring under peak load. Water conservation devices reduced peak effluent loads to all systems. User acceptance of the water conservation devices was very good. Hydraulic load reduction with water conservation devices seems to be a viable method of alleviating failed septic tank soil absorption systems where the cause of failure is slowly permeable soil or organic clogging of soils with otherwise acceptable porosity. (Baker-IVI)
W85-01656

PILOT PLANT DEMONSTRATION OF BIOLOGICAL PHOSPHORUS REMOVAL,
Whitman, Requardt and Associates, Baltimore, MD.
C. W. Deakyne, M. A. Patel, and D. J. Krichten.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 867-873, July, 1984. 6 Fig, 3 Tab, 3 Ref.

Descriptors: *Wastewater treatment, *Phosphorus removal, *Activated sludge process, Industrial wastes, Metals, Phosphates, Biological wastewater treatment, Pilot plants.

The A/O process is a modified form of the activated sludge process that promotes the growth of certain microorganisms which absorb large amounts of phosphate while oxidizing the polluting components of the wastewater. The modification consists of the addition of a non-aerated zone upstream of the normal aerated tank. A conventional secondary clarifier with recycle sludge pumps completes the process. The A/O process provides for removal of phosphates from the wastewater via a biological process that incorporates the phosphates within waste activated sludge. The A/O plant produced an effluent with a phosphorus concentration within the NPDES discharge permit limit while simulating the full scale annual average flow of 3.07 cu m/sec with diurnal variations and all four reactor trains in operation. The plant met the effluent BOD5 and suspended solids NPDES permit requirements under both test modes. The sludge from the pilot plant exhibited good flocculating and settling characteristics with average sludge volume index values from 59 to 75 mL/g. The phosphorus is removed from the system via waste sludge with elevated phosphorus levels of about 5% P by weight. The A/O waste activated sludge releases phosphorus if allowed to become anaerobic, and addition of ferric chloride and lime precipitates the released phosphorus in as little as 5 minutes contact time. (Baker-IVI)
W85-01657

NONSTEADY-STATE-BIOFILM PROCESS FOR ADVANCED ORGANICS REMOVAL,
Newmark (Nathan M.) Consulting Engineering Services, Urbana, IL.
B. E. Rittmann, and C. W. Brunner.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 874-880, July, 1984. 9 Fig, 3 Tab, 12 Ref.

Descriptors: *Wastewater treatment, *Biofilms, *Model studies, Organic compounds, Galactose, Nitrification, Nitrates, Ammonia.

The long term capability of a nonsteady state biofilm to allow efficient removal of a trace level substrate was demonstrated. A mathematical model that predicts the transient growth, decay, and substrate utilization of a nonsteady state biofilm was developed and evaluated while the role of nitrification and bacterial adaptation in reducing the rate of heterotrophic biofilm decay under nonsteady state conditions was investigated. The nonsteady state biofilm process was able to sustain good (>85%) removal of trace level substrate for 1 year without reactivation. Although background organic material in the feed medium contributed to reducing the biofilm loss rate, the slow loss of biofilm activity was explained primarily by organic supplementation from nitrification and bacterial adaptation to oligotrophic conditions. The transient biofilm model included growth of loss of biofilm thickness during nonsteady state operation. The model was reasonably successful at predicting biofilm growth and approach to steady state when all input parameters were determined independently. Because of the complications with nitrification, adaptation, and background organics, the model could not be satisfactorily evaluated during the loss phase. The slow decay of the nonsteady state biofilm suggests that the nonsteady state process should be able to achieve advanced organics removal for extended periods of time without requiring sophisticated operating procedures. (Baker-IVI)
W85-01658

MIXING EFFECTS IN UV DISINFECTION,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. F. Severin, M. T. Suidan, and R. S. Engelbrecht.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 881-888, July, 1984. 12 Fig, 10 Ref.

Descriptors: *Ultraviolet radiation, *Wastewater facilities, *Design criteria, *Disinfection, Wastewater treatment, Kinetics, Mixing, Destratification, Chemical reactions.

The design of UV reactors for the disinfection of wastewater effluents presents a unique set of problems: complex inactivation kinetics, rapid reactions, and complex and nonuniform UV inte profiles within the reactor. Methods are prese for quantifying mixing effects in single-lamp, a lar reactors with nonuniform UV intensity f through the use of series event inactivation k ics. An event is assumed to be the total dar incurred in a level of UV exposure. Events o in a stepwise fashion and each step is considere an integer function. The rate at which an orga passes from one event level to the next is order with respect to UV intensity and is i pendent of the event level occupied by the o nism. Batch UV inactivation data were collecte a completely mixed, thin-layer reactor using w with high UV transmission. Having developed fundamental concepts of limiting mixing condi on reactor efficiency for annular single lamp r tors from series event inactivation kinetics, it determined that mixing in the radial directio extremely beneficial while mixing in the longi nal direction is detrimental to reactor efficienc general, it is probably beneficial to allow mixi the longitudinal direction in order to ensure radial stratification does not occur. These ind ual concepts of limiting mixing conditions ca combined to qualitatively describe the efficienc a simple reactor system. (Baker-IVI)
W85-01659

AEROBIC SLUDGE DIGESTION WITH CONTROL - PRELIMINARY INVESTI TION,
British Columbia Univ., Vancouver. Dept. of Engineering.
B. C. Anderson, and D. S. Mavinic.
Journal of the Water Pollution Control Federa Vol. 56, No. 7, p 889-897, 7 Fig, 6 Tab, 12

Descriptors: *Activated sludge process, *Aer digestion, *Hydrogen ion concentra Wastewater treatment, Industrial wastes, Mu pal wastes, Biological wastewater treatment, L

The behavior of a waste activated sludge unde ing aerobic digestion was examined when the of the digesting mass was raised above that f in normal operation. The first phase of the rese used clarifier underflow sludge from a pilot s wastewater treatment trailer for nutrient rem research. In the second phase the waste sl came from the clarifier underflow of a conven al, full-scale, activated sludge plant. At 20 deg C there was considerable improvement in the ciency of the digestion process at pHs higher those usually associated with the field digestio waste sludge. Depending on the digester pH, solids retention time and the type of sludge u VSS destruction efficiencies of almost 54% obtained. The lime doses needed to attain t performances were considered minimal. Dige performance was decreased at 12 C and 5 mainly because of the biological nature of process and the temperature responses of microorganisms. In most cases the conventi sludge outperformed the modified Barden sludge in terms of digestion efficiency in the un fered reactors. The modified-Bardenpho sludg sponded much better to liming and achieved di tion efficiencies much greater than the convent al sludge at higher pHs. The overall effec liming at any of the temperatures was to incr the efficiency of the digestion process to the ex that various sets of operating parameters coul chosen to achieve a given VSS reduction. A benefit analysis was used to identify possible a of cost savings from lime pH control. (Baker-I W85-01660

CONVENTIONAL WATER PROCESS CO STUDIED,
Texas Univ. at El Paso. Dept. of Civil Engin ing.
A. Tarquin, and S. Goodwin.
Water Engineering and Management, Vol. No. 7, p 24-27, July, 1984. 2 Fig, 3 Tab, 10

Descriptors: *Wastewater treatment, *Slu *Aeration, *Economic aspects, *El Paso, *Te Cost-benefit analysis, Hardness, Turbidity, W properties.

study is presented of aeration and sludge recir-
ation processes at an El Paso, Texas water
nt. Of 13 parameters measured, only those relat-
to hardness and turbidity were affected by
ondary sludge recirculation and aeration. Aer-
on without sludge recirculation did not improve
performance of the primary clarifier with re-
ct to any of the raw water parameters meas-
d. Recirculation of secondary sludge ahead of
primary clarifier effected hardness reduction
h significant savings in the cost of lime. Al-
ugh the largest hardness and turbidity reduc-
ns through the clarifier occurred when both
dge recirculation and aeration were practiced,
most cost-effectve operating procedure oc-
red during sludge recirculation only. The com-
nly applied water treatment practices of sludge
irculation and aeration can significantly affect
removal of some compounds in the primary
rifier. The large increases in energy costs which
ve occurred over recent years warranted re-
wed investigations of a case by case basis of the
t effectiveness of such practices. (Baker-IVI)
35-01706

**DRODYNAMIC OF CIRCULAR PRIMARY
ARIFIERS,**
ndsor Univ. (Ontario). Dept. of Civil Engineer-
.
M. Abdel-Gawad, and J. A. McCorquodale.
nadian Journal of Civil Engineering, Vol. 11,
. 2, p 299-307, June, 1984. 11 Fig, 30 Ref.

escriptors: *Clarifiers, *Hydrodynamics, Mathe-
tical equations, Simulation, Velocity, Disper-
n, Settling tanks, Water treatment, Wastewater
atment, Prediction, Strip integral method.

e strip integral method has been applied to a
ical restricted inlet circular primary clarifier, in
der to simulate the flow pattern and dispersion
aracteristics of the flow. This method assumes a
minant flow direction and with the use of veloc-
shape functions reduces the equations of motion
d continuity to a set of simultaneous ordinary
uations. Three shapes were chosen, correspond-
g to the boundary layer, the potential core, and
e free mixing and recirculation zone. A Runge-
tta method was used to integrate the set of
dinary differential equations. A standard finite
ment method was used in the withdrawal zone.
e numerical predictions compared favorably
th experimental velocity distributions obtained
a physical mode of circular sedimentation tanks.
e model is restricted to circular clarifiers of
crete suspension with low concentration operat-
g at neutral density environment. The model was
ed to predict the velocity and dispersion charac-
istics of the circular tanks used at the West
ndsor Pollution Control Plant, Windsor, Ontar-
(Author's abstract)
85-01716

**DSORPTION OF COPPER, LEAD AND
OBALT BY ACTIVATED CARBON,**
exas Univ. at Dallas, Richardson. Inst. for Envi-
nmental Sciences.
Netzer, and D. E. Hughes.
ater Research, Vol. 18, No. 8, p 927-933, 1984.
Fig, 1 Tab, 8 Ref.

escriptors: *Copper, *Lead, *Cobalt, *Activated
rbon, *Adsorption, Hydrogen ion concentration,
eavy metals, Metal removal.

he phenomena of lead, copper and cobalt adsorp-
on by activated carbon from aqueous solution
as studied in detail. Laboratory studies were con-
cted to evaluate and optimize the various proc-
s variables (i.e. carbon type, solution pH, equilib-
m time and carbon dose). A quantitative deter-
ination of the adsorptive capacity of activated
rbon to remove these metals was also deter-
ined. Significant differences were found in the
ility of different types of activated carbons to
sorb lead, copper and cobalt from aqueous solu-
on. Solution pH was found to be the most impor-
nt parameter affecting the adsorption. It was
und that there was practically no adsorption of
ad, copper and cobalt by activated carbon below
well defined solution pH value for each metal.
This critical solution pH value was found to be lower than the pH value associated with the formation of hydrolysis products. Of the ten commercially available activated carbons evaluated in these experiments, Barney Cheney NL 1266 was found to absorb the largest percentage of lead, copper and cobalt. The adsorption of any single metal (lead, copper and cobalt) was hindered by the presence of the other metals; the metals apparently competed for adsorption sites. (Author's abstract)
W85-01717

EFFECTS OF BAFFLES ON THE PERFORMANCE OF MODEL WASTE STABILIZATION PONDS,
Birmingham Univ. (England). Dept. of Civil Engineering.
J. S. Kilani, and J. A. Ogunrombi.
Water Research, Vol. 18, No. 8, p 941-944, 1984. 2 Fig, 2 Tab, 11 Ref.

Descriptors: *Stabilization ponds, *Baffles, Wastewater treatment, Hydraulic properties, Biochemical oxygen demand, Chemical oxygen demand, Dispersion, Flow pattern.

The hydraulic flow pattern in stabilization ponds is one of the major factors influencing pond performance. The performance of three baffled laboratory-scale facultative ponds were compared with that of an unbaffled control pond. The hydraulic characteristics of the ponds were estimated from the results of tracer tests. Biochemical oxygen demand (BOD5) removals achieved with the control pond and with the ponds having 3, 6 and 9 baffles were 79, 81, 86 and 89% respectively and chemical oxygen demand (COD) removals were 81, 84, 84.2 and 84.2%. The reductions in total solids (TS) were respectively 43, 46, 51 and 64%. The performance of laboratory scale facultative stabilization ponds was found to be considerably improved by decreasing the dispersion index of the pond flow pattern by using baffles. Dispersion indices of 0.161, 0.126, 0.112 and 0.096 were obtained for the control, 3, 6 and 9 baffle ponds respectively, which indicated a trend of decreasing dispersion index with increasing number of baffles. Near-plug-flow conditions were obtained and these are desirable for efficient operation of facultative ponds. (Moore-IVI)
W85-01719

INITIAL STUDIES ON THE USE OF HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY FOR THE RAPID ASSESSMENT OF SEWAGE TREATMENT EFFICIENCY,
L. Brown, M. M. Rhead, and J. Braven.
Water Research, Vol. 18, No. 8, p 955-961, 1984. 8 Fig, 14 Ref.

Descriptors: *High-performance liquid chromatography, *Wastewater treatment, Chromatography, Activated sludge process, Biological wastewater treatment, Efficiency, Biodegradation.

The difficulties inherent in getting real-time feedback information, suitable for in situ monitoring of biodegradation efficiency, has severely hampered the development of automatic biological treatment optimization and cost effective treatment. High-performance liquid chromatography (HPLC) techniques suitable for the rapid analysis of low-molecular weight polar dissolved organic compounds (PDOC) have been developed and applied to the full-scale field trial assessment of the efficiency of secondary sewage treatment at an activated sludge and percolating biological filter sewage works. The results obtained for the fate of specific polar low-molecular weight constituents are compared with concurrently obtained dissolved and total BOD5, COD, ammonium and total oxidized nitrogen data. HPLC techniques may offer an alternative to BOD5, COD analyses and give an insight into the fundamental removal processes occurring during primary and secondary sewage treatment. (Moore-IVI)
W85-01721

CONTACT FLOCCULATION-FILTRATION OF HUMIC SUBSTANCES,
Technion - Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
M. Rebhun, Z. Fuhrer, and A. Adin.
Water Research, Vol. 18, No. 8, p 963-970, 1984. 10 Fig, 4 Tab, 12 Ref.

Descriptors: *Humic substances, *Flocculation, *Filtration, Alum, Polymers, Minerals, Clarification, Wastewater treatment.

Contact coagulation filtration of humic substances gives early breakthroughs shortening the filtration cycles. Contact flocculation filtration of humic dispersions with alum in medium grain (0.62 mm) sand gave short runs to breakthrough, while in coarse (1.2 mm) media clarification was inefficient. Alum with cationic polymer gave in coarse media acceptable runs, but shorter then for mineral dispersions. Analysis of the breakthrough curves and of filtration parameters from different models indicates that initial filtration is rapid and efficient, but the resistance to detachment or disturbance forces is weak. The detachment or disturbance forces overtake with increase in specific deposit values and the low filtration capacity for humic-alumino flocs and corresponding low density of its accumulated deposit indicate a voluminous nature of the deposit. The solid content and the density of alumo-organic deposits in bed are much lower than of alumo-mineral deposits. Polymers and minerals increase the solid content, the density of deposits and the mass capacity of filter beds. (Moore-IVI)
W85-01722

MECHANISMS OF METAL ADSORPTION FROM AQUEOUS SOLUTIONS BY WASTE TYRE RUBBER,
Edinburgh Univ. (Scotland). Dept. of Chemistry.
A. G. Rowley, F. M. Husband, and A. B. Cunningham.
Water Research, Vol. 18, No. 8, p 981-984, 1984. 4 Tab, 10 Ref.

Descriptors: *Adsorption, *Tires, *Cadmium, *Lead, *Mercury, Sulfur, Zinc, Heavy metals, Carbon black, Rubber, Ion exchange, Wastewater treatment.

The idea that shredded tire rubber might serve as a suitable adsorbent for the removal of toxic metals from effluents is plausible, particularly considering that vulcanizates contain carbon black (about 30% w/w). Sulfur is also present in the form of thiol groups and polysulfide links which might provide sites for the sorption of metals such as mercury. The mechanisms of adsorption of cadmium(II), mercury(II) and lead(I) on to shredded rubber from old automobile tires were studied. Sorption of mercury (II) and cadmium(II) from aqueous solutions by vulcanized rubber occurs at least partially by an ion-exchange type mechanism involving displacement of zinc(II). There are at least two types of site from which zinc(II) can be displaced. The first type of site is available to cadmium(II) only, whereas the second type can be used by both cadmium(II) and mercury(II) but in a competitive situation mercury(II) is bound in preference. The sorption of lead(II) from aqueous solution by vulcanizates involves an entirely separate mechanism and site of adsorption as compared to mercury(II) and cadmium(II) sorption, and no zinc(II) displacement occurs. (Moore-IVI)
W85-01724

KINETICS AND PRODUCTS OF THE CHLORINATION OF CAFFEINE IN AQUEOUS SOLUTION,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 5B.
W85-01727

FATE OF TRACE ORGANICS DURING RAPID INFILTRATION OF PRIMARY WASTEWATER AT FORT DEVENS, MASSACHUSETTS,
National Center for Ground Water Research, Norman, OK.
S. R. Hutchins, M. B. Tomson, J. T. Wilson, and C. H. Ward.

Water Research, Vol. 18, No. 8, p 1025-1036, 1984. 9 Fig, 7 Tab, 38 Ref.

Descriptors: *Land disposal, *Organic compounds, *Rapid infiltration, *Fort Devens, *Massachusetts, Trace compounds, Groundwater pollution, Wastewater treatment, Infiltration.

Transport and fate of trace organics were studied during rapid infiltration of primary wastewater at a land application facility in Fort Devens, Massachusetts. A preliminary sampling trip was made to compare trace organic concentrations in the infiltrating wastewater and in ground water samples from three monitoring wells around the site. Trace organic concentrations were reduced by the rapid infiltration process. However, significant concentrations of specific compounds could be detected in ground water down-gradient of the site. Therefore, a field study was undertaken to determine the primary region where trace organics were removed in the system. Teflon monitoring wells were installed at a depth of 1.2-m in one of the basins at the site prior to flooding. Flooding was initiated and samples of the raw wastewater, the wastewater entering the basin, the infiltrate at 1.2-m depth and the ground water down-gradient of the site were analyzed for six compounds selected for the study. Results from replicate samples during the 6-day flooding period demonstrated that most of the removal for the six compounds occurred in the top meter of the soil, although concentrations of each compound increased substantially in the basin infiltrate from two of the sample points after the fourth day of flooding. No removal of p-dichlorobenzene, p-(1,1,3,3-tetramethylbutyl)phenol and 2-(methylthio)benzothiazole was apparent in the aquifer itself, as indicated by relatively high concentrations of these compounds in the contaminated monitoring well down-gradient of the site. These data indicate that trace organic concentrations in primary effluent can be reduced by rapid infiltration and that most of the removal occurs in the top meter of the soil during the early phase of the flooding cycle. This removal capability can rapidly diminish, however, and result in ground water contamination by trace organics above backgrounds levels. (Author's abstract)
W85-01730

MATERIAL BALANCE ANALYSIS FOR FLUORIDE IONS IN EXPERIMENTAL WASTE DISPOSAL PLANT,
NEC Environmental Engineering Ltd., Tokyo (Japan).
T. Iwasaki, K. Shirasuka, and S. Hayano.
Water Research, Vol. 18, No. 8, p 1053-1054, 1984. 1 Fig.

Descriptors: *Wastewater treatment, *Fluorides, *Alumina, Adsorbents, Waste disposal.

One problem which arose since the installation of an experimental waste disposal plant at the University of Tokyo has been the increase of the fluoride ion concentration in the discharged effluent over the standard value of 15 mg/liter. Countermeasures were taken by the trial use of activated alumina for adsorbent, and a study on the material balance of fluoride ions was carried out for the whole system. While the concentration of fluoride ions in the effluent can be effectively reduced below the legal level by the calcification-alumina adsorption combined process, there is still a problem to be solved in treating and removing the residual fluoride ions of 6.2 kg (10%) which is now released into the municipal sewer systems. (Baker-IVI)
W85-01732

WASTEWATER TREATMENT WITH AERATED SUBMERGED BIOLOGICAL FILTERS,
Montana State Univ., Bozeman. Inst. for Process Analysis
B. Rusten.
Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 424-431, May, 1984. 15 Fig, 3 Tab, 19 Ref.

Descriptors: *Wastewater treatment, *Aeration, *Municipal waste, *Filter media, Temperature effects, Sludge, Biological filters, Biological wastewater treatment.

Municipal wastewater was treated in two pilot-scale aerated submerged biological filters. Filter media with specific surfaces of 140 sq m/cu m and 230 sq m/cu m were tested. Design should be based on total organic surface load. The treatment efficiency decreased from 75% to 57%, measured as COD removal, when the organic load was increased from 5 g COD/sq m/day to 120 g COD/sq m/day. Volumetric removal rates were in excess of 10 kg COD/cu m in both filters. The organic load influenced the settling ability of the biological sludge. With the filters operating in a two-stage process at overflow rates of up to 0.9 cu m/sq m/hr the effluent suspended solids were below 10 mg/L. Improved settling may occur in full-scale settling basins. With the filters operating as single-stage reactors, specific sludge production was between 0.35 and 0.55 g TS/g COD removed. With the two stage process the sludge production increased from virtually zero at an organic removal rate of 3 g COD/sq m/day up to 0.40 g TS/g COD removed at a rate of 25 g COD/sq m/day. Oxygen transfer was good in both filters. Aerated submerged biological filters seem to be a good alternative to other biological treatment processes. The microorganisms grow on the media, eliminating sludge recycle and any disturbance resulting from sludge bulking. Trickling filters need a certain minimum hydraulic load to work efficiently. The strong turbulence also ensures good contact between substrate and microorganisms. An aerated submerged biological filter with a high surface area filter media is a simple and compact treatment process. (Baker-IVI)
W85-01736

METALS DISTRIBUTIONS IN ACTIVATED SLUDGE SYSTEMS,
Illinois Inst. of Tech., Chicago. Armour Coll. of Engineering.
J. W. Patterson, and P. S. Kodukula.
Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 432-441, May. 1984. 2 Fig, 12 Tab, 36 Ref.

Descriptors: *Metals, *Sludge, *Wastewater analysis, *Model studies, Distribution, Aluminum, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Zinc.

Models are described which were developed to predict the distribution of metals in activated sludge system process streams. The study focused on eight metals: Al, Cd, Cr(III), Cu, Fe, Pb, Ni, and Zn. Composite samples of the dosed raw sewage, primary effluent, activated sludge mixed liquor, and secondary effluent were collected between 4 and 12 times during each run. The experiments indicated that a number of wastewater and process variables can affect metals distribution between the soluble and solids phases, but these findings are not easily extrapolated to continuous-flow systems receiving time-varying inputs of real wastewater. Based on extensive pilot plant data, empirical metals distribution models have been developed which are believed to be generally applicable. The models accurately predict the distribution of process stream metals between the soluble and solids phases. There is convincing evidence that solids-bound metals are disproportionately distributed between settleable and non-settleable solids in both raw wastewater and activated sludge mixed liquor. One model presented allows for that disproportionate distribution and accurately predicts metals removal across treatment train unit processes. (Baker-IVI)
W85-01737

RAPID BOD MEASUREMENT FOR MUNICIPAL WASTEWATER SAMPLES USING A BIOFILM ELECTRODE,
Washington Univ., Seattle. Coll. of Forest Resources.
S. E. Strand, and D. A. Carlson.
Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 464-467, May, 1984. 5 Fig, 9 Ref.

Descriptors: *Biofilms, *Biochemical ox demand, Wastewater treatment, Decomposin ganic matter, Municipal wastewater.

The response of the biofilm BOD electrode compared with the conventional 5-day BOD samples of untreated, primary-settled, and sec ary-treated municipal wastewaters. The bi BOD probe provided a signal within 20 mi that was proportional to the conventional 5 BOD for soluble organics in primary-settled nicipal wastewater and secondary-treated mu pal wastewater. The biofilm BOD probe did respond to the particulate organic matter in treated municipal wastewater. The precision o biofilm BOD was comparable to the precisio the conventional 5-day BOD, and the BOD p could be maintained in a stable condition for u 3 weeks. (Baker-IVI)
W85-01739

IRRIGATION OF PUBLIC USE AREAS LAND APPLICATION OF COMBINED IND TRIAL AND DOMESTIC WASTE EFFLUE
Naval Facilities Engineering Command, Cha ton, SC. Southern Div.
W. H. Sloan.
Journal of the Water Pollution Control Federa Vol. 56, No. 5, p 474-481, May, 1984. 5 Fig, 4 9 Ref.

Descriptors: *Wastewater irrigation, *Irriga *Land application, *Waste disposal, *Pensa *Florida, Wastewater treatment, Industrial wa

The wastewater treatment clinic plant at Naval Station Pensacola provides primary and secon treatment for both the domestic and indus wastes generated on the Station. Effluent is ently discharged into Pensacola Bay. A proje now under construction for irrigation of two courses with the combined effluent. The w sources at the station are diverse and unusual, the wastewater generated is complex and diff to treat. Therefore, the waste treatment plant an unusual design using separate modes of pret ment for domestic and industrial influents and merous ponds to dampen surges and provide si icant flow retention and system stability. The cally limited water supply potential along the treme Gulf coastal areas makes water supp significant problems at the Station. The hydro logic character of the area makes the golf cou favorable sites for land treatment of effluent. project will provide coincident benefits such reduction in potable water use and a decreas irrigation costs. A better golf course turf will r due to increased availability of water, nitrogen phosphorous in the effluent. A significant por of the plant effluent, a potentially useful resou will be reused when the project is comple Although the surficial aquifer within the are readily recharged by surface applied water, system has been carefully designed in coopera with state regulatory officials, and poses no th to water supply sources. (Baker-IVI)
W85-01740

BLUE CRAB PROCESSING PLANT EFF ENT TREATMENT,
Maryland Univ., College Park. Dept. of Agri tural Engineering.
F. W. Wheaton, R. B. Brinsfield, K. M. Lomax and E. L. Geiger.
Journal of the Water Pollution Control Federat Vol. 56, No. 5, p 482-486, May, 1984. 4 Fig, 6 8 Ref.

Descriptors: *Food processing wastes, *Indus wastes, *Wastewater treatment, Biochem oxygen demand, Food processing industry, C forms, Biological wastewater treatment, Total pended solids.

Effluent characterization studies showed retort effluent had very high BOD5, in the ra of 4,000 to 24,000 mg/L. Washdown water effluent from hand sinks had much lower BO concentrations, in the range of 146 to 710 mg Total and fecal coliform counts were high eno

equire disinfecting to meet Maryland discharge elines. A 60-mesh screen significantly reduced dissolved solids of effluent but had little effect he BOD5, or volatile and nonvolatile solids centrations in the effluent. An aerated biologi- reatment system was installed in a blue crab essing plant to treat plant wastewater. Reten- time in the treatment system varied with the t processing schedule, but averaged about 2 . Water quality results indicate the pilot m will not provide sufficient treatment to the BAT (Best Available Technology Eco- ically Achievable) discharge limitations for and BOD5. (Baker-IVI)
-01741

GANIC AND INORGANIC MERCURY SPE- S IN THE FT. LEWIS SOLVENT REFINED L PILOT PLANT WATER TREATMENT OCESS,
hington State Univ., Pullman. Nuclear Radi- Center.
. Filby, and B. W. Blomquist.
ilable from the National Technical Information ice, Springfield, VA 22161 as PB84-202480, e codes: A04 in paper copy, A01 in microfiche. er Research Center Completion Report, De- er 1983. 52 p, 9 Fig, 16 Tab, 31 Ref. Project OWRT A-114-WASH(1), Contract/Grant No. 4-0001-2151.

criptors: *Wastewater treatment, *Mercury, conversion process, Liquefaction, Pilot ts, Washington, *Activated sludge process, Ef- ts.

distribution of Hg in the water treatment ess of the Ft. Lewis Solvent Refined Coal C II) pilot plant was measured when the plant operating in a production mode (50 tons coal day). Mercury was found to concentrate in de-rich process waters as the HgS2(2-) ion. In reatment of organic-rich wastewaters, Hg pre- ates on dilution as HgS and is also concentrat- the biosludge and clarifier sludge (Al(OH)3) e process. A concentration of 2610 ng Hg/g weight basis) was observed in the biosludge. ent waters from the treatment process con- d 0.2 ng Hg/mL, compared to previously rmined values of 2 to 5 ng Hg/mL. A 2.8L ratory unit was constructed to model an oper- activated sludge process. A synthetic coal faction wastewater was formulated to contain mg C/L, predominantly in the form of phen- Mass balance studies of the behavior of HG in system showed that efficient reduction of HG s in the feedwater (100 ng Hg/mL) to ap- imately 4 ng Hg/mL was achieved. Approxi- ly 31 percent of the Hg entering the system volatilized, presumably as Hgo. The reaction ared to be reduction of Hg (II) by the bacte- enzyme, mercury reductase since the volatili- n was a function of biological activity. The 4 nL levels of Hg in effluent waters was found e 80 percent organic and 20 percent inorganic ture. The organic species were not identified are probably organic complexes of Hg (II) r than organomercury species (e.g., HgX)).
-01798

ESTIGATION OF PHOTOCATALYTIC OX- TION FOR WASTEWATER CLEANUP D REUSE,
X Corp., Austin, TX.
V. DeBerry, A. Viehbeck, G. R. Peyton, and Karpinski.
ilable from the National Technical Information ce, Springfield, VA 22161 as PB84-202548, e codes: A07 in paper copy, A01 in microfiche. er Reuse Report RU-83/12, Bureau of Recla- on, Washington, D.C., July 1983. 119 p, 16 32 Fig, 82 Ref, 2 Append. Project No. RT C-10029-R(1453)(1), Contract/Grant No. 4-001-1453.

criptors: *Water reuse, Water treatment, Solar gy, *Wastewater treatment, Organic com- nds, *Photocatalysis, *Oxidation, Titanium di- e, *Reaction kinetics.

A treatment process was investigated for removal of low concentrations of organic compounds from wastewaters. The treatment process uses light energy as the driving force for the photocatalytic oxidation of dissolved organic species on suspended semiconductor powders. Based on the results of a previous study, TiO2 was the semiconductor used in this program, which was designed to further characterize the process with respect to operating parameters and scope of applicability. Detailed kinetic analyses for the removal of a variety of organic compounds are presented. Factors such as light intensity, amount of semiconductor added, irradiated surface to volume ratio, light intensity, and amount of ionic constituents in the water were also investigated. Actual wastewater samples were obtained from several sources and used for process testing. The degree of effectiveness of the process was found to depend in part on the type of organic molecule being treated. Polar substances and compounds containing nitrogen or sulfur groups were much more susceptible to treatment than unsubstituted aromatics, mineral oils, or saturated hydrocarbons. The relative removal rates were not in direct relationship to the corresponding reaction rates with hydroxyl radicals, indicating that more is involved than hydroxyl radical production at the semiconductor powder surface. The main limiting rate factor for the systems studied was the low quantum efficiency found, coupled with the wide band gap of TiO2 which allows use of only a small fraction of the solar spectrum.
W85-01813

DISPOSAL OF HOUSEHOLD WASTEWATER IN SOILS OF HIGH STONE CONTENT (1981-1983),
Arkansas Univ., Fayetteville. Water Resources Research Center.
E. M. Rutledge, C. R. Mote, D. T. Mitchell, M. S. Hirsch, and M. D. Harper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-195809, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Research Center Publication No. 103, December 1983. 183 p, 71 Fig, 20 Tab, 32 Ref, 1 Append. Project No. OWRT B-060-ARK(1), Contract/Grant No. 14-34-0001-1204.

Descriptors: Septic tank systems, *Filter fields, Soil adsorption systems, Septic tank treatment, Climatic stress periods, *Wastewater disposal fields, *Wastewater disposal, Wastewater treatment, Soil filtration, Ammonia, Nixa soils, Organic carbon, Nitrates, Nitrification.

Four experimental filter fields were constructed with built-in monitoring equipment in Nixa soils, containing chert fragments, and a fragipan (the design limiting feature) at 60 cm. The four were (1) a 'standard' field, 76 cm deep, in the pan; (2) a 'modified standard', 30 cm deep, above the pan; (3) a 'modified pressure' field, 40 cm deep, above the pan, with pressure distribution, and (4) a 'modified pressure' field, 6 cm below the soil surface. Placing filter fields higher in soil above the pan led to improved hydraulic performance. Approximately a 50% reduction of TOC occurred within all beds, with further reductions of 30% to 40% within 60 cm of the beds. Reductions in NH3 of 10% to 15% occurred within the beds of the 'standard', and 'modified standard' fields, with further reductions of 80% to 90% in the soil. There was a significant reduction in the total of NH3 and NO3 concentrations with distance from the beds.
W85-01815

RUNOFF FROM UTILITY WASTE LANDFILL TO BE RECYCLED FROM DETENTION BASIN TO SCRUBBER MAKE-UP,
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
J. J. Lentz.
Industrial Water Engineering, Vol. 20, No. 1, p 8-17, January/February, 1983. 3 Fig, 5 Tab, 11 Ref. Maryland Power Plant Sitting Program Contract P1-81-03.

Descriptors: *Runoff, *Settling basins, *Waste disposal, *Vienna, *Maryland, Landfills, Fly ash, Sludge disposal, Powerplants, Heavy metals, Dissolved solids, Calcium, Sulfates.

Runoff from the working face of a proposed landfill for blended fly ash and scrubber sludge at a Vienna, Maryland powerplant will be captured in a lined retention basin and used for 7 to 10% of total scrubber make-up needs in order to prevent escape of heavy metals and high total dissolved solids, mostly calcium and sulfate ions, into the sensitive surface water and ground water of the Delmarva Peninsula. The effectiveness of a runoff detention basin was investigated using 30 years of daily temperature and precipitation data to simulate continuing operation of the basin and make-up system under a variety of assumptions and alternate operation rules. The number of potential overflows which might be calculated is most highly sensitive to the assumed runoff coefficient. The runoff coefficient will not be a constant, but will vary directly with the degree to which the surface becomes saturated during a precipitation event. The system is sensitive to the rate at which make-up is withdrawn. Although the number of overflows during 3- or 6-week shutdown periods showed increases, the quantities of runoff spilled remained small. While the number of spills varied greatly as a function of both runoff coefficient and withdrawal rate, with careful matching of facilities design and operation to expected demand, a basin designed to hold contaminated runoff for recycling represents a workable approach to the management of an otherwise serious waste disposal problem. (Baker-IVI)
W85-01849

STATE-OF-THE-ART OF THE ELECTRODIALYSIS REVERSAL (EDR) PROCESS,
W. E. Katz.
Industrial Water Engineering, Vol. 21, No. 1, p 12-20, Winter, 1984. 4 Fig, 3 Tab, 8 Ref.

Descriptors: *Electrodialysis, *Wastewater treatment, Membrane processes, Water treatment, Minerals, Water quality control.

The Electrodialysis Reversal Process (EDR) removes ionized salts and minerals from water and concentrates them in smaller volumes of water by means of direct current electricity. The DC electricity moves ions from a demineralizing or diluting compartment through selective ion exchange membranes into an adjoining concentrating compartment. This process is more tolerant than other commercially available membrane processes of a wide range of troublesome organic, inorganic, colloidal, and biological contaminants in water. The predominant use of EDT for much of the 1970s was the demineralization of brackish waters of several thousand parts per million total dissolved solids to potable levels of a few hundred parts per million for municipalities, oil and construction camps, hospitals, hotels, military bases, bottlers of beverages and purveyors of bottled water. By mid-1983, five public utility steam-electric generating stations with an aggregate capacity of 4000 MW had chosen EDR to pretreat boiler feed water prior to ion exchange demineralization. The basic principles for electrodialysis and EDR are defined and other applications of the method are given. (Baker-IVI)
W85-01851

REDUCTION OF COSTS AND LIABILITY RISKS IN ELECTROPLATING WASTEWATER TREATMENT,
A. C. Salas, and H. J. Cunha.
Industrial Water Engineering, Vol. 21, No. 2, p 9-13, Spring, 1984. 4 Fig, 5 Tab, 8 Ref.

Descriptors: *Wastewater treatment, *Electroplating, *Industrial wastes, Economic aspects, Electrodialysis, Reverse osmosis, Evaporation, Ion exchange, Waste recovery.

The Federal Water Pollution Control Act prohibits the discharge of pollutants into waterways from any point source, unless an appropriate permit has been issued. A summary of the Federal technology-based standards and their applicability is offered for the treatment of wastewaters from the electroplating industry. End of the line systems are used to clean the effluent streams just before discharg-

ing. These include steps to ensure the destruction of cyanides by oxidation with chlorine gas, sodium hypochlorite, hydrogen peroxide, or ozone; reduction of chromates by chemical or electrochemical means; combination of all metal bearing streams, adjustment of pH, and precipitation of metal hydroxides or sulfides; settling of suspended solids in a clarifier; thickening of the clarifier's sludge; and optional filtering of the clarifier's overflow, and discharge. Recovery systems are considered including evaporative concentration, reverse osmosis, electrodialysis, ion exchange, and electrolytic techniques. To establish a comparison between the various systems discussed with respect to cost and performance, a nickel plating operation was used an as example and costs and performance were estimated for each technology. While recovery systems are not the answer to all the water problems in electroplating operations, they should be the first ones to be considered in new installations and even as potential replacements for existing destructive systems. (Baker-IVI)
W85-01852

ANALYSIS OF QUANTITATIVE WASTEWATER MEASUREMENTS OF A COUNTRY RESTAURANT SITUATED AT APPROXIMATELY 1080 M ALTITUDE AND OF A MOUNTAIN INN SITUATED AT APPROXIMATELY 1410 M ALTITUDE (AUSWERTUNG VON SCHMUTZWASSER-MENGENMESSUNGEN BEI EINEM AUSFLUGSRESTAURANT, RUND 1080 M U. M. UND BEI EINEM BERGGASTHOF, RUND 1410 M U. M.),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
H. Weber.
Wasser, Energie, Luft, Vol. 75, No. 3, p 37-42, 1983.

Descriptors: *Wastewater, *Restaurants, *Hotels, Wastewater treatment, Domestic wastes, Recreation.

The country restaurant (excursion restaurant) is on a throughfare and is the departure point for hiking and skiing trips. The restaurant seats 100, with 200 seats on the sun-terrace. The scenic mountain inn is for tourists and guests. Outside the 120 seat restaurant is room for 70 places, and the guesthouse has 30 beds. The wastewater of the two restaurants was measured quantitatively. The most important results obtained from the quantitative wastewater measurements are described and compared with previous data. With regard to the relative wastewater peaks, expressed in multiple daily means, the absolute peak values for 20, 60 and 120 minutes are plotted in liters per second. These wastewater handling levels determine treatment system parameters. (Moore-IVI)
W85-01854

YIELD AND QUALITY OF COTTON GROWN WITH WASTEWATER,
Arizona Univ., Tucson. Dept. of Plant Sciences.
A. D. Day, and J. A. McFadyen.
BioCycle, Vol. 25, No. 3, p 35-37, April, 1984. 3 Tab, 10 Ref.

Descriptors: *Water reuse, *Irrigation, *Crop yield, *Arizona, Water conservation, Cotton, Nutrients, Nitrogen, Salts, Phosphorus.

The effectiveness of municipal wastewater as a source of irrigation water and plant nutrients has been demonstrated in cotton production in Arizona. The crop was planted in April and harvested in November in each year. About 122 cm (48 inches) of irrigation water were required to produce a cotton crop. Two sources of irrigation water included pump water from local wells, and municipal wastewater and pump water in a 50:50 mixture. The pump water contained 4,600 ppm total soluble salts, 21 ppm nitrate nitrogen, 22 ppm total nitrogen, and 0 ppm elemental phosphorus. The wastewater and pump water mixture contained 3,400 ppm total soluble salts, 6 ppm nitrate nitrogen, 40 ppm total nitrogen, and 4 ppm elemental phosphorus. Fifty-six kg/ha of nitrogen fertilizer were applied prior to planting the cotton that was irrigated with pump water, increasing the total nitrogen to 334 kg/ha. Cotton grown with the mixture was taller, produced more seed cotton and lint cotton than cotton irrigated with only pump water. The wastewater when added to the pump water had no significant detrimental effects on most cotton fiber quality characteristics. (Baker-IVI)
W85-01869

CONSTRUCTION OF RATIONALIZATION EQUIPMENT AT THE ROSTOCK WATER-SUPPLY AND WASTEWATER-TREATMENT FACILITY (RATIONALISIERUNGSMITTELBAU IM VEB WASSERVERSORGUNG UND ABWASSERBEHANDLUNG ROSTOCK),
VEB Wasserversorgung und Abwasserbehandlung, Rostock (German, D.R.).
For primary bibliographic entry see Field 5F.
W85-01877

ENERGY STUDIES OF WASTEWATER-TREATMENT FACILITIES AS A BASIS FOR OPTIMAL ENERGY USE (ENERGIESTUDIEN VON ABWASSERBEHANDLINGSANLAGEN ALS GRUNDLAGE FUR DEN OPTIMALEN ENERGIEEINSATZ),
VEB Projektierung Wasserwirtschaft, Erfurt (German, D.R.).
H. Lopp.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 1, p 21-23, January, 1984. 1 Fig, 3 Tab, 5 Ref.

Descriptors: *Wastewater treatment facilities, *Energy, Gas production, Sludge treatment, Heat, Economic aspects, Pumps, Aerators.

The choice of means of energy supply for a wastewater-treatment facility (WTF) and of utilization of gas produced by the WTF demands in consideration of specific WTF conditions and the regional energy-supply structure. Criteria include economical effectiveness, longevity of machinery, feasibility of installation, and fullest possible energy supply of the WTF by self-produced gas and wastewater heat. Comparative energy-supply/gas-utilization studies should be preceded by efforts to optimize wastewater- and sludge-treatment processes and to reduce electrical and thermal energy requirements. Measures to reduce electricity demand include improvement of aeration equipment and correct adaptation of pumps to output. Heat requirements can be reduced by well constructed and insulated buildings and, in the case of sludge digestion plants, a better volume: surface ratio. Maximal gas production can be achieved through optimal design of the digestion tank with suitable sealing and insulation materials as well as intensification of the digestion process, including thickening of raw sludge, adequate circulation of digestion-tank contents, and maintenance of optimal tank temperature. The basis for effective gas utilization is its transformation into a usable form of energy, ensuring high energy level during transformation; coupling gas utilization with other energy-producing equipment, e.g., heat pumps with a high level of primary energy exploitation, and installation of the most economical energy carrier. Models for utilizing gas and supplying energy include gas boiler + coal boiler (to cover peak demand) + transformation of excess gas into fuel; gas boiler + coal boiler + selling excess gas; block thermal power station (BTPS) + gas boiler + coal boiler; BTPS + compression heat pump. (Gish-IVI)
W85-01878

DEVELOPMENT OF THE SCHWARZHEIDE CHEMICAL SYNTHESIS WORKS IN THE FIELD OF WASTEWATER AND BY-PRODUCT TREATMENT (ENTWICKLING DES VEB SYNTHESEWERK SCHWARZHEIDE AUF DEM GEBIET DER ABWASSER- UND ABPRODUKTBEHANDLUNG),
VEB Synthesewerke, Schwarzheide (German, D.R.).
R. Heepe.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 2, p 42-43, February, 1984. 1 Fig.

Descriptors: *Chemical industry, *In wastewater, *Herbicides, Chemical wastes vated sludge treatment, Biological wast treatment, Costs, Cooling water, Recycling, conservation.

The Schwarzheide chemical works manuf herbicides and polyurethanes (polyester-an ester alcohols plus isocyanate) in the C Democratic Republic. It produces highly p wastewater as well as toxic solid and liqu products. At the works, by-products are inc ed. All wastewater is treated on-site by a tw activated sludge facility and nitrification, wastewater with COD up to 30,000-100,00 goes through two preliminary steps (therm fication, biological treatment) and that with 1,500-30,000 mg/l goes through the biologic liminary step. Elimination of 90-98% of C day BOD, phenols, nitrate, ammonia, herb and anline is achieved, but the annual cost million Marks has necessitated efforts to in economic efficiency. Industrial and cooling demand has dropped by about 30%, thereby ing the wastewater volume and saving 1,00 hours/yr and 305,000 Marks/yr. Continuous urement of ammonia and phosphate in wast has resulted in lower dosages of nitrogen and phorus for a 900,000 Marks/yr saving. Sluc sulting from wastewater treatment is no incinerated but used in the reclamation of dumps, saving over 3 million Marks worth oil. By-products of isocyanate manufacture cycled, saving 11 million Marks/yr. Gas re from the production process has been subs for fuel oil used in the incinerator, resulting annual reduction in oil consumption of mor 5,000 tonnes. (Gish-IVI)
W85-01881

IMPROVED OPERATIONAL CONTRO SEDIMENTATION FACILITIES THRO THE USE OF FIBEROPTIC SEN (VERBESSERTE BETRIEBSKONTROLLE SEDIMENTATIONSANLAGEN DURCH ZUNG FASEROPTISCHER SENSOREN),
VEB Zellstoff- und Papierfabrik, Ros (German D.R.).
A. Geisenheiner, M. Wyrwich, and A. Hoffm
Wasserwirtschaft-Wassertechnik, Vol. 34, N 43-45, February, 1984. 4 Fig, 8 Ref.

Descriptors: *Fiberoptics, *Sensors, *Partic *Sedimentation, Wastewater treatment, Ind wastewater, Pulp wastes, Suspended solids.

A device was developed at the Rosenthal pul paper factory, Blankenstein, German Demo Republic, to monitor the recirculator in its mentation facility, which is used in the trea of industrial water. The device was need control suspended and settled particulates, due to various factors in the sedimentation p often exceed the number permitted by l wastewater treatment. A submersible prob developed using photoconductive fibers; thi be called up to provide an underwater prof particulate distribution. The probe consists o sensor arms, one bearing a lamp and one bea phototransistor. In the measurement apertu tween the two sensor arms, which is lit b lamp, the flocs cause absorption impulses th opto-electronically transformed by the phot sistor, then amplified and plotted. Fiberglass beam the light from the lamp to the measur aperture and transmit the absorption impulse the floc to the phototransistor. The light diameter is determined by the most commo size, while the absorption aperture is fixed ac ing to maximum sensitivity of the phototra at a given light intensity. The probe was us several months without problems to prove it ability and usefulness. It could also be us activation basins and in natural waters up to deep. (Gish-IVI)
W85-01882

FRIEDRICHRODA WASTEWATER TR MENT FACILITY - RESULTS OF AN EX

T (KLARANLAGE FRIEDRICHRODA - EBNISSE EINES EXPERIMENTS),
Wasserversorgung und Abwasserbehandling, (German, D.R.).
Moller, H. Kuhles, and J. Hattenbach.
erwirtschaft-Wassertechnik, Vol. 34, No. 3, p April 1984. 11 Fig, 4 Ref.

iptors: *Wastewater treatment facilities, struction, *Friedrichroda, *East Germany, Centrifugal pumps, Pipes, Aeration, Sludge zation, Tanks, Optimization.

ew wastewater treatment plant (15,500 popu- equivalents, 160 cu m/hr dry-weather water inflow) at the German Democratic Re- spa resort of Friedrichroda was constructed e site of an old one, which continued to te during the building process. The rake with its vertical bar rake was built without a container or bridge crane (debris was dis- ed directly into a trailer and hauled away). ewater is driven into the two activation basins eans of two above-ground centrifugal sewage s, each with a series-connected intake con- . Activation, tertiary-treatment, thickening, sludge-stabilization tanks were built above d to reduce costs by eliminating under- d construction; the choice of wood as a ruction material was not ideal. Constructing e bridges from steel was successful; design orrosion prevention are especially important. se of insulated open-air pipes with auxiliary ical heaters was advantageous due to elimina- f underground construction and good condi- for installation. Aeration of the two activa- asins is achieved by an injector system. Opti- ion of the sludge stabilization process was ved by experimentation. Costs were consider- reduced by the construction and treatment ods. (Gish-IVI)
-01884

TEWATER PURIFICATION AS RELATED THE STUDY OF A RIVER SYSTEM (AB- SERREININGUNG IN VERBINDUNG MIT UNTERSUCHUNG EINES FLUSSSYS- S),
azdalkodasi Tudomanyos Kutato Intezet, Bu- st (Hungary).
szto, and A. Horkai.
erwirtschaft-Wassertechnik, Vol. 34, No. 3, p , April, 1984. 3 Fig, 4 Ref.

riptors: *Water pollution control, stewater treatment, *Rivers, Water quality, s, Regulations, Standards, Planning, Comput-

g the example of a river system (consisting of river, tributary, and periodic stream empty- nto the main river), it is demonstrated that r pollution and the demand for good-quality r can be treated as a spatial unit. This concept ts in the elimination of unnecessary water ities when compared with the traditional od of viewing users as individual units. In the ning stage, the complicated nature of the river m concept with the necessity of providing for pliance with standards and regulations ughout the entire system rather than for indi- al facilities requires computer technology. Ex- les of calculations for guaranteeing water-qual- requirements and for various costs are given. h-IVI)
-01885

MPUTERIZED DISTRIBUTION RECORDS- D PAVES THE WAY,
ohue and Associates, Inc., Waukesha, WI.
primary bibliographic entry see Field 5F.
-01902

DUCTION OF THE USE OF MATERIALS TH THE AID OF SCIENCE AND TECHNOL- Y AT THE HYDROTECHNOLOGY AND TER-MANAGEMENT-PLANNING COM- E (SENKUNG DES PRODUKTIONSVER- AUCHS MIT HILFE VON WISSENSCHAFT D TECHNIK IM VEB KOMBINAT WAS-

SERTECHNIK UN PROJEKTIERUNG WASSERWIRTSCHAFT),
VEB Projektierung Wasserwirtschaft, Halle (German D.R.).
K. Heilmann.
Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 45-46, February, 1983. 1 Ref.

Descriptors: *Wastewater treatment facilities, *East Germany, *Costs, Construction, Biological wastewater treatment, Pipes, Rakes, Blowers.

The German Democratic Republic Hydrotechnology and Water-Management Planning Combine (HTWMP) produces industry-specific equipment and rationalization devices to aid in the intensification of the water industry in compliance with government policy. One of the goals of rationalization is to reduce the amount of materials used in production while increasing production. An example of reduction in materials usage is a compact small-scale sludge-activation facility produced at the Merseburg wastewater treatment facilities to provide complete biological treatment of municipal wastewater. The compact facility corresponded to international standards with regard to performance, but the amount of material used in manufacture was too high. Cooperative study between workers, technology experts, and designers resulted in a 21% reduction in materials, especially in steel plate and pipe. Increased efficiency was achieved by means of a new type of blower, and this also reduced construction costs for the blower house by 30%. The central HTWMP has begun work to improve rake design; already 22% of material has been saved by redesigning the fork rake, and manufacture has been simplified. The next step will be the standardization of rakes, so that they will all be constructed according to the same principle. Reduction in materials usage can also be achieved by preventive maintenance to avoid repairs. (Gish-IVI)
W85-01968

INTENSIFICATION OF WASTEWATER AND SLUDGE TREATMENT PROCESSES THROUGH UTILIZATION OF THE ENERGY POTENTIAL OF WASTEWATER (INTENSIVIERUNG DER ABWASSER-UND SCHLAMMBEHANDLINGSPROZESSE DURCH NUTZUNG DES EIGENENERGIEPOTENITALS DER ABWASSER),
VEB Projektierung Wasserwirtschaft, Halle (German D.R.).
G. Voigtlander, and R. Zemlin.
Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 54-47, February, 1983. 2 Tab, 24 Ref.

Descriptors: *Wastewater treatment, *Energy recovery, Biological wastewater treatment, Sludge treatment, Biogas, Heat, Construction costs, Chemical treatment.

The energy crisis demands utilization of the energy potential of wastewater. This potential consists of wastewater heat and energy-rich organic matter. Heat in wastewater can arise from the industrial process producing the wastewater or from municipal wastewater, which can be 5 K warmer than drinking water. Biological gas from wastewater and sludge treatment has been transformed into mechanical or electrical energy with simultaneous utilization of waste heat at wastewater treatment facilities. A relatively new development has been the installation of heat pumps driven by biological gas, which use thermal energy from wastewater. Past efforts to optimize wastewater treatment have concentrated on biological processes occurring under natural environmental conditions. Future efforts should emphasize chemical treatment procedure with the specific goal of reducing construction costs. Intensification of the chemical procedure leads to reduced reactor volumes and thereby to a need for less equipment and lower construction costs. Raising temperatures to increase treatment speed is significant, especially in the case of highly concentrated wastewater and sludge. Anaerobic processes will become increasingly important due to their low energy consumption, as will the breeding of microorganisms for biological treatment at high temperatures. Tables are given for temperature-dependent wastewater and sludge chemical treatment methods for temperatures < or = to 353 K and = or > 353 K. (Gish-IVI)
W85-01970

SUGGESTION FOR YEAR-ROUND WASTEWATER UTILIZATION IN THE FORESTRY INDUSTRY (VORSCHLAG ZUR GANZJAHRIGEN ABWASSERVERWERTUNG IN DER FORSTWIRTSCHAFT),
M. Bahler, E. Drus, and R. Lutzke.
Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 60-62, February, 1983. 1 Fig, 1 Tab, 3 Ref.

Descriptors: *Frankfurt (Oder), *East Germany, *Land disposal, *Forestry, Wastewater disposal, Wastewater irrigation, Crop yield.

In order to eliminate the need to construct expensive tertiary wastewater treatment plants in the Frankfurt (Oder) region of the German Democratic Republic, preliminary studies were made for a pilot facility for the application of wastewater to forested land. This practice confers the same benefits as agricultural wastewater application (increased crop yield and wastewater purification through nutrient uptake by plants and filtering ability of soil) but unlike agricultural application can be continued throughout the entire year. The site chosen should be far from groundwater supplies with a permeable soil and should preferably be completely flat. Wastewater is applied via shallow furrows up to 200-m long, between which the trees are planted in rows. High wood yields are achieved with poplars and willows (25 cu m/hectare); this represents a three to four times higher yield than that produced from pine trees on the same, non-treated soil. Year-round application (75 mm every 2 wk; 1,800 mm total) resulted in the removal of 71.4% of total nitrogen (as measured in percolating water) and almost complete elimination of 5-day BOD and phosphates. Problems relating to health are significantly fewer with forest than with agricultural application, since forestry products are not used for human consumption. The preliminary studies resulted in the selection of two suitable forest areas for the pilot facility. (Gish-IVI)
W85-01971

ENZYMATIC HYDROLYSIS TESTS ON AN INDUSTRIAL EFFLUENT PRIOR TO ITS BIOLOGICAL PURIFICATION (ESSAIS D'HYDROLYSE ENZYMATIQUE D'UN EFFLUENT INDUSTRIEL AVANT SON EPURATION BIOLOGIQUE),
R. Mesnier.
Aqua, No. 6, p 471-476, 1982. 5 Fig, 3 Tab, 25 Ref.

Descriptors: *Industrial wastes, *Bulking sludge, *Wastewater treatment, *Enzymes, *Hydrolysis, Sludge, Bacteria, Biological treatment.

Studies were undertaken to determine the effect of retrograded boiled starch present in effluent to be treated on the bulking of sludge. When treating industrial effluent by biological means after enzymatic hydrolysis of the starch, the following points surfaced: enzymatic hydrolysis of the starch by amylase allowed the retrogradation of the boiled amylose to be avoided; this allowed the assimilation of the amylose and of the amylopectin by the purifying flora through the almost complete transformation of these compounds into simple sugars. This also limited the bulking phenomenon and rebalancing of the micro-fauna in the activated sludge. The development of filamentous bacteria was accompanied by an increase in the concentration of insoluble sugars (retrograded boiled starch) in the activated sludge. Application of this enzymatic hydrolysis technique was insufficient to bring about complete regression of bulking sludge in full expansion. Filamentous bulking of activated sludge depends both on a limiting substrate that is hard to assimilate and on the qualitative balance between the various nutrients necessary to the microorganisms to ensure the degradation of carbonaceous matter and purification of the wastewater. The pretreatment of substrates by enzymatic hydrolysis is not a sure-fire weapon in

dealing with bulking phenomena in general. (Baker-IVI)
W85-01975

STUDY CASES OF OPERATIVE CONDITIONS OF MUNICIPAL TREATMENT BY LAGOONING (ETUDE DES CONDITIONS DE FONCTIONNEMENT ET D'EXPLOITATION DE QUELQUES CAS CONCRETS DE TRAITEMENT D'EAUX RESIDUAIRES URBAINES PAR LAGUNAGE),
Societe Lyonnaise des Eaux et de l'Eclairage, Paris (France).
N. Dalga, G. M. Faup, and M. Ferry.
Aqua, No. 6, p 477-480, 1982. 7 Fig.

Descriptors: *Lagoons, *Municipal wastewater, *Aerated lagoons, Wastewater treatment, Biological oxygen demand, Chemical oxygen demand, Operating costs, Bacteria, Sludge lagoons.

In a study of 22 aerated lagoons and 9 natural lagoons in France, aerated lagoons were found to be under-sized compared to the generally accepted values; this is not usually the case with natural lagoons. Problems connected with the creation of lagoons were the seal of the reservoirs, dike stability, communications between reservoirs, and aerating devices. The main parameters taken into account for the purifying performance of lagoons were usual rejection parameters (MES-COD-BOD5) as well as the bacteriological charge. The results obtained were, generally, 90% on BOD5 and 75% on MES due to the presence of algae in the treated effluents. There was a reduction in the germ tests of 10 to the power of 4 or 6. The various maintenance operations were estimated in order to establish an operating cost. A first study of the energy consumption of aerated lagoons was carried out to establish a comparison with the usual methods. The major heavy operation in the running of lagoons concerns the extraction of sludge. The study made it possible to establish an average cleaning frequency while also finding a means of controlling silting. (Author's abstract)
W85-01976

BIOLOGICAL FOULING OF REVERSE OSMOSIS MEMBRANES,
Orange County Water District, Fountain Valley, CA.
D. G. Argo, and H. F. Ridgway.
Aqua, No. 6, p 477-480, 1982. 22 Fig, 8 Tab, 6 Ref.

Descriptors: *Membrane processes, *Reverse osmosis, *Wastewater treatment, Wastewater renovation, Detergents, Membranes, Enzymes, Chlorination.

During 28 months of operation, the Water Factory 21 experienced an overall flux decline rate of -0.159 gfd/month due to fouling in its wastewater demineralization plant, and a 40% decline in flow. The fouling layer was 90% organic and contained considerable quantities of carbohydrate, protein and adenosine triphosphate. A total bacterial count of about 7,500,000 cells/ml and a viable bacterial count of 10,000 cells/ml in the feedwater was noted. The fouling layer consisted primarily of bacteria attached to surfaces of the cellulose acetate membranes. The increase in bacterial numbers associated with the reverse osmosis membranes was inversely related to a progressive decline in membrane water flux. When the membranes were exposed to a free chlorine residual of 10 to 15 mg/l for a few days, they were rapidly destroyed. Evaluation of a number of different cleaning solutions indicated several were capable of removing the biofilm in laboratory experiments. The membranes receiving chlorinated feedwater appeared to clean better than those receiving nonchlorinated feed. All cleaners were less effective over time as the amount of biofilm on the membrane surfaces increased. The most effective solutions were combinations of detergents and enzymes. (Baker-IVI)
W85-01977

USE OF ARTIFICAL WETLANDS TO REMOVE NITROGEN COMPOUNDS FROM WASTEWATER,
Ecological Research Associates, Davis, CA.
R. M. Gersberg, C. R. Goldman, and B. V. Elkins.
Aqua, No. 6, 492-496, 1982. 4 Tab, 4 Ref.

Descriptors: *Wastewater treatment, *Nitrogen, *Nitrate, *Artificial wetlands, Wetlands, Bacteria, Biological treatment, Biological wastewater treatment.

The deleterious effects of nitrogen on both surface and groundwater supplies have led to a significant increase in research focused on the development of cost-effective and energy-efficient nitrogen removal process. Our investigations at Santee, California, have demonstrated the exceptional utility of artifical wetlands (800 sq m) for the removal of nitrate from nitrified secondary wastewaters at relatively high application rates. The major loss of nitrogen from these wetland systems was due to bacterial denitrification. When no carbon source was added to the marsh beds to supplement the carbon supply and fuel the denitrification process, nitrogen removal in the artifical wetlands was relatively low (8%). However, when the artifical marsh beds were amended with methanol, mean removal of TN (total nitrogen) was 94% at an application rate of 20 cm per day. Since artifical wetlands provide an ideal environment for photosynthetic carbon fixation as well as denitrification, we tested the efficacy of using plant biomass, mulched and applied to the surface of the artifical marsh beds, as an alternate and low-cost source of carbon. In mulch-amended beds the mean removal efficiencies were 70% for the TN and 77% for TIN (total inorganic nitrogen) at an application rate of 20 cm per day. Rising operational and energy costs make biological systems such as artificial wetlands very attractive as low-cost, low-energy systems for removal of nitrogen from municipal and agricultural wastewaters and contaminated groundwater supplies. (Author's abstract)
W85-01978

ULTRAVIOLET DISINFECTION OF WATER,
Katadyn Products, Inc., Wallisellen (Switzerland).
M. Angehrn.
Aqua, No. 2, p 109-115, 1984. 17 Fig, 5 Tab, 18 Ref.

Descriptors: *Ultraviolet radiation, *Water treatment, *Disinfection, Drinking water, Potable water, Water quality control, Bacteria, Microorganisms.

The first prototype unit for ultraviolet disinfection of water was built in 1910 in Marseille. The method was introduced into treatment of public water supplies in Switzerland in the 1950s. In Europe over 2000 communities now disinfect their drinking water with ultraviolet rays. Sufficient exposure and intensity inactivate irreversibly the DNA of microorganisms. Water quality and ageing of UV lamps in operation also have to be considered when dimensioning UV plants. Scientific tests using specific microorganisms and naturally contaminated water conclusively prove the safety of this method of disinfection. It is a cost-effective and valid alternative to chlorination and does not require the addition of chemicals to the water. (Baker-IVI)
W85-02020

CHLORINATION OF COOLING WATERS AND QUALITY OF WATER RESOURCES,
Antwerpse Waterwerken (Belgium).
W. Van Craenenbroeck.
Aqua, No. 3, p 165-169, 1984. 1 Fig, 23 Ref.

Descriptors: *Drinking water, *Chlorination, *Cooling towers, *Water quality control, Potable water, Microorganisms, Heat treatment, Powerplants, Industrial wastes.

Cooling waters from electric power plants are chlorinated in order to prevent bacterial slime formation in the condensor pipes, or mussel growth in the intake culverts. What effects this causes in the environment are considered along with possible alternative ways of treating the problem and thereby minimizing these environmental effects. Alternative antifouling treatments include the use of mechanical systems (such as rubber balls cle the condensor tubes to prevent microfo caused by bacterial slime deposits), surface ments, and heat treatments (by recycling wa up cooling water). In many cases more chl has been added to treatment systems than actually needed. (Baker-IVI)
W85-02023

MECHANISM OF SEMIFLUIDIZED BIOREACTOR FOR BIOLOGICAL PHE DEGRADATION,
Ohio State Univ., Columbus. Dept. of Che Engineering.
L. S. Fan.
Available from the National Technical Inform Service, Springfield, VA 22161 as PB84-20 Price codes: A06 in paper copy, A01 in micro Water Resources Center Completion Report, 99 p, 34 Fig, 9 Tab, 63 Ref, 1 Append. Projec OWRT A-060-OHIO(1).

Descriptors: *Wastewater treatment, *Mass fer, *Biodegradation, Aeration, *Phenols, Kin *Bioreactors, Bacteria, Organic wastes, Sem dized bed reactor.

The kinetics of biological phenol degradatio the performance of the bacteria in a packed and semifluidized bed reactor were investigat this research project. Batch studies at three peratures, 24 degrees C, 35 degrees C, an degrees C, were undertaken to determine the mum operating temperature. Sewage bacteri climated to high phenol concentrations at temperature were used in these studies. The b ria were seeded onto various types of pac material for use in the semifluidized and pa bed studies. In the semifluidized bed, the flo gas and liquid was countercurrent. From the fluidized bed studies, a decrease in the liquid rate from 1500 ml/min to 100 ml/min increase phenol degradation by approximately 10 per Investigation was also extended to cover the drodynamic behavior of the semifluidized Separate experiments were conducted to stud hydrodynamic behavior of countercurrent flo gas and liquid in a packed bed. A computat procedure was developed which allows a re ably accurate prediction of the pressure drop i semifluidized bed.
W85-02106

DEHALOGENATION OF THREE CHLO ATED HYDROCARBONS: AMINE-ASSIS VERSUS METAL-CHELATE ASSISTED,
University of South Florida, Tampa. Chemical Environmental Management Services Center.
For primary bibliographic entry see Field 5F.
W85-02121

EFFECT OF CHLORINATION ON ANTIBI IC RESISTANCE PROFILES OF SEWAGE LATED BACTERIA,
Ottawa Univ. (Ontario). Dept. of Biology.
G. E. Murray, R. S. Tobin, B. Junkins, and D. Kushner.
Applied and Environmental Microbiology, 48, No. 1, p 73-77, July, 1984. 1 Fig, 5 Tab, 25 Canadian Dept. of Supplies and Services con ISU80-00323.

Descriptors: *Chlorination, *Antibiotic resista *Wastewater, Effluents, Bacteria, Wastew treatment, Disinfection.

A total of 1,900 lactose-fermenting bacteria isolated from raw sewage influent and chlorin sewage effluent from a sewage treatment plan well as from chlorinated and neutralized d sewage, before and after a 24-h regrowth perio the laboratory. Of these isolates, 84% were re ant to one or more antibiotics. Chlorinatio influent resulted in and increase in the propor of bacteria resistant to ampicillin and cephalo the increase being most marked after regro occurred following chlorination. Of the other antibiotics tested, chlorination resulted in an creased proportion of bacteria resistant to so

decrease in the proportion resistant to the
nder. Multiple resistance was found for up to
antibiotics, especially in regrowth popula-
Identification of about 5% of the isolates
d that the highest proportion of Escherichia
ll in untreated sewage. Some rare and poten-
pathogenic species were isolated from chlor-
and regrowth samples, including Yersinia
colitica, Yersinia pestis, Pasteurella multo-
and Hafnia alvei. The results indicate that
nation, while initially lowering the total
er of bacteria in sewage, may substantially
se the proportions of antibiotic-resistant, po-
lly pathogenic organisms. (Author's abstract)
02139

Ultimate Disposal Of Wastes

HYDROLOGY OF THE MEADOWBROOK IFICIAL-RECHARGE PROJECT SITE IN T MEADOW, NASSAU COUNTY, NEW K,
ogical Survey, Albany, NY. Water Resources

rimary bibliographic entry see Field 2F.
01774

NICIPAL SOLID-WASTE DISPOSAL AND UND-WATER QUALITY IN A COASTAL IRONMENT, WEST-CENTRAL FLORIDA,
ogical Survey, Tallahassee, FL. Water Re-es Div.
ernandez, Jr.
lable from OFSS, USGS, Box 25425, Fed. Denver, CO 80225. USGS Water-Resources stigations Report 83-4072, 1983. 29 p, 12 Fig, 2 25 Ref.

riptors: *Landfills, *Water pollution sources, r quality, Domestic waste, Coastal environ-, *Florida, *Solid waste disposal, Groundwat-llution.

l waste is defined along with various methods isposal and the hydrogeologic factors to be idered when locating land-fills is presented. es of solid waste, composition, and sources are tified. Generation of municipal solid waste in ida has been estimated at 4.5 pounds per day person or about 7.8 million tons per year. hate is generated when precipitation and nd water percolate through the waste. Gases, ly carbon dioxide and methane, are also pro-d. Leachate generally contains high concen-ons of dissolved organic and inorganic matter. two typical hydrogeologic conditions in west-ral Florida are (1) permeable sand overlying and limestone and (2) permeable sand overly-limestone. These conditions are discussed in tion to leachate migration. Factors in landfill selection are presented and discussed, followed discussion on monitoring landfills. Monitoring ndfills includes the drilling of test holes, meas-g physical properties of the corings, installa-of monitoring wells, and water-quality moni-ng. (USGS)
5-01789

STE MANAGEMENT SCENARIOS FOR NNESOTA'S TWIN CITIES,
Goldstein.
Cycle, Vol. 24, No. 1, p 17-20, January/Febru-1983.

criptors: *Waste disposal, *Incineration, *Land osal, *Minnesota, *Composting, Management, nning, Twin Cities.

rious methods of dealing with wastes in Minne-'s Twin City area are discussed. Currently ployed solutions include landspreading, incinera-n, and co-composting. The Metropolitan Waste ntrol Commission operates a regional sewage atment plant, which generates 80% of the re-n's sludge. Land application for much of the dge was used as an interim solution. While this erim solution has now become a successful oper-on, work on the incineration system is nearing mpletion using the Zimpro process. In this proc-ess the sludge is pressure cooked and heat from the initial batches is used to continue thermally treating the other sludge. During the winter all the sludge will be needed to run the incinerators, but during the summer, it may be possible to burn about 50% of the sludge and landspread and/or compost the remainder. Many neighborhoods also have waste management programs. The possible co-composting of both yard/leaf waste and regular garbage with sewage sludge is being studied. Another area of study has been the feasibility of a centralized processing pretreatment facility for platers in the Twin City area. This facility would be designed for small- to medium-sized metal finishers, electroplaters, and printed circuit manufacturing industries who can't afford to comply with discharge requirements on their own. (Baker-IVI)
W85-01867

HYDROGEOLOGY AND WATER QUALITY OF SIX LANDFILL SITES IN HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-01946

VOLATILE ORGANIC INPUTS FROM AN OCEAN OUTFALL NEAR BARCELONETA, PUERTO RICO,
Texas A and M Univ., College Station. Dept. of Oceanography.
M. C. Kennicutt, II, J. M. Brooks, and T. J. McDonald.
Chemosphere, Vol. 13, No. 4, p 535-548, 1984. 5 Fig, 5 Tab, 11 Ref. NOAA grants 04-8-MO1-55 and NA80RAD00039.

Descriptors: *Waste disposal, *Volatility, *Organic compounds, *Ocean dumping, *Barceloneta, *Puerto Rico, Industrial wastes, Outfalls.

A study was undertaken to compare two methods of ocean disposal (ocean outfall and ocean dumped) using volatile organic compounds (VOCs) as a measure of waste dispersion. The assessment of the environmental consequences of ocean disposal involves four considerations: waste quality and quantity, method of discharge, and discharge location. When wastes are discharged to the ocean a choice has to be made between barging the waste and discharging through an outfall. A major advantage of outfall disposal is that it is less expensive. Environmental costs may be higher, however, because the coastal zone is an area of high productivity and economic use. When industrial wastes are introduced deep into the water column via a coastal outfall, the coastal environment is not readily flushed of the discharged waste, and waste contamination does impinge on the shoreline. When the waste contains high concentrations of VOCs, as well as high fecal coliforms, it is preferable environmentally to discharge the waste at the surface in the open ocean because the VOCs are more readily lost to the atmosphere than by introduction at depth, and contamination is less likely to reach the shoreline along an economically useful coastal zone. (Baker-IVI)
W85-01963

5F. Water Treatment and Quality Alteration

COST AND BENEFITS OF DRINKING WATER TREATMENT,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
R. M. Clark, J. A. Goodrich, and J. C. Ireland.
Journal of Environmental Systems, Vol. 14, No. 1, p 1-30, 1984-85. 15 Fig, 11 Tab, 14 Ref.

Descriptors: *Cost-benefit analysis, *Social costs, *Drinking water, *Water treatment, Cost analysis, Environmental control, Public health, Chlorination, Filtration, Infectious diseases, Activated carbon.

As inflationary and regulatory pressures increase and regulated industries and the public question the usefulness of investing in environmental control measures, a need to relate environmental control costs to their benefits is more apparent. This article develops a framework for evaluating the costs and benefits of environmental control and preventive public health practices and asks the policy question: How do we achieve the best mix of protection against infectious disease and toxic chemicals in drinking water. In an attempt to answer this question, the costs and benefits of chlorination and filtration are analyzed retrospectively, and the results of this analysis extended to include a newer technology, granular activated carbon (GAC) filtration. Both a net benefit and cost per life saved approach is used in the analysis. The issue of uncertainty in estimating benefits and the resulting impact on the selection of an optimal strategy is examined. Net benefits associated with chlorination and filtration are shown to be more than adequate for installation of these technologies; with GAC technology, the relative benefits drop. The best cost benefit relationship for GAC technology results when GAC replaces sand in the filtration scheme. Benefits tend to increase with increasing scale of service. (Author's abstract)
W85-01649

DETERMINATION OF CHLORINE DIOXIDE AND CHLORITE IN DRINKING-WATER (BESTIMMUNG VON CHLORDIOXID UND CHLORIT IM TRINKWASSER),
Technische Univ., Munich (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
G. Hartung, and K.-E. Quentin.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17, No. 2, p 50-62, 1984. 8 Fig, 4 Tab, 17 Ref.

Descriptors: *Chlorine dioxide, *Chlorite, *Drinking water, *Photometry, Interference, Chlorination, Water treatment.

The photometric determination of iodine at 350 nm after oxidation of iodide by ClO2 at pH 7 or pH 2.5 was shown to be suitable for determination of concentrations of chlorine dioxide down to 0.001 mg/l. Interfering chlorine can be removed so that chlorite only interferes at pH 2.5. For concentration and isolation ClO2 can be stripped with nitrogen or extracted with hexane. In a similar way chlorite can be determined down to 0.001 mg/l after removing chloride dioxide previously by stripping or extraction. Very small quantities of chlorite can be oxidized with sodium peroxydisulfate to chlorine dioxide, which after concentration is determined photometrically. Variations of the method are described together with their procedures. The methods especially pertain to those concentrations of ClO2 and ClO2(-) being used in waterworks and to these recommendations in the new edition of the Trinkwasser-Aufbereitungs-Verordnung (chlorine dioxide up to 0.1 mg/l, in excepted cases up to 0.4 mg/l chlorite up to 0.1 mg/l). (Author's abstract)
W85-01664

ENTERIC VIRUS LEVELS IN WASTEWATER EFFLUENTS AND SURFACE WATERS IN THE SEVERN TRENT WATER AUTHORITY 1979-1981,
Severn-Trent Water Authority, Birmingham (England).
For primary bibliographic entry see Field 5B.
W85-01718

FORMATION OF STABLE ORGANIC CHLORAMINES DURING THE AQUEOUS CHLORINATION OF CYTOSINE AND 5-METHYLCYTOSINE,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
J. P. Gould, J. T. Richards, and M. G. Miles.
Water Research, Vol. 18, No. 8, p 991-999, 1984. 11 Fig, 3 Tab, 13 Ref.

Descriptors: *Chlorination, *Cytosine, *Methylcytosine, *Organic chloramines, Hypochlorous acid, Chlorohydrins, Hydrogen ion concentration, Chlorinated hydrocarbons, Chemical reactions.

The interaction of aqueous hypochlorous acid with the aminopyrimidines, cytosine and 5-methylcytosine has been investigated. Analysis of the reaction mixtures indicated substantial formation of chlorine substitution and addition products with little reduction of chlorine to chloride. Very high levels of combined chlorine were observed. Ultraviolet spectra showed complex patterns of behavior with peak shifts and intensity changes occurring some cases and full loss of aromaticity in others. The latter process was suggestive of addition of HOCl to double bonds with formation of chlorohydrins. The behavior was found to depend on reaction pH and chlorine to base ratios. Thin layer chromatography revealed complex patterns of stable chloramine formation with the reaction mixture complexity tending to increase with increasing pH and FAC/base ratios. Chemical ionization mass spectra disclosed the existence of a number of organic chloramines containing up to three chlorine atoms and, in the case of 5-methylcytosine a major ring cleavage and rearrangement product of as yet undefined structure. The half-life for the decay of the combined chlorine was found to be approx. 3.9 days and to be independent of precursor compound and pH. (Author's abstract)
W85-01726

FORMATION AND REMOVAL OF MUTAGENIC ACTIVITY DURING DRINKING WATER PREPARATION,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands). Chemical Biological Div.
H. J. Kool, and C. F. Van Kreijl.
Water Research, Vol. 18, No. 8, p 1011-1016, 1984. 5 Fig, 5 Tab, 19 Ref. Netherland Cancer Society grant RID 80-1.

Descriptors: *Mutagenic activity, *Chlorination, *Ozonation, *Drinking water, Water treatment, Ames test, Filtration, Sand filters, Activated carbon, Mutagens.

The influence of different treatment processes on the mutagenic activity (Ames test) and some chemical parameters in water were investigated in a few waterworks. Application of a chlorine treatment generally increased the direct and promutagenic activity, but the extent increase proved to be dependent on the type of water chlorinated. The use of ozone in the preparation of drinking water decreased the mutagenic activity in the water. The extent reduction was also dependent on the type of water ozonated. Dune filtration greatly reduced the mutagenic activity. Slow sand filtration could not be evaluated, because of the toxicity of the organic concentrates for the bacterial strains. Granular activated carbon filters, in operation for about 1 year, reduced the mutagenic activity below the detection level. A similar filter which has operated for more than 1.5 years in a pilot plant, showed a breakthrough of mutagenic activity suggesting that carbon filters are able to remove organic mutagens for a limited period. The results of the chemical parameters measured before and after the different treatment processes showed that none of these parameters were a reliable indicator for the mutagenic activity. (Author's abstract)
W85-01728

CHLORINE AS AN ALGICIDE IN A CONVENTIONAL WATER TREATMENT PLANT,
American Univ., Beirut (Lebanon). Dept. of Environmental Health.
J. Ibrahim, L. Squires, H. Mitwalli, and M. Taha.
International Journal of Environmental Studies, Vol. 20, No. 1, p 41-46, 1982. 1 Fig, 2 Tab, 12 Ref.

Descriptors: *Water treatment facilities, *Algicides, *Chlorination, *Beirut, *Lebanon, Prechlorination, Algal growth, Tropical regions.

The Beirut, Lebanon, Water Treatment Plant is of conventional design, and processes between 147,000 and 190,000 cu m of water per day. Algae grow abundantly in the various treatment units of the plant, particularly during spring and summer. Algae in the water entering the plant and algae growing within the plant cause severe management and operational difficulties. A study was conducted to determine the dose of chlorine lethal to the algae which were causing operational difficulties. In laboratory experiments, a single dose of 1.8 mg/l of chlorine was sufficient to kill all the algal taxa growing in the plant. If the chlorine dose was regenerated to the original concentration every 24 hours, then a dose of 1.2 mg/l was sufficient. In field studies, continuous dosing of chloride to maintain a residual chlorine level of 0.8 mg/l was found lethal to the algal taxa. Prechlorination is therefore recommended as an effective method for the control of algal growth in conventional water treatment plants in the tropics. (Moore-IVI)
W85-01749

MICROBIAL CONTAMINATION OF POTABLE WATER IN DISTRIBUTION SYSTEMS,
Vermont Univ., Burlington. Dept. of Civil and Mechanical Engineering.
D. R. Hemenway.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202456, Price codes: A03 in paper copy, A01 in microfiche. Vermont Water Resources Research Center Completion Report, September 1983. 25 p, 2 Tab, 5 Ref, 1 Append. Project No. OWRT A-045-VT(1).

Descriptors: *Drinking water, *Potable water, Water distribution systems, *Coliforms, Water conveyance, Enterobacter, Psuedomonas, Flavobacterium, Citrobacter, Aeromonas, Serratia, Klebsiella, Bacteria, *Vermont, Microorganisms, Microbiological studies, Champlain, Rutland City.

Drinking water from two sites in Vermont were sampled and analyzed to examine the relationships among water source, prevailing treatment practices and the quantity and identity of the microorganisms in the distribution systems. Samples of raw water or settled raw water, water immediately after treatment, and at three locations at the end of the distributions systems were taken from the Rutland City water system and the Champlain Water District system. Turbidity, free and total chlorine, pH, conductivity, total coliform count and low power microscopic estimation of the bacteriological densities were performed on each sample. Predominant organisms from the total and fecal coliform and standard plate counts were routinely isolated and identified. Coliform bacteria were not found in the distribution network of either system during the sampling period. Fecal coliform in the raw water at Champlain Water District accounted for approximately 9% of the total coliform count, while in Rutland no fecal coliform were found after prechlorination of the raw water in this system. Seventy-four percent of the organisms identified in the treated water belonged to the Family Pseudomonadaceae. Presumably these organisms colonized the distribution system.
W85-01796

STATUS OF REVERSE OSMOSIS VS. ION EXCHANGE FOR PETROLEUM/PETROCHEMICAL UTILITIES,
H. S. Bourgeois, Jr.
Industrial Water Engineering, Vol. 21, No. 2, p 14-18, 1984. 2 Fig, 4 Tab, 2 Ref.

Descriptors: *Reverse osmosis, *Ion exchange, *Water treatment, *Industrial water, Dissolved solids, Particulates, Membrane processes, Pretreatment, Oil industry.

With the advent of Reverse Osmosis in the late 1960's, an alternative process to straight ion exchange became available to industry for the removal of dissolved solids. Reverse Osmosis (RO) has been utilized extensively in the electronics industry for the preparation of 'ultra-pure' water used primarily in the manufacture of semi-conductors. RO provides the added advantage of essentially complete particulate removal, along with dissolved solids removal, prior to final polishing by ion exchange. There also has been widespread application of RO in conjunction with ion exchange in the electric utility industry to provide feedwater for high pressure steam generators. To date, Reverse Osmosis has seen very limited use in this country in the petroleum/petrochemical industry. This is probably the result of the availability of good quality water supplies in the areas where these industries are located. Since 1979, the c of regeneration chemicals and ion exchange r have increased rapidly compared to R.O. m branes and Reverse Osmosis with ion exch polishing has become economically attrac when compared to straight ion exchange at lo dissolved solids levels. The most important fa in the design and successful operation of a s system is proper pretreatment to protect the m brane against fouling. The principle aspects of treatment are discussed followed by an econo evaluation of Reverse Osmosis versus straight exchange for three typical Gulf Coast water plies. (Author's abstract)
W85-01853

DEVELOPMENT OF THE CONDITION THE BALDEGGERSEE (1900 TO 1980) A THE EFFECT OF INTRALAKE PROCEDUI (DIE ZUSTANDSENTWICKLUNG DIS B DEGGERSEES (1900 BIS 1980) UND DIE A WIRKUNG VON SEEINTERNEN MASSN. MEN),
For primary bibliographic entry see Field 5C.
W85-01865

STATE-OF-THE-ART FOR ELECTRO GRADE ULTRAPURE WATER MANUF TURING AND DISTRIBUTION, PART I,
Anatel Instrument Corp., Boulder, CO.
C. F. Firth, Jr.
Journal of Environmental Sciences, Vol. 27, No p 22-26, July/August, 1984. 4 Tab.

Descriptors: *Water treatment, *Ultrapure wa Standards, Monitoring, Trace elements, W quality control, Electronics industry, Reverse mosis, Ion exchange.

Ultrapure water is essential for producing semic ductor devices. The methods of monitoring tr contaminants, materials of construction, and dis bution from the central production area to po of use are very important in designing the ri system. Standards are being proposed for levels water quality by organizations such as the Am can Society for Testing and Materials to assist manufacturing and engineering personnel. In selection of primary treatment, the basic quest of reverse osmosis versus ion exchange econom is a never-ending discussion. In the 50-300 m grams of total dissolved solids per liter range decision must be based on the type of contamina to be removed from the water system. If extens pretreatment is required to protect the reve osmosis membrane, then deionization should considered. If the ultrafiltration characteristics the RO membrane outweigh the other facts, verse osmosis is the obvious choice. When water reaches the polishing stage, the majority constituents has been reduced to a very low lev The ionic concentration has been controlled a final removal of trace amounts of the dissolv inorganic material requires special steps. It is misconception to feel that the water has be treated to such a point that the other contamina have likewise been reduced. (Baker-IVI)
W85-01873

EXECUTION OF SOCIALIST BUSINESS MA AGEMENT IN THE CONTINUATION OF TH COLBITZ MOVEMENT (DIE DURCHSETZU DER SOZIALISTISCHEN BETRIEBSWIRT CHAFT IN FORTFUHRUNG DER COLBITZ BEWEGUNG),
VEB Wasserversorgung und Abwasserbehan lung, Magdeburg (German, D.R.)
R. Wernecke.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 1 17-18, January, 1984. 4 Ref.

Descriptors: *Water treatment, *Colbitz, *E Germany, Costs, Management, Water use, Optin zation, Water treatment facilities, Automation.

At the Colbitz waterworks, German Democra Republic, efforts were begun at the end of 1970s increase performance. Waterworks capacity w increased by 154,000 cu m/day between 1976 a

the goal being a total increase of 204,600 cu
y by 1985. During the same period, water
increased from 10 to 11%, supply of water
nd rose from 75.9 to 92.0%, 68 jobs were
ated, and annual production costs dropped
0-1.5 million Marks. This was achieved by
ving weak spots in the production process
ut expanding the facility. The second step of
ovement consisted of rationalization of water
nd optimization of water network operation.
nal models for the Colbitz-Letzlinger Heide
ground reservoir and operation of the Mag-
g network were developed. Analyses were
of scientific and technological developments
regard to their impact on the workforce and
e quality of water and water facilities. Work-
ill have to be more highly educated in future,
e introduction of micro-electronics is inevita-
For further development of the Colbitz move-
the Magdeburg water-supply and
water-treatment facility was given the task of
g new methods of automation and process
ol. Intensive analyses of the production proc-
were carried out, in particular, analysis of
ng conditions as a basis for the development
concept for optimal production. The introduc-
f an achievement-oriented pay scale is impor-
(Gish-IVI)
01876

**STRUCTION OF RATIONALIZATION
IPMENT AT THE ROSTOCK WATER-
PLY AND WASTEWATER-TREATMENT
ILITY (RATIONALISIERUNGSMITTEL-
IM VEB WASSERVERSORGUNG UND
ASSERBEHANDLUNG ROSTOCK),**
Wasserversorgung und Abwasserbehand-
Rostock (German, D.R.).
chofer.
erwirtschaft-Wassertechnik, Vol. 34, No. 1, p
), January, 1984. 3 Fig.

riptors: *Water treatment facilities,
stewater treatment facilities, *Rostock, *East
many, Chlorination, Water treatment, Filtra-
Automation.

workshop was given to the Rostock water-
ly and wastewater-treatment facility for the
ose of building rationalization equipment be-
ng in 1977. During its first year, the workshop
uced equipment worth 70,000 Marks, increas-
to 338,000 Marks in 1980. Construction of
nalization equipment on-site plays a large part
e 1981-85 five year plan, especially in terms of
stry-specific items that cannot be completed
where or provided by East German businesses,
ernizing existing equipment, and producing
e parts. At Rostock, industry-specific equip-
has been developed in innovator collectives
has resulted in the construction of a transport-
drinking water treatment station, a transport-
pressure station, a chlorine-dosage station that
be mounted on a trailer, electronic transmitter
surement, and automatic filter aeration and
ilation. The water-treatment station was de-
ed for backup during reconstruction or heavy
ution but could also be used as an independent
erworks in rural areas. (Gish-IVI)
5-01877

**MPUTERIZED DISTRIBUTION RECORDS-
OD PAVES THE WAY,**
ohue and Associates, Inc., Waukesha, WI.
Curtiss, and P. A. Lohmiller.
nal of the American Water Works Associa-
, Vol. 76, No. 7, p 56-61, July, 1984. 3 Fig, 2
, 4 Ref.

criptors: *Computers, *Water distribution,
akage, Water audit, Mapping, Sewer systems,
er conveyance.

findings of a water audit and leak detection
stigation generated input for a new computer-
ed drafting and design system (CADD) for the
of Des Plaines, Ill. Installation of the comput-
ed system will upgrade the usefulness and ac-
acy of documents pertaining to the city's water
sewer systems. Immediate benefits were real-
from the discovery of significant leakage, and long-range benefits will be realized from the inherent flexibility of the CADD system and the ease with which up-to-date records can be maintained. Graphic overlays on base maps of the city can be generated in hard-copy form to produce the graphic and nongraphic data needed for a given use. These data, stored in CADD, will also be of use to other municipal departments. (Author's abstract)
W85-01902

MICROCOMPUTER PROGRAMS FOR DESIGNING WATER SYSTEMS,
Public Works Dept. of Malaysia, Kuantan.
For primary bibliographic entry see Field 8A.
W85-01903

CALIBRATING WATER SYSTEM MODELS,
Denver Water Dept., CO.
A. L. Cesario, and J. O. Davis.
Journal of the American Water Works Association, Vol. 76, No. 7, p 66-69, July, 1984. 8 Ref.

Descriptors: *Water conveyance, *Model studies, *Computers, Water distribution, Calibration.

Calibration of network models is an integral part of water distribution system analysis. Telemetry data and field measurements of the system provide base data for calibration, but computer programs that automatically extract and compare pertinent data with simulated values can aid the process. Calibration establishes the credibility of the model that is used as a benchmark case for studies and as a predictor. Sources of error or inaccuracies include improper network definition or demand distribution, or both. The degree of confidence as a model should be fine-tuned is related to the complexity of the model and to the purpose of the study. A thorough knowledge of operation and performance of the system is gained through the process of calibration. This may be more important than the degree of accuracy of calibration, since modeling is often more concerned with changes than with absolute values. (Moore-IVI)
W85-01904

COMPUTER MODELING IN WATER SYSTEM PLANNING AND DESIGN,
Krebs (Paul B.) and Associates, Inc., Birmingham, AL.
R. U. Harris.
Journal of the American Water Works Association, Vol. 76, No. 7, p 78-81, July, 1984. 2 Fig, 7 Ref.

Descriptors: *Computer models, *Water distribution, *Design, *Planning, Simulation, Model studies, Water demand, Water use, Hydraulic design, Emergency demand.

Benefits that can be derived from the use of hydraulic network computer modeling and analysis in the planning and design of water systems include: data management; evaluation of variations in consumption; simulation of emergency water demands; effect of new water demands; optimization of system operation; long-range planning, facility design, and comprehensive knowledge of the system. Case studies of applications in Charlottesville, Va., Decatur, Ala., and Opelika, Ala. are presented. The availability of low-cost, efficient hydraulic network analysis computer software, and the continuing reduction in the cost of computer hardware, enhances the benefits of simulating the hydraulic conditions of water systems with properly developed and calibrated models. (Moore-IVI)
W85-01906

COMPUTER-ASSISTED WATER SYSTEM ANALYSIS AND DESIGN FOR CHARLESTON, S.C.,
CH2M Hill, Montgomery, AL.
R. E. Topping, and R. J. Puccia.
Journal of the American Water Works Association, Vol. 76, No. 7, p 83-89, July, 1984. 3 Fig, 4 Tab, 5 Ref.

Descriptors: *Computer models, *Water distribution, *Charleston, *South Carolina, Cost analysis, Pipes, Water storage, Pumps, Energy costs.

A computer model was developed and used to analyze all components of the Charleston, S.C. water distribution system in anticipation of improving the system to meet future demands. After limitations and deficiencies were identified, cost-effective improvements to piping, storage facilities, service pumps, and booster pumps were recommended. An improved operations program, which included a power management plan that resulted in substantial savings in energy costs, was also determined with the computer model. (Author's abstract)
W85-01907

FLOCCULATION MODEL TESTING: PARTICLE SIZES IN A SOFTENING PLANT,
Texas Univ. at Austin. Dept. of Civil Engineering.
D. F. Lawler, and D. R. Wilkes.
Journal of the American Water Works Association, Vol. 76, No. 7, p 90-97, July, 1984. 13 Fig, 1 Tab, 25 Ref. EPA grant R-808192-01.

Descriptors: *Flocculation, *Particle size, *Water treatment, Mathematical models, Fluid shear, Turbidity, Suspended solids.

Designing an efficient and cost-effective flocculation unit has always been a challenge to engineers. Measurements of its capability have necessarily been after the fact - examining turbidity or suspended solids concentration after settling. Particle-size-distribution analyses during flocculation more closely reflect the actual process but are difficult, time-consuming, and prone to sampling errors. Research using Smoluchowski's equation has led to a mathematical model for the process of flocculation. This model was tested against actual treatment plant performance for particle size distribution. Using different conditions, the model successfully predicted changes in small or large particles, but not both. The model compared favorably with most experimental results but needs improvement to predict the effects of changes in fluid shear and particle concentration. (Author's abstract)
W85-01908

LOWER DETECTION LIMITS FOUND FOR CHLORINE DIOXIDE CONTAMINANTS,
Miami Univ., Oxford, OH. Dept. of Chemistry.
G. Gordon, and Y. Ikeda.
Journal of the American Water Works Association, Vol. 76, No. 7, p 98-101, July, 1984. 3 Tab, 23 Ref.

Descriptors: *Chlorates, *Chlorites, *Chlorine dioxide, Water analysis, Disinfection, Water treatment, Hypochlorites, Idometry, Potentiometry.

Chlorine dioxide disinfection of water eliminates trihalomethane formation but generates chlorate and chlorite ions. Government regulations under consideration would require the removal of these by-products to levels for which no detection methods exist. An iodometric-potentiometric method is developed to measure chlorate, chlorite, and hypochlorite ions, even in mixtures that contain high hypochlorite ion concentrations such as those frequently observed in a water treatment plant. This method can also be used to determine directly the concentration of chlorite ion, in contrast to other indirect methods. Measurements of synthetic mixtures that contain these ions can be carried out with an accuracy of + or - 3% at the 0.3-mg/L level, with lower limits of 0.1 mg/L. (Moore-IVI)
W85-01909

SEDIMENTATION SUCCESS FROM MODIFIED JAR TESTS,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
G. D. Reed, and D. A. Reece.
Journal of the American Water Works Association, Vol. 76, No. 7, p 101-105, July, 1984. 8 Fig, 1 Ref.

Descriptors: *Sedimentation, *Jar tests, *Wastewater treatment, Turbidity, Filtration, Flocculants, Hydraulic comparison equation, Flow rate, Residence time.

Delivery of clear water from settling basins to filtration systems is important for the smooth operation of a treatment plant. But operators work at a disadvantage when they cannot determine what is happening during the sedimentation process. Incomplete settling allows turbid outflows to reach filters, shortening their runs and adding to water quality costs. A modified jar test method for modeling basin behavior has been designed. It uses a hydraulic comparison equation sensitive to basin flow rates, water residence times, and flocculant dosages. When properly calibrated, it can reflect actual basin performance, detect problems, and point to areas where solutions may be found. (Author's abstract)
W85-01910

ANN ARBOR CONTROLS TRIHALOMETHANES,
Michigan Dept. of Public Health, Lansing.
R. S. Sacks.
Journal of the American Water Works Association, Vol. 76, No.7, p 105-108, July, 1984. 6 Fig, 3 Tab, 6 Ref.

Descriptors: *Trihalomethanes, *Water treatment, *Ann Arbor, *Michigan, Drinking water, Disinfection, Chlorine, Chloramines, Anhydrous ammonia, Halogenated hydrocarbons.

A maximum contaminant level (MCL) was established by the EPA for total trihalomethanes (TTHMs) in public drinking water supplies. Many water treatment plants need new methods to control the formation of trihalomethanes as by-products of existing disinfection practices. The city of Ann Arbor, Michigan experimented with a variety of disinfection schemes using chlorine and chloramines. Anhydrous ammonia, added to the raw water after prechlorination, reduced TTHM concentrations to required levels without sacrificing bacteriologic quality, as determined by routing plate count samples. (Moore-IVI)
W85-01911

EFFECT OF TREATMENT WITH A COMMERCIAL BACTERIAL SUSPENSION ON WATER QUALITY IN CHANNEL CATFISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
C. E. Boyd, W. D. Hollerman, J. A. Plumb, and M. Saeed.
Progressive Fish Culturist, Vol. 46, No. 1, p 36-40, January, 1984. 3 Fig, 1 Tab, 11 Ref.

Descriptors: *Catfish farming, *Bacteria, *Biological treatment, *Water pollution treatment, Saprophytic bacteria, Bacillus, Nitrobacter, Pseudomonas, Aerobacter, Cellulomonas, Rhodopseudomonas, Nitrogen, Phosphorus, Chemical oxygen demand, Biochemical oxygen demand, Chlorophyll a, Cyanophyta, Phytoplankton, Fish farming, Aquaculture.

Water quality deterioration and off-flavor in fish are common problems in the commercial culture of channel catfish (Ictalurus punctatus). Four I. punctatus ponds were treated with a commercial suspension of saprophytic bacteria (Aqua-Bacta-Aid) consisting of Bacillus, Nitrobacter, Pseudomonas (two strains), Aerobacter, Cellulomonas, and Rhodopseudomonas. Concentrations of inorganic nitrogen, total phosphorus, chemical oxygen demand, 5-day biochemical oxygen demand, and chlorophyll alpha; numbers of bacteria and phytoplankters per milliliter; and percentage of bluegreen algae did not differ significantly ($P > 0.05$) between treatments on any sampling date. On three sampling dates between mid July and mid August, there were significantly higher ($P < 0.05$) dissolved oxygen concentrations in the morning and in the afternoon on ponds treated with the bacterial suspension. Fish production did not differ between treatments ($P > 0.1$). The bacteria applied in the suspension are common saprophytic bacteria that are known to inhabit freshwater and terrestrial environments. The quantity of bacteria applied was quite insignificant compared to the natural bacterial community. (Collier-IVI)
W85-01922

DATA BANK FOR WATERWORKS AND FACILITIES - GOALS AND PROBLEM-SOLVING CONCEPT (DATENBANK WASSERWERKE UND ANLAGEN - AUFGABEN UND LOSUNGSKONZEPTION),
Institut fuer Wasserwirtschaft, Berlin (German D.R.).
E. Tutsch, and H. Weruschek.
Wasserwirtschaft-Wassertechnik, Vol 33, No. 2, p 46-49, February, 1983. 2 Fig, 2 Tab, 4 Ref.

Descriptors: *Water treatment facilities, *Computers, *East Germany, Data processing, Data storage and retrieval, Data collections, Planning, Water quality Water supply.

The goal of a data bank projected for German Democratic Republic waterworks and facilities is to provide decision-making information with regard to materials and energy use, to improve the cost-benefit ratio, and to secure the water supply. The data bank will be instrumental in the development of one-year, five-year, and long-range plans. Studies of user information needs showed that data analysis should be supplied in the areas of facility capacity, water quality, technology and operating regimes, planning for facility construction/expansion, and maintenance. The projected data bank will be centralized. Primary data will be very heterogeneous, comprising about 80% of total stored data (the remaining 20% being results and control data) and consisting of core data, e.g., technological, construction, economic, and capacity figures; aperiodic variable data, e.g., damages, run times; and periodic variable data, e.g., water quality, groundwater conditions, energy consumption. The project will require a mainframe computer; (an ESER ES 1040 or 1055). Four developmental stages are planned: creation of core data from waterworks, pressure increasing facilities, reservoirs, and water-supply areas, of the analysis call-up system, frame program, and universal analysis program system; integration of data from water-intake facilities and wells; integration of data from water-treatment plants and completion of data search capability; integration of water-conveyance data and capability for input and output via CRT. (Gish-IVI)
W85-01969

OBSERVATIONS FROM THE TEST OPERATION OF AN ION-EXCHANGE FACILITY FOR NITRATE REMOVAL IN DRINKING-WATER TREATMENT (ERFAHRUNGEN AUS DEM ERPROBENGSBETRIEB EINER IONENAUSTAUSCHERANLAGE ZUR NITRATELIMINATION IN DER TRINKWASSERAUFBEREITUNG),
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
K. Wiegleb, C. Scholze, S. Bierhals, and H. Elsner.
Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 69-70, February, 1983. 1 Tab, 5 Ref.

Descriptors: *Ion exchange, *Nitrates, *Water treatment, *Gera, *East Germany, Drinking water, Chlorides, Regeneration, Automation.

An ion-exchange facility (IE) for the removal of nitrate in water treatment has been in use since 1980 at the Gera (German Democratic Republic) water- and wastewater-treatment plant. Its capacity is 200 cu m/-day. Before treatment, the water contains 40-70 mg/l NO3(-) and 12-30 mg/l Cl(-). Expressed in effective volume capacity (EVC), nitrate elimination corresponded well to a previously published model, despite differing operating conditions. Nitrate levels in treated water were depending on regenerating conditions 10-18 mg/l, which was 2-7 mg/l above those predicted for small facilities. These results were not achieved and required a longer operating cycle. The increase in chloride produced by the IE in treated water also corresponded well to the published theory with levels of 80-120 mg/l. MgCl2 brine was chosen as the regeneration chemical, so that the concentrated portion of wastewater produced by regeneration of total wastewater (about 16%) could be used for melting snow on the streets. The concentrated wastewater consisted of elutriate and rinse water, which was collected separately from the remaining regeneration wastewater and contained > 5-10 g/l chloride (10-15% salt solut Frequent problems occurred in automatic nit measurement, requiring changing the membr refilling the electrode with electrolytes, and moving air bubbles from the reference electr Total automation or regeneration every 3-7 da recommended for small facilities to ensure nomical operation and compliance with stand for nitrate in drinking water. (Gish-IVI)
W85-01974

APPROPRIATE WATER SUPPLY TECHN OGY FOR DEVELOPING COUNTRIES,
I. Mirchandani.
Aqua, No. 1, p 11-18, 1983. 9 Fig.

Descriptors: *Water supply development, *De oping countries, *Ethiopia, Hydrams, Po Windmills, Springs, Pumps, Dams, Drink water, Storage reservoirs, Water storage, Ciste Appropriate technology.

In Ethiopia only 4 to 5% of the people in r areas have access to drinking water, and i unlikely that the entire population of the cou will have access to potable drinking water in next few decades. Innovative practices within capacity of the community to implement can l to universal use of potable drinking water consequent improvement in health standards. isting sources of supply of water can be used v improvements that enable communities to use same water but in an uncontaminated form as acceptable standards. Appropriate technolo consist of use of ponds, spring development, drams, windmills, current water lift pumps, water storage, subsurface dams, and monitoring ground water resources in drought affected ar (Wheatley-IVI)
W85-01981

PRACTICAL WATER TREATMENT FOR CO MUNITIES IN DEVELOPING COUNTRIES,
North Carolina Univ. at Chapel Hill. Area Hea Education Centers Program.
D. A. Okun, and C. R. Schulz.
Aqua, No. 1, p 23-26, 1983. 6 Fig, 1 Tab, 6 F

Descriptors: *Water treatment, *Appropriate te nology, *Developing countries, Economic aspe Filtration, Coagulation, Sedimentation, Coa lants, Flocculation, Groundwater, Drinking wa

Rather than transferring water treatment techno gy from industrialized countries to develop countries, simple low maintenance methods more practical. Groundwater is the prefer choice for community water supplies, as it gene ly does not require treatment. If no suita aquifers are available, relatively clear waters fr lakes or streams are best treated by slow sa filtration. Pretreatment may be provided by pl sedimentation or horizontal roughing filters pr to slow sand filtration. Only as a last resort shou chemical coagulation and rapid sand filtration adopted. Even then, only simple, practical techn ogies such as hydraulic rapid mixing and floccu tion, horizontal-flow sedimentation, and manua operated filters should be used. Methods of util ing self-backwashing filters are suggested incor rating the flow from other filter systems and tered water levels. The use of natural coagulants water treatment is one economic technology p sented. Locally available plant materials can used, such as seeds of the nirmali tree, extra from the tamarind tree, guar plant, and red sore plant. Fenugreek and lentils can be utilized f effective coagulants. Chitosan from exoskeletons arthropods is one of the most effective coagula available.
W85-01983

WATER SUPPLY OF ALEXANDRIA EGYP
Zurich Water Supply (Switzerland).
M. Schalekamp.
Aqua, Vol. 1983, No. 1, p 31-41, 1983. 20 Fig, Ref. (In English and French).

criptors: *Water treatment, *Potable water, ypt, *Alexandria, Nile River, Canals, Floccula- , Coagulation, Settling basins, Water supply elopment.

xandria, Egypt, obtains its water primarily n the Nile River. Because of evaporation and er water loss mechanisms, most of this water is sported via artificial canals. Water treatment is tively simple: flocculation and filtration. A ew of the main water treatment facilities is en. An expansion of water treatment and deliv- systems is underway. New pumping plants and elines are being constructed with more that 70 ion Egyptian pounds being spent from 1978 to 1. In order to meet the forecasted needs for n quality water for Alexandria and environs, nsive construction and financial plans are being nulated. (Wheatley-IVI)
5-01985

L ABOUT OZONE - ITS ADVANTAGES D DISADVANTAGES IN TREATING TER,
ich Water Supply (Switzerland).
Schalekamp.
ua, No. 3, p 89-96, 1983. 38 Fig, 21 Ref.

scriptors: *Water treatment, *Ozonation, *Swit- land, Review, Disinfection, Monitoring, Ozone, nking water.

e history of the use of ozone in Switzerland as agent for water treatment is briefly reviewed. ts conducted in Zurich and St. Gall reveal that ndly-treated and ozonized water should in no y enhance regermination of microorganisms in water mains any more than nonozonized water. s is confirmed also by those Swiss waterworks ich ozonize their ground and spring water and not notice any form of regermination in their ter mains. A comparison is made of the effects reating water with 1 or 5 mm ozone/liter. With ard to the destruction of bacteria and inactiva- n of viruses in water of not too high a degree of tamination, a higher concentration of ozone n 1.0 to 1.5 is not needed. Before selecting the per dosage, an exact analysis is needed as to at the ozone is to be required to do. Ways to nitor and control the ozone concentration of the ter and in the exhaust air of treatment plants are cribed. (Baker-IVI)
5-01986

UDY OF MUTAGENIC ACTIVITY IN ATER IN A PROGRESSIVE OZONATION IT (ETUDE DU CARACTERE MUTAGENE L'EAU DANS UNE FILIERE DE PRODUC- ON A OZONATION ESTAGEE),
mpagnie Generale des Eaux, Paris (France).
M. Bourbigot, J. L. Paquin, L. H. Pottenger, F. Blech, and P. Hartemann.
ua, No. 3, p 99-102, 1983. 3 Fig, 2 Tab, 13 Ref.

scriptors: *Ozonation, *Mutagenic activity, ater treatment, Drinking water, Activated bon, Chlorination, Toxicity.

mples of water were collected at various points ng a drinking water treatment process which ludes several ozonation stages, activated carbon ration and postchlorination. They were concen- ted on XAD-4 and XAD-8 resins (x 700 at 000), and eluated with DMSO. The concen- tes were assayed o two strains of Salmonella himurium (TA 98 and TA 100) and on Chinese mster lung cells (V79). The mutagenecity test on 79 cells was more sensitive and provided more formation than the bacteria test, and allowed termination of mutagenic, initiator and promoter tivities. These appeared only in the raw river d at the head of the treatment line. With the cteria test, the positive results were obtained ly on strain TA 98. No mutagenic activity was und in samples of water from the final treatment ges. The results obtained with ozonated water emed to indicate that optimization of ozone treat- ent improves the water's characteristics with re- ect to potentially mutagenic organic molecules. ith an adequate ozone dosage, the mutagenic and omoter activities disappear. (Author's abstract)
85-01987

NICE ON THE FRENCH RIVIERA - THE BIRTHPLACE OF DRINKING WATER TREATMENT WITH OZONE (NICE, SUR LA RIVIERA FRANCAISE - BERCEAU DU TRAITEMENT DE L'EAU PAR L'OZONE),
Compagnie Generale des Eaux, Paris (France).
P. Decourcelle.
Aqua, No. 3, p 105-110, 1983. 9 Fig.

Descriptors: *Nice, *France, *French Riviera, *Ozonation, *Drinking water, *Water treatment facilities, Disinfection, Filtration, History.

It was in 1904 that the Nice Administration decided to provide the municipal waterworks with facilities for disinfection of water with ozone - the very first in the world. The plant was also to serve as a center for the study of effects of ozone on water, carried out by Marius-Paul Otto, a researcher from Nice. The waterworks was named Bon-Voyage and, at the start provided treatment at a rate of 100 cu m/h. Following receipt of favorable results, the plant's production rate was increased several fold in 1907 to exceed 22,500 cu m/day, and the Nice Administration went ahead with construction of a waterworks using ozonation at Rimiez; then again in 1925, a third one at Saint-Pierre de Feric. The latter two could each accommodate a disinfection rate of 13,000 cu m/day. Soon after, in rapid succession, ozone disinfection procedures were adopted for the use in all cities on the French Riviera situated between Nice and Menton. It is common knowledge now that the popularity of ozone has since spread throughout the world. Continued population growth had, by 1935, necessitated supplementing the surface water supply with groundwater sources which were derived, by a system of wells installed along the riverbank, from aquifers in the Var region. Thus, a pumping rate of 90,000 cu m/day has been attained with a water made naturally potable thanks to the good filtration capacity of the Var gravel beds. In 1969, the municipal administration decided to replace the three waterworks employing ozonation (as they now had become insufficient to meet city needs and the equipment was timeworn) with only one plant, able to function at a rate of 90,000 cu m/day; the Super-Rimiez Treatment Plant, inaugurated in 1972. Water here is treated using the latest techniques including, of course, ozonation. The architecture and landscaping of this waterworks have been especially successful. In 1982, the Jean Moreno plant producing 90,000 cu m of potable water per day, including an ozonation stage, was inaugurated. (Author's abstract)
W85-01988

CONTROL OF METAL CONTAMINANTS IN DRINKING WATER IN DENMARK,
Korrosionscentralen ATV, Glostrup (Denmark).
K. Nielsen.
Aqua, No. 4, p 173-182, 1983. 15 Fig, 15 Ref.

Descriptors: *Drinking water, *Denmark, *Plumbing, *Trace metals, *Heavy metals, Domestic water, Lead, Cadmium, Nickel, Copper, Zinc.

Traces of metals are dissolved when water is transported in mains and in house installations. Some of these metals are toxic at sufficiently high concentrations. Even when lead pipes are not used, lead can be picked up from house installations in considerable amounts. Cadmium can be found in small amounts in both pipes and fittings, but it can and should be avoided. High concentrations of other metals such as nickel, copper and zinc should be prevented in drinking water. Field tests were made on metal pick-up from galvanized steel pipes of different manufacture, from brasses and from gun metal. Observations were made in three different types of water over a six-month period. A modified test method was developed for judging the magnitude of metal pick-up from fittings in drinking water installations. Pick-up of lead and cadmium from new house installations in Denmark is kept sufficiently low by the following measures: the use of lead-containing soft solder or cadmium-containing brazing metal for joining copper tubes is forbidden; and only approved fittings, tap valves, and other equipment to be installed may be used. The approval procedure includes a test for cadmium and lead pick-up. (Author's abstract)
W85-01993

REPORT ON THE WATER SUPPLY OF THE PEOPLE'S REPUBLIC OF CHINA,
Zurich Water Supply (Switzerland).
M. Schalekamp.
Aqua, No. 5, p 205-212, 1983. 30 Fig, 6 Ref.

Descriptors: *China, *Water supply, *Drinking water, *Water management, Resources management, Water resources development, Water supply development.

For the last four thousand years China has been the water-problem country par excellence. There were either big droughts or catastropic floods, which destroyed agricultural growth. Today, after the most immense effort - e.g. for the prevention of flood catastrophies 160 000 km of dams have been constructed along the rivers and more than 10 000 storage lakes with a total capacity of 400 billion cubic meters for regulation of run-off water, were realized. This means that now 75% or 75 million hectares of agricultural land are protected against such destruction. Everyone in China, whether they live in the country or the towns, is supplied with water. In rural areas 50% of the population receive their water from wells, i.e. the water must be fetched from the well and from the stand pipe, but at least it is clean. The other 50% of the rural population are supplied with water by means of a simple pressure water system and have one or two water taps in their houses. In the cities the largest part of the inhabitants are connected to a pressure water supply system. The Water Supply Beijing distributes 95% groundwater and 5% treated surface water. It is just the opposite in Shanghai. The city delivers 5% groundwater and 95% treated river water. In Beijing the water is hard. There are no quality problems only domestic problems with the calcification. Shanghai, on the other hand, has no domestic problems but quality problems, because the river is being increasingly polluted by waste water. The price of water amounts to 12 Fen or about SFr.0.13 per cubic meter. Compared to the gross national product per inhabitant of Switzerland, a cubic meter of water would cost 35 to 40 times as much or, expressed in Swiss Francs about 4.20 to 5.20. Considering the purchasing power then, our ancestors, one hundred years ago, had to pay the same price for water. (Author's abstract)
W85-01995

BACTERIA IN WORKS AND MAINS FROM GROUND WATER SUPPLIES,
Aarhus Univ. (Denmark). Inst. of Hygiene.
G. J. Bonde.
Aqua, Vol. 5, p 237-239, 1983. 1 Fig, 7 Tab, 7 Ref.

Descriptors: *Bacteria, *Water quality control, *Groundwater, *Water distribution, Microorganisms.

Many changes taking place in the numbers of microorganisms found in water between the works and the consumer premises are investigated. Tests are outlined to identify these organisms, and growths at different temperatures are recorded. These bacteria can spoil food, cause offensive taste and odor problems or give rise to discolored water. A total of 268 samples were examined: 118 from waterworks plants, 150 from mains. The counts at 30 degrees C show a rather uniform distribution as to magnitude in mains and works, although there is a tendency to slightly higher counts from the works. Counts at 21 and 37 degrees C, however, show more distinct differences. The counts obtained at these temperatures show a bimodal distribution, which supports theories of pollution and regrowth of different types of organisms. In distribution systems in tall buildings quite high temperatures may be attained during stagnation as over the weekends. Satisfactory supplies deteriorated in 46% of the hospital samples. In temperate water systems high counts of 10,000-50,000 per ml were found regularly and occasionally in ordinary supplies. (Baker-IVI)
W85-02001

FIRST EXPERIENCES WITH A WOMEN-SPECIFIC PROJECT FOR THE WATER DECADE,
S. A. A. Jahn.

Aqua, No. 6, p 275-276, 1983. 3 Ref.

Descriptors: *Developing countries, *Water treatment, *Sudan, Education, Drinking water, Flocculation, Turbidity, Water resources development, Coagulation.

Methods by which turbid waters may be used and cleaned using naturally occurring coagulation materials are described. Efforts are underway to train the local women in rural Africa (Northern Sudan) to make use of these methods in supplying their families with an adequate and clean water supply using water from rivers, irrigation canals, rain ponds, and artificial rain water storage basins. One method makes use of a simple village jar test. The response of different types of rural women to this clarification project is described. (Baker-IVI)
W85-02004

REMOTE MONITORING AND OPTIMISATION OF PUMPING AT THE SYNDICAT DES EAUX OF LA HAUTE-LOUE (TELESURVEILLANCE ET OPTIMISATION DU POMPAGE DU SYNDICAT DES EAUX DE LA HAUTE-LOUE),
P. Musquere, M. Dumontel, M. Bouverot, and B. Maison.
Aqua, No. 6, p 279-284, 1983. 8 Fig.

Descriptors *Drinking water, *Water treatment, *Water distribution, Computers, Economic aspects, Rural areas.

For a long period of time the automation of treatment of drinking water has been limited to large networks because the magnitude of the problems justified the use of data processing to find the solutions. With recent innovations it is possible that these techniques may soon be applied to medium sized rural networks at a reasonable cost. Remote monitoring and automatic control systems, simple but effective, can solve many problems and improve the service offered. Specific use of these modern techniques to solve problems at the Company Gaz et Eaux which is a subsidiary of the Lyonnaise des Eaux is cited as an example. The results of the experimental efforts conducted at this location appear to be promising. (Baker-IVI)
W85-02005

AUTOMATED SENSOR SYSTEMS FOR WATER RESOURCE POLLUTION WARNING AND TREATMENT PROCESS CONTROL,
Sunderland and South Shields Water Co. (England).
J. F. Wallwork, and G. Ellison.
Aqua, No. 6, p 313-320, 1983. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Monitoring, *Automation, *Water pollution, *England, Water treatment, Sensors, Rivers, Intakes.

Definition is given for an automated sensor system and its functional requirements are stated in relation to pollution warning and treatment process control. The choice of individual parameters to be continuously monitored is described for a river monitoring station which is charged with protecting a direct river abstraction water treatment works in North East England. Five years of operational experience of the station is reviewed with information given on improvements carried out at the station during that time period. General criteria are offered for automated sensor systems and areas where development of such systems are needed. (Baker-IVI)
W85-02010

REVIEW OF THE WATER SUPPLY IN THE SOVIET UNION,
Zurich Water Supply (Switzerland).
M. Schalekamp.
Aqua, No. 1, p 9-16, 1984. 24 Fig, 1 Tab.

Descriptors: *USSR, *Water supply, *Drinking water, Groundwater, Water quality standards, Water pollution control, Ozonation, Disinfection.

In terms of land area, the Soviet Union is the largest country in the world. For their drinking water supplies, the major cities such as Moscow depend almost entirely on surface water. The water supplies of the smallest cities and towns, as well as those in the rural districts, have sufficient groundwater available for their needs. In the Soviet Union 40% groundwater and 60% surface water are distributed. There are quality standards for raw water and for drinking water and laws are in force for the protection of the drinking water resources against pollution. On the average 650 l/person day are required in Moscow, i.e. 5.2 million cu m/day. All the water passes a very intensive treatment system. The largest ozone facility in the world with a capacity of 200 kg ozone/h is situated in the eastern part of Moscow. For water treatment in rural areas simple processes, which are however very effective, are in operation. In the whole country water can be drunk from the tap without any misgivings. Generally speaking, the water supply bodies are of a good standard. (Author's abstract)
W85-02012

MATARA WATER SUPPLY PROJECT IN SRI LANKA,
National Water Supply and Drainage Board, Colombo (Sri Lanka).
N. D. Peiris, and J. N. Jones.
Aqua, No. 1, p 17-25, 1983. 4 Fig, 1 Tab, 2 Ref.

Descriptors: *Water supply development, *Water management, *Sri Lanka, Design criteria, Water demand, Water supply, Developing countries.

Existing problems of a typical water supply operating in a developing country with system capacity well below present demands are delineated. The system has a cost recovery system which is inadequate to finance effective maintenance. There is also a lack of technical skills. The design philosophy adopted here has been to keep the supply system basic and straightforward, making best use of gravity for trunk and distribution systems, rationalizing pumping systems, designing treatment systems using minimum simple robust and easy to maintain mechanical and electrical plants and easy to operate with seim-skilled labor. The overall system is capable of extension both eastwards and westwards and there is sufficient capacity to meet the predicted demands for the year 2000. (Baker-IVI)
W85-02013

APPROPRIATE TECHNOLOGY TO IMPROVE DRINKING WATER QUALITY,
Techno-Consult, Karachi (Pakistan).
S. Ahmad, M. T. Wais, and F. Y. R. Agha.
Aqua, No. 1, p 26-31, 1984. 7 Fig, 2 Tab, 12 Ref.

Descriptors: *Water quality control, *Drinking water, *Water treatment, *Appropriate technology, Turbidity, Sedimentation, Urban areas.

Experimental results indicated that plain sedimentation could be effective as a pretreatment process to reduce the turbidity of raw water to as low as 10 NTU. Plain sedimentation is an appropriate technology to improve the quality of treated water and its aesthetic appearance especially in a developing country where skilled plant operation for the successful control of alum coagulation is absent. Apart from the direct effect of poor quality of the treated water on the community, it has an indirect adverse effect on the water supply system. For urban water management in a developing country, simple technical and technological alternatives should be given due consideration because of numerous factors like educational background, technical skill and surveillance attitude of local plant operators. (Baker-IVI)
W85-02014

2001 ... THE FUTURE OF WATER TREATMENT (2001 ... L'AVENIR DU TRAITEMENT DE L'EAU),
Compagnie Generale des Eaux, Paris (France).
For primary bibliographic entry see Field 6A.
W85-02017

DRINKING WATER IN DEVELOPING C... TRIES - THE MINIMUM TREATMENT ... LOSOPHY. A CASE STUDY,
Norconsult A/S, Sandvika (Norway).
For primary bibliographic entry see Field 3B.
W85-02018

OZONATION AND ACTIVATED CARBON ... TRATION: A CRITICAL EVALUATION,
J. G. Janssens, F. Van Hoof, and J. Dirickx.
Aqua, No. 2, p 102-107, 1984. 6 Fig, 9 Tab, ...

Descriptors: *Ozonation, *Activated carbon, ... tration, Water treatment, Organic carbon, Ch... ation, Drinking water.

Ozonation should not be considered as an add... al treatment unit process, but rather as an int... ed process in the total water treatment system... value of ozonation should therefore alwa... assessed as a function of its impact on the ... process of which a treatment line is composed ... conclusion of the present study can be summa... as follows. Ozonation prior to GAC filtr... lengthens the operating time of GAC filters b... 65%, when using a reduction of 1 mg/l TOC ... criterion. A dosage higher than 2 mg oz... added shows no additional effect. Additional ... of ozonation cannot be covered by cost-savin... reactivation of activated carbon. However, ... an AOC limit value is applied as a criterion fo... operating time, ozonation prior to GAC filtr... results in a significant shortening of the se... time of GAC filters. GAC filters remove the r... genic activity produced by prechlorination ... ozonation until 30 000 bed volumes of water ... been treated; in this respect, no difference is f... between filters receiving ozonated and non-oz... ed waters. (Author's abstract)
W85-02019

ULTRAVIOLET DISINFECTION OF WAT...
Katadyn Products, Inc., Wallisellen (Switzerl...
For primary bibliographic entry see Field ...
W85-02020

POTENTIAL USE OF ENZYMES AS CA... LYSTS IN DRINKING WATER FOR THE ... DATION OF TASTE CAUSING SUBSTAN...
Societe Lyonnaise des Eaux et de l'Eclairage, ... (France).
F. Fiessinger, S. W. Maloney, J. Manem, and J ... Mallevialle.
Aqua, No. 2, p 116-118, 1984. 3 Tab, 17 ...

Descriptors: *Water treatment, *Enzymes, D... ing water, Purification, Bacteria, Horseradish ... oxidase, Taste, Odor, Organic compounds, Ch... phenols, Phenols.

The efficacy of horseradish peroxidase is con... ered for the removal of 2-chlorophenol (2-CP... taste and odor compound, and pentachlorophe... (PCP), a wood preservative sometimes found ... contaminant in drinking water. These compou... were evaluated at low as well as high concer... tions, and in the presence of potentially compe... compounds. In all experiments, the removal ... greater than 95% for 2-CP. The enzyme and ... oxide concentrations were also varied with ... effect on the results. It appears from the study ... 100 units/l of horseradish peroxidase and 1 ... peroxide is sufficient for removal of low con... trations of 2-CP. The use of enzymes in drink... water treatment has several advantages over ... use of whole bacteria. Enzymes often have h... specificities for substrate, so there is better con... over the compound removed and the product p... duced. The enzymes concentration in the wate... controlled by the plant operator, thus there is ... dependence on the growth rate of the bacte... Bacteria require an incubation time to acclima... to the substrate and grow, but enzymes may ... added as needs require. (Baker-IVI)
W85-02021

ABLE WATER TREATMENT IN TROPI- COUNTRIES: RECENT EXPERIENCES) SOME TECHNOLOGICAL TRENDS,
ete Degremont, Rueil-Malmaison (France).
fouchet.
a, No. 3, p 143-164, 1983. 27 Fig, 13 Tab, 34

criptors: *Water treatment, *Drinking water, opical regions, Potable water, Water quality, imentation, Filtration, Ozonation, Disinfection, iews.

ent examples of the treatment of water prob- s in tropical countries are cited. While these nples are not exhaustive, they are divided into ips so as to point out the variety of the prob- s posed. The examples generally refer to sur- waters such as lakes, rivers, and impounded ers, but the treatment of underground water is referred to where applicable. Treatment prob- s due to the quality of raw waters such as high idities, eutrophication in the impounding reser- rs, entailing in particular the treatment of ers containing very large amounts of algae. tics naturally present in the water like arsenic fluorine, and aggressive waters are examined. st of these problems are due to the fact that ler tropical weather conditions, the differences ween the dry season and the rainy season are y pronounced. Waters also vary between very y and very high concentrations of minerals. chnical problems encountered are inherent to size of the plants, the space available, the rch for an optimum efficiency, the origin and iability of the waters. Problems are considered m the points of view of clarification, filtration, l ozonization. (Baker-IVI)
5-02022

RRENT WATER TREATMENT PRACTICES WESTERN INDIA - CASE STUDIES OF O METROPOLITAN CITIES, BOMBAY D AHMEDABAD,
ta Consulting Engineers, Bombay (India).
R. Kanga.
ua, No. 3, p 173-177, 1984. 2 Fig.

scriptors: *Water treatment, *India, *Bombay, hmedabad, Planning, Water management, inking water, Water resources development, ater supply development.

cities grow in size and complexity the oper- onal problems of the systems serving them in- ease both in scale and in complexity necessitating anges requiring the adoption of an integrated proach and the introduction of new simplified tterns. How this is being achieved currently in o of the largest cites in western India, Bombay d Ahmedabad, is described with particular refer- ce to the problems of water treatment. The nts as described are larger than any other so far talled in the country. Each city started develop- g its water supplies on entirely different lines, ch commencing with the exploitation of local urces. The overwhelming trend in each case has en a move toward simplicity in order to combat e problems which come with complexity. This ive toward simplicity is visible in the Master ans for each city. Bombay has had to switch er from gravity supply to one largely dependent pumping. Ahmedabad will have to phase out e tube wells and bores on which it has been so avily dependent in the past and switch over the rface supplies. Treatment of water is assuming ore importance in each city. The size of treat- ent facilities has also been increasing. These rger plants are vulnerable to situations where the ling up of a back log on washing operations one can throw the entire plant out of gear. By iopting the system of variable declining rates of tration such situations involving escalating fail- es can be much better controlled. In this system hen a filter bed gets choked and cannot take its rmal burden the load is automatically transferred other units in the same battery which are in a esher condition. (Baker-IVI)
'85-02024

OAGULATION AND RESTABILIZATION OF ARTICULATE, MACROMOLECULAR AND PROTECTED ORGANIC AQUASOLS BY ALUMINUM (III),
Ohio State Univ., Columbus. Dept. of Civil Engineering.
A. J. Rubin, and P. R. Schroeder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207364, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center Completion Report No. 711522, March, 1984. 104 p, 20 Fig, 5 Tab, 83 Ref. Project No. OWRT A-054-OHIO(1).

Descriptors: *Coagulation, *Colloids, *Aluminum III salts, *Chemical coagulation, *Organic soils, Core, Starch, Mineral oil, *Aggregation, *Aluminum compounds, *Water treatment, Hydrogen ion concentration, Hydrolysis.

Chemical coagulation processes for the removal of particulate organic sols including suspensions of finely-ground coal, starch and mineral oil emusions were studied. The specific objectives of the project were to examine the effects of pH, neutral salts and hydrolyzing aluminum salts on the stability of these organic colloids and to determine the mechanisms by which these aggregants operate. Stability limit diagrams were developed for each system. The principal zone of aggregation for those systems using hydrolyzing aluminum salts was the central sweep zone. For both coal and starch, aggregation in the sweep zone was by enmeshment of the colloid in the floc particles of the aluminum hydroxide precipitate. The aggregation of simple mineral oil emulsions by aluminum sulfate was, for the most part, typical of hydrophobic sols.
W85-02105

LACK OF NEPHROTOXICITY IN THE RAT BY SODIUM CHLORITE, A POSSIBLE BY-PRODUCT OF CHLORINE DIOXIDE DISINFECTION IN DRINKING WATER,
Massachusetts Univ., Amherst. Div. of Public Health.
G. S. Moore, E. J. Calabrese, and A. Forti.
Journal of Environmental Science and Health, Vol. A19, No. 6, p 643-661, 1984. 2 Tab, 34 Ref.

Descriptors: *Sodium chlorite, *Chlorine dioxide, *Drinking water, *Toxicity, Water treatment, Disinfection, Chlorite ion, Sodium.

This study evaluated the nephrotoxic effects of sodium chlorite when administered in the drinking water of male Sprague-Dawley rats. Sodium chlorite was administered for periods of 30, 90, and 180 days and at concentrations of 31.2, 125, and 500 ppm (along with appropriate negative and positive controls). Examination of sections by light microscope revealed no abnormalities in the kidneys of the rats in the chlorite exposure groups. Water consumption, mortality, kidney weight, body weight change, and percent kidney to body weight ratio showed no statistically significant relationship to chlorite ion concentration, although an association was observed between the latter two parameters and sodium concentration of treatment water. (Author's abstract)
W85-02119

DEHALOGENATION OF THREE CHLORINATED HYDROCARBONS: AMINE-ASSISTED VERSUS METAL-CHELATE ASSISTED,
University of South Florida, Tampa. Chemical and Environmental Management Services Center.
K. A. Hewes, and D. F. Martin.
Journal of Environmental Science and Health, Vol. A19, No. 6, p 713-724, 1984. 2 Tab, 12 Ref.

Descriptors: *Dehalogenation, *Chlorinated hydrocarbons, Metal chelates, Amines, Chloroform, Solvents.

Metal chelate compounds of the type M(o-OC6H4CH=NC4H9)2 (M = Ni, Cu, Zn, etc.) participate in the dehalogenation of chloroform in the presence of ethylene diamine or tetramethylenediamine under homogeneous conditions and at elevated temperatures. Both an amine-assisted and a metal-assisted pathway are recognized on the basis of rate expression. In contrast, only an amine-assisted pathway was observed for dichloromethane. Under non-homogeneous conditions, however, i.e., using pure solvent, dehalogenation led to (M(diamine)n)Cl2. The importance of solubility as a driving force is considered as are the implications in the design of agents that will effect dehalogenation of chlorinated methanes. (Author's abstract)
W85-02121

INSTRUMENTATION CONTROL AND AUTOMATION FOR ECCUP TREATMENT WORKS,
B. E. Marsh.
Water Services, Vol. 88, No. 1060, p 224-224, 228, June, 1984. 2 Fig.

Descriptors: *Water treatment, *Filtration, *Computers, Management, Water treatment facilities, Flocculation, Sedimentation.

Eccup filtration works is an operational water treatment works using flocculation, sedimentation and rapid gravity filtration to treat water supplied to approximately half of Leeds, England. The current output is about 80 l/day. The most recent development is a scheme involving the renewal of filter valves and updating of all the associated control equipment. The major benefits obtained by providing a computer system to integrate the operational aspects of the works are to provide a good opportunity for analyzing the complete process, to demonstrate the technical viability of the system, quantify the practical benefits and define the operating methods and skills required at all levels; and to provide facilities for evaluating and demonstrating the performance of the equipment. The SCADA computer system forms the middle tier of the hierarchical computer system in that it receives plant data from various sources. Special applications of the SCADA software with respect to Eccup are discussed. (Baker-IVI)
W85-02131

ASSOCIATION OF METAL TOLERANCE WITH MULTIPLE ANTIBIOTIC RESISTANCE OF BACTERIA ISOLATED FROM DRINKING WATER,
Oregon State Univ., Corvallis. Dept. of Microbiology.
J. J. Calomiris, J. L. Armstrong, and R. J. Seidler.
Applied and Environmental Microbiology, Vol. 27, No. 6, p 1238-1242, June, 1984. 2 Fig, 2 Tab, 26 Ref.

Descriptors: *Drinking water, *Bacteria, *Antibiotic resistance, *Metal tolerance, *Oregon, Copper, Lead, Zinc, Raw water, Aluminum, Tin, Cadmium, Water distribution,.

Bacterial isolates from the drinking water system of an Oregan coastal community were examined to assess the association of metal tolerance with multiple antibiotic resistance. Positive correlations between tolerance to high levels of Cu(2+), Pb(2+), and Zn(2+) and multiple antibiotic resistance were noted among bacteria from distribution waters but not among bacteria from raw waters. Tolerances to higher levels of Al(3+) and Sn(2+) were demonstrated more often by raw water isolates which were not typically multiple antibiotic resistant. A similar incidence of tolerance to Cd(2+) was demonstrated by isolates of both water types and was not associated with multiple antibiotic resistance. These results suggest that simultaneous selection phenomena occurred in distribution water for bacteria which exhibited unique patterns of tolerance to Cu(2+), Pb(2+), and Zn(2+) and antibiotic resistance. (Author's abstract)
W85-02133

DETECTION OF ENTERIC VIRUSES IN TREATED DRINKING WATER,
Texas Univ. Medical School at Houston.
B. H. Keswick, C. P. Gerba, H. L. DuPont, and J. B. Rose.
Applied and Environmental Microbiology, Vol. 27, No. 6, p 1290-1294, June, 1984. 5 Tab, 13 Ref.

Descriptors: *Enteroviruses, *Drinking water, Bacteria, Rotaviruses, Turbidity, Raw water,

Water treatment, Coliforms, Seasonal variation, Turbidity, Clarification, Filtration, Chlorination.

The occurrence of viruses in conventionally treated drinking water derived from a heavily polluted source was evaluated by collecting and analyzing 38 large-volume (65- to 756-liter) samples of water from a 9 cu m/s (205 x 10 to the 6th gallons (776 x 10 to the 6th liters) per day) water treatment plant. Samples of raw, clarified, filtered, and chlorinated finished water were concentrated by using the filter adsorption-elution technique. Of 23 samples of finished water, 19 (83%) contained viruses. None of the nine finished water samples collected during the dry season contained detectable total coliform bacteria. Seven of nine finished water samples collected during the dry season met turbidity, total coliform bacteria, and total residual chlorine standards. Of these, four contained virus. During the dry season the percent removals were 25 to 93% for enteric viruses, 89 to 100% for bacteria, and 81% for turbidity. During the rainy season the percent removals were 0 to 43% for enteric viruses, 80 to 96% for bacteria, and 63% for turbidity. None of the 14 finished water samples collected during the rainy season met turbidity standards, and all contained rotaviruses or enteroviruses. (Author's abstract)
W85-02136

EFFECT OF CHLORINATION ON ANTIBIOTIC RESISTANCE PROFILES OF SEWAGE-RELATED BACTERIA,
Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5D.
W85-02139

EFFECT OF NONCOLIFORMS ON COLIFORM DETECTION IN POTABLE GROUNDWATER: IMPROVED RECOVERY WITH AN ANAEROBIC MEMBRANE FILTER TECHNIQUE,
Arizona Univ., Tucson. Dept. of Microbiology and Immunology.
S. G. Franzblau, B. J. Hinnebusch, L. M. Kelley, and N. A. Sinclair.
Applied and Environmental Microbiology, Vol. 48, No. 1, p 142-148, July, 1984. 4 Fig, 6 Tab, 23 Ref.

Descriptors: *Groundwater, *Potable water, *Coliforms, *Bacterial analysis, *Membrane filter, Most probable number test.

A total of 529 well and distribution potable water samples were analyzed for total coliforms by the most-probable-number and membrane filter (MF) techniques. Standard plate count bacteria and MF noncoliform bacteria were also enumerated. Frequency of coliform detection, turbidity in most-probable-number tubes, and extensive overgrowth by noncoliforms on MF filters were directly proportional to standard plate counts. Recovery of coliforms was greatest by the MF method at low (< 100 CFU/ml) standard plate count densities and better by the most-probable-number method (confirming gas and turbid tube) at high (> 500 CFU/ml) standard plate count densities. In the latter case, overgrowth by noncoliforms on MF filters suppressed sheen development and, in turn, masked coliform detection. Of 341 atypical (no sheen) MF colonies verified by parallel inoculation of lauryl sulfate broth and billiant green-bile broth, 156 were aerogenic in the latter medium. Of atypical isolates, 84% were identified as either Citrobacter or Enterobacter species. A 4.3-fold reduction in numbers of overgrown MF filters and an 2.2-fold increase in numbers of coliforms recovered from 127 water samples was accomplished by anaerobic incubation of MF cultures. This anaerobic modification of the standard MF technique significantly reduced overgrowth and enhanced recovery of coliforms from potable groundwater. This technique is simple, cost effective, and suitable for monitoring of untreated ground water common to some small water systems and private water supplies. (Author's abstract)
W85-02140

5G. Water Quality Control

BEACH FECAL COLIFORMS,
Gore and Storrie Ltd., Toronto (Ontario).
For primary bibliographic entry see Field 5B.
W85-01711

MODELING ALGAL BEHAVIOUR IN THE RIVER THAMES,
Institute of Hydrology, Wallingford (England).
P. G. Whitehead, and G. M. Hornberger.
Water Research, Vol. 18, No. 8, p 945-953, 1984. 7 Fig, 2 Tab, 27 Ref.

Descriptors: *Algal growth, *Thames, *England, *Model studies, Sensitivity analysis, Extended Kalman Filter, Mechanistic models, Forecasting, Potable water, Water quality.

Forcasting the movement and growth of algae in river systems is particularly important for operational managers responsible for the distribution and the supply of potable water. Algae affect the taste and smell of water and pose considerable filtration problems at water treatment plants. In a collaborative study with the Thames Water Authority, algal models have been developed for the River Thames. The non-linear process controlling algal growth are examined uaing a generalized senitivity analysis technique and the dominant parameters controlling system behavior are identified. The extended Kalman filter (EKF) is then used to estimate these important parameters. The technique of using generalized sensitivity analysis prior to EKF estimation is suggested as a pragmatic approach to the problem of identifying the subset of physically, chemically or biologically meaningful parameters controlling system behavior in mechanistic models. (Author's abstract)
W85-01720

EVALUATION OF THE VISIBILITY CRITERION OF THE MASSACHUSETTS SANITARY CODE FOR SWIMMING IN NATURAL WATERS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6E.
W85-01800

XXVI CFMT - EXHIBITION OF SCIENTIFIC AND TECHNICAL ACHIEVEMENT OF YOUTH IN THE WATER-MANAGEMENT INDUSTRY,
B. Lidzba.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 1, p 9-10, January, 1984.

Descriptors: *Water management, *Water quality, Water treatment, Wastewater treatment, Water pollution control, Drinking water, Water supply.

The 1983 Fair of the Masters of Tomorrow (FMT) demonstrated how the young innovators in this East German movement compare favorably to their older colleagues in the water-management industry in increasing worker productivity, intensifying and rationalizing water facilities and reducing manpower, saving energy and materials, utilizing funds better, and raising quality while reducing costs. In 1983, 33.8% of all youth in the water industry participated in the FMT movement. Of innovators in FMT, 74.3% were young people and 53.8% of youth brigades presented exhibits. At the XXVI Central FMT, 56 exhibits were presented in the environmental-protection and water-management area. These presented a business gain of 1.8 million Marks, a 7.7 million-mark return on investment, savings of 20,441 manhours/yr and 1,789 MWh/yr energy, a 338,231 cu m increase in drinking water in the public network, and a 734,414-cu m savings in circulating water. (Gish-IVI)
W85-01875

RESULTS AND EXPERIENCE OF THE GREIZ WATER-SUPPLY DISTRICT IN THE FIELD OF RATIONAL WATER USE (ERGEBNISSE UND ERFAHRUNGEN DES VERSORGUNGS-BEREICHS GREIZ BEI DER RATIONELL WASSERVERWENDUNG),
For primary bibliographic entry see Field
W85-01880

WASTEWATER PURIFICATION AS RELAT TO THE STUDY OF A RIVER SYSTEM WASSERREINIGUNG IN VERBINDUNG DER UNTERSUCHUNG EINES FLUSSS TEMS),
Vizgazdalkodasi Tudomanyos Kutato Intezet, dapest (Hungary).
For primary bibliographic entry see Field
W85-01885

QUALITY ASPECTS OF THE BIESBOS RESERVOIRS,
Biesbosch Water Storage Corp. (Netherlands).
G. Oskam.
Aqua, No. 6, p 497-504, 1982. 13 Fig, 7 Tab, 7

Descriptors: *Biesbosch Reservoirs, *Netherla *Water treatment, *Aeration, *Meuse River, treatment of water, Reservoir operation, Ther stratification, Ammonia, Chlorination, He metals, Algal growth, Kinetics, Model studies.

The Biesbosch Reservoirs (in The Netherlands) fed with moderately polluted, highly eutrop water from the River Meuse. Air injection at bottom of the reservoirs prevents thermal stra cation, as this would cause deterioration of w quality. Reservoir mixing also serves as an effic algal control measure. Under mixed conditi light plays the role of limiting factor for growth of algae and this, combined with graz by zooplankton, keeps algal biomass in the re voirs at low levels. Self-purification process lea a striking improvement in water quality during storage period. The improvement not only rel to 'classical' effects like bacterial oxidation of ganic substances and ammonia and the die-off fecal organisms, but also to removal of inorga and especially organic micropollutants. Phys processes include settling of heavy metals evaporation of volatile substances, whereas che cal transformations like hydrolysis and photol are responsible for the removal of phtalate es and polynuclear aromatic hydrocarbons resp tively. Pollutant behaviour in the reservoirs can described by kinetic models. This is applied to control of the ammonia levels in the reservoirs selective intake of river water. The model u Michaelis Menten kinetics for nitrification of a monia and also considers the equalizing effect the reservoirs. As a consequence of the low amm nia concentration in the delivered water breakpo chlorination is not needed any more and the use chlorine for transport chlorination has been mu reduced. (Author's abstract)
W85-01979

GENERAL STRATEGY FOR SECURITY WATER SUPPLY,
Compagnie Generale des Eaux, Paris (Franc
M. Dutang, and E. Souteyrand.
Aqua, No. 4, p 155-159, 1983. 10 Fig.

Descriptors: *Environmental protection, *Wa pollution prevention, *Water quality contr *Water supply systems, *Drinking water, *Pa *France, Accidents, Water pollution control.

Water suppliers can produce top quality drinki water from polluted resources, but are still thre ened by accidental pollution. The first stage in t realization of an overall security strategy in t Paris suburbs was to assess the actual risks inspecting the industrial facilities upstream of t major plants. The second step focused on acquiri knowledge of the behavior of pollution throu simulations with rhodamine B and their integrati into a computerized mathematical model allowi for rapid computation of the real impact on pl intakes. The third step, probably the most imp tant, concerned the detection of acute pollution. highly sophisticated monitoring station upstre ensures enough time to implement safety measur Two distinct emergency plans have been devis

f which is followed depending on the extent
pollution. An analysis of the optimum man-
ent of the production and back up facilities
s that through the use of alternative re-
es, interconnections, and increased produc-
rior to arrival of detected pollution, two of
ree supply areas are absolutely safe against
ental pollution, and projects to guarantee the
(River Seine) are under study. (Author's ab-
)
01990

INSTRUMENTATION IN AUTOMATIC
ER QUALITY MONITORING,
nal Board of Waters, Helsinki (Finland).
ohonen, and P. Princz.
, No. 6, p 292-297, 1983. 7 Fig, 10 Ref.

riptors: *Automation, *Water quality control,
nitoring, Ammonia, Total organic carbon.

widespread use of automatic monitoring of
r quality is limited both by the lack of suitable
rs and analyzers for continuous measurement
y the expense and the malfunction sensitivity
ghly developed and complete monitoring sys-
The new Finnish-built automatic water qual-
nonitoring station and the results of the field
made in Finland on the Hungarian ammonia
otal organic carbon monitoring equipment are
ribed. The developed water monitoring station
e first type in Finland where the measuring
e is placed directly at the site to be measured.
method avoids the changes in quality of the
r due to pumping and transfer of the samples.
system consists of a probe unit including the
rs which is submerged into water, and of the
al unit connected to the probe with a multi-
cable. The system has proved to be very
ble for the control of both river water and
e water treatment processes. The use of this
on in different measuring circumstances is very
because of the modular construction. By using
ler measuring means and cheaper monitoring
ons together with the newest monitoring in-
nents, the usefulness of automatic monitoring
be expanded from the measurement of indica-
parameters to total quality parameters within
ame costs. (Baker-IVI)
5-02007

TOMATED SENSOR SYSTEMS FOR
TER RESOURCE POLLUTION WARNING
D TREATMENT PROCESS CONTROL,
derland and South Shields Water Co. (Eng-
).
primary bibliographic entry see Field 5F.
5-02010

IDIFIED LAKES: SEDIMENT TREATMENT
TH SODIUM CARBONATE - A REMEDY,
d Univ. (Sweden). Limnological Inst.
K. Lindmark.
drobiologia, Vol. 92, p 537-547, July, 1982. 10
, 4 Tab, 19 Ref.

criptors: *Lake restoration, *Sodium carbon-
*Acidified lakes, Lake sediments, Acidifica-
, Lime, Lye, Phosphorus, Algal growth,
ion exchange, Nutrient transport, Phytoplank-
, Hydrogen ion concentration, Lakes.

il now, additions of lime have been used to
ore the buffering capacity of acidified lakes, but
alternative method which is more effective in
treatment of lakes with organogenic sediments
recently been applied in a full-scale experi-
nt. The method, called CONTRACID, is based
the cation exchange properties of lake sediment.
sodium carbonate (soda ash) solution is injected
o the sediment (by a harrow), so that the sedi-
nt becomes sodium stocked. A reverse exchange
curs during subsequent acidification. Liming has
imited effect on humic lakes, since Ca-humates
ve a reduced reverse exchange ability and also
lime, which remains undissolved, is rendered
ctive. Ionic exchange processes and nutrient
nsport were studied in water/sediment cores
d in situ enclosures after additions of soda ash-,
- and lime solutions with subsequent re-acidifi-
cation. Sodium carbonate additions in laboratory systems resulted in a sorption to the sediment of 42-62% of the added sodium ions (5 eq/sq m) and a release of 14-78 mg/sq Pm sediment. Similar results were obtained in the enclosures where phosphorus release stimulated algal growth. Sediment pH, elevated by the sodium base addition, was lowered by re-acidification. Limed systems released no phosphorus and only about 25% of the added lime remained active for future neutralization. With the injection of the sodium carbonate solution into the sediment, only about 12% of the added sodium was recovered in lake water by spring circulation. Lake water alkalinity was then 0.12 meq/l and pH 6.7. Total phosphorus had been raised by 0.007 mg P/l causing an increase in phytoplankton biomass. Observations indicate that manipulations of acidic lake sediment according to the CONTRACID method create a long-lasting neutralizing capacity and a biological stimulation (through phosphorus release), which makes the method an attractive alternative to frequent liming. (Author's abstract)
W85-02096

LAKE TREHORNINGEN RESTORATION PROJECT. CHANGES IN WATER QUALITY AFTER SEDIMENT DREDGING,
National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab.
S.-O. Ryding.
Hydrobiologia, Vol. 92, p 549-558, July, 1982. 5 Fig, 5 Tab, 16 Ref.

Descriptors: *Lake restoration, *Dredging, *Water quality, *Lake Trehorningen, *Sweden, Lake sediments, Macrophytes, Phosphates, Algal growth, Nutrients, Water pollution control, Lakes.

An increased load of domestic wastewater to Lake Trehorningen induced oxygen-poor water conditions and the development of a reduced sulfide-rich sediment layer. Severely polluted, the lake did not recover, even after advanced wasterwater treatment and sewage diversion. Restoration measures with suction dredging and macrophyte elimination were applied in 1975 and 1976. The loose topmost sediment was pumped into an embanked and overgrown bay which was used as a settling pond. The activities also included a restoration of the shorelines. This project is the largest restoration program carried out in Sweden on a single lake, corresponding to a cost of about US $2 000 000. The restoration of Lake Trehorningen was followed by a highly intensive research program which included water chemistry and algal assays. The concentrations of phosphate and total phosphorus decreased by 73 and 50% respectively, as summer average values, two years after the restoration. However, the concentrations of phosphorus are still too high to permit this element to act as a prime algal growth-limiting nutrient. The algal biomass has also remained at the same magnitude as before the restoration. Nitrate-N concentrations showed a tenfold increase, based on average values for the summer period. However, based on the results of the algal assays, a rapid and marked response was obvious, with a drastic decline in the algal growth potential. In addition, the water quality of the tributaries was frequently of an objectionable character (0.1-0.2 g P/cu m). The nutrient loading from these sources exceeds the critical level for the lake, and measures have now been carried out to treat all the inflowing waters for the removal of phosphorus. (Author's abstract)
W85-02097

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

NEW ECOLOGICAL APPROACH TO THE WATER CYCLE: TICKET TO THE FUTURE,
Swedish Natural Science Research Council, Stockholm.
M. Falkenmark.
Ambio, Vol. 13, No. 3, p 152-160, 1984. 8 Fig, 34 Ref.

Descriptors: *Hydrologic cycle, *Water demand, *Water policy, *Planning, *Human population, Resources management, Water management, Water supply, Water shortage, Water scarcity.

Water availability poses definite limits to population development in Northern Africa and the Middle East. Projected population growth will not be possible without a fundamental change in approach to the interaction between water and land. Ecologists will have to start including the water cycle in the ecosystem concept. As gross demands on water multiply with the population, the 'hunger zone' - a wide belt including both arid and humid areas, centered around the equator - will face critical water shortages by the middle of the next century unless far-reaching management schemes are introduced linking together soil and water conservation. The most damaging impacts will develop in Asia and Africa, where the amount of water available on a per capita basis will be reduced from the present (1980) average level of 5100 and 9000 cu m per person per year in Asia and Africa, respectively, to 2600 and 1600 cu m per person per year, respectively. Only through more efficient use of water resources can planners even hope to cope with this shortfall. Under conditions of water scarcity it will be necessary to exchange the technical approach to water with a totally new ecologically based approach. (Collier-IVI)
W85-01704

RATIONALIZATION OF CENTRAL PLANNING IN WATER MANAGEMENT THROUGH THE INTRODUCTION OF EDP (RATIONALIZIERUNG DER ZENTRALEN PLANUNG IN DER WASSERWIRTSCHAFT DURCH EINSATZ DER EDV),
For primary bibliographic entry see Field 7C.
W85-01879

PRACTICAL INTRODUCTION OF THE REMOTE CONTROL SYSTEMS AND PROCESS CONTROL FACILITIES,
Grombach Consulting Engineers, Zurich (Switzerland).
P. Grombach.
Aqua, No. 6, p 285-291, 1983. 6 Fig.

Descriptors: *Remote control, *Water treatment facilities, Monitoring, Computers.

Before rushing into the use of a remote control system, three areas of investigation must be pursued to determine if such a system is necessary. The task of the remote control system or process control facility must be defined as exactly, completely and concretely as possible. Secondly, since the remote control system will generally be introduced into an existing water supply installation which is already controlled in some way, it is necessary to examine in detail the short-comings of the existing monitoring and control system. Thirdly, it is advisable to set a cost limit on the total expenditure for the introduction of the remote control technique and the process control as early as possible. Once these questions are answered, the task must be delineated so that the call for bids can be made. A diagram must be drawn of the whole water supply to be controlled, including all installations. A diagram of the equipment to be installed in the dispatching center must be elaborated. If the scope of supervision and control justifies the installation of a process computer, there are often difficulties in describing the computing program specification. Incoming bids must be evaluated. Preference should be given to the system having the simpler design. (Baker-IVI)
W85-02006

MICRO-ELECTRONICS IN THE WATER INDUSTRY - A REVIEW OF PRESENT AND PROBABLE FUTURE DEVELOPMENTS,
Newcastle and Gateshead Water Co., Newcastle-upon-Tyne (England).
T. R. Atkinson.
Aqua, No. 6, p 298-301, 1983. 9 Ref.

Group 6A—Techniques Of Planning

Descriptors: *Automation, *Water supply, *Management, Computers, Review.

The microprocessor consists of a small central processing unit, complete with an arithmetic unit and memory which can perform logical decisions as required by a list of instructions or programs. Present trends indicate continued development of communication circuits making greater use of optical fibers, microwave transmissions and, in difficult terrain, satellite links. Program packages are being produced to enable users to write and modify systems without the help of software specialists and new types of language such as PROLOG will enable artificial intelligence to be introduced into systems. PROLOG is a conversational language which allows facts and rules to be stored and questioned and is based on logic rather than numeric analysis. (Baker-IVI)
W85-02008

TOWARDS TOTAL AUTOMATION OF WATER DISTRIBUTION (VERS L'AUTOMATISATION INTEGRALE DANS LA DISTRIBUTION D'EAU),
Compagnie Generale des Eaux, Paris (France).
J. Fontaine.
Aqua, No. 6, p 302-312, 1983. 11 Fig, 8 Ref.

Descriptors: *Automation, *Water distribution, *Water management, *Paris, *France, Planning, Computers, Remote control, Monitoring.

A brief outline is offered of the initial uses of electronics in water distribution with particular emphasis on centralized remote control. Industrial electronics and data processing as related to the water distribution industry are considered. Recent advancements have enabled systems to be established which provide better operation of installations, improved economic management, proper statistical management which makes possible sound investment decisions. A description is offered of a complete system now under development for fitting out the water supply installations serving 4 million inhabitants of the Paris suburbs. Three production plants, on the Seine, Marne and Oise rivers, respectively, delivering an average of 900,000 cu m/day of water, 40 pumping stations and 100 reservoirs spread out over the territory of the 14 communities served have been integrated into the automated monitor and management system. (Baker-IVI)
W85-02009

2001 ... THE FUTURE OF WATER TREATMENT (2001 ... L'AVENIR DU TRAITEMENT DE L'EAU),
Compagnie Generale des Eaux, Paris (France).
P. Schulhof.
Aqua, Vol. 1984, No. 2, p 79-85, 1984. 10 Fig.

Descriptors: *Water treatment, Forecasting, Planning, Technology transfer, Data storage and retrieval, Computers, Ozonation, Reverse osmosis.

This research aspires to analyze the lines of force of the current evolution of water treatment technology which has been characterized by a better understanding of the phenomena involved, a mastery of processes, and an increasing complexity of the treatment stages. Integration of processes, use of tertiary reagents, on-line instrumentation, laser, data bank, and computer assisted analysis are some of the technological steps which have characterised the main technical evolution during these last years. Improvements and new developments in ozonation, reverse osmosis, and other treatment processes need to be made before water treatment technology can meet the needs of our immediate future. New methods of measuring water quality have to be widely applied. The great technological revolution in the field of water treatment has not yet occurred but is inevitable. (Wheatley-IVI)
W85-02017

CURRENT WATER TREATMENT PRACTICES IN WESTERN INDIA - CASE STUDIES OF TWO METROPOLITAN CITIES, BOMBAY AND AHMEDABAD,
Tata Consulting Engineers, Bombay (India).
For primary bibliographic entry see Field 5F.
W85-02024

CASE FOR AUTOMATED WATER MANAGEMENT,
P. Millington.
Water Services, Vol. 88, No. 1060, p 219-220, June, 1984. 5 Fig.

Descriptors: *Water management, *Automation, *Control systems, *Water distribution, *Water treatment, *Industrial water, *Pumping plants, England, Wales, Remote control, Monitoring.

The water cycle - from reservoir or river to effluent discharge - is under two masters. The water authority controls extraction, storage, delivery and eventually the effluent reception and treatment. In between is the industrialist who manages or mismanages the water distributed for use within his plant. Philip Millington suggests that neither body does this really efficiently and that there is great scope for educated automation to improve reliability and reduce operating costs. (Author's abstract)
W85-02130

IRRIGATED AGRICULTURAL EXPANSION PLANNING IN DEVELOPING COUNTRIES: RESILIENT SYSTEM DESIGN,
Cairo Univ., Giza (Egypt). Dept. of Irrigation and Hydraulics.
M. N. Allam, and D. H. Marks.
Water Resources Research, Vol. 20, No. 7, p 775-784, July, 1984. 5 Fig, 8 Tab, 15 Ref.

Descriptors: *Irrigation, *Agricultural development, *Developing countries, *Planning, Uncertainties, Economic efficiency, Model studies, Resilient system design.

A multicriteria optimization model is built to determine performance as well as operating rules of an agricultural system under future uncertainties inherent in the planning parameters. Performance of the agricultural systems is measured in terms of the economic efficiency and income redistribution criteria. The operating decisions are determined in such a way that the reduction in performance due to unpleasant surprises in the planning parameters can be minimized. The multicriteria model is used in deriving the relationship between the performance of a case study and the unpleasant changes in the planning parameters. A resiliency index in terms of the gradients of these functional relationships in a probabilistic framework is provided. Based on this resiliency index, a definition of resilient system design is reached. (Author's abstract)
W85-02144

USE OF MODELS FOR WATER RESOURCES MANAGEMENT, PLANNING, AND POLICY,
Office of Technology Assessment, Washington, DC.
R. Friedman, C. Ansell, and S. Diamond.
Water Resources Research, Vol. 20, No.7, p 793-802, July, 1984. 1 Fig, 1 Tab, 11 Ref, 2 Append.

Descriptors: *Water management, *Planning, *Policy, *Model studies, Mathematical models, Institutional constraints, Training.

The Office of Technology Assessment (OTA) of the U.S. Congress investigated the current and potential use of water resource-related mathematical models. It focused on mathematical modeling as a means of assessing the broader issue of the nation's ability to analyze and plan courses of action to deal with current and long-range water problems. OTA found that models capable of analyzing many pressing water resource issues are currently available and that these models have significant potential for increasing the accuracy and effectiveness of information available to managers, decisionmakers and scientists. Surveys and workshops conducted by OTA, however, indicate that institutional constraints to modeling - including inadequate Federal support services for model dissemination, training, and technical assistance, and maintenance - have impeded modeling from realizing its full potential. The states, in part, are hard pressed to fulfill their present respo... ities without an improved capacity to use th... available analytical tools, which they rely o... federal government, in part, to provide. ... major federal agencies, however, lack an int... ed plan for developing and supporting mod... the absence of a comprehensive strategy, f... agencies are often unresponsive to both stat... federal problem-solving needs. (Author's ab...
W85-02146

6B. Evaluation Process

EVALUATION OF FISHERMAN BENE... STEMMING FROM SPECIAL USE FISH... MANAGEMENT PROGRAMS,
Wyoming Water Research Center, Laramie.
M. A. Collins, T. Buchanan, and C. Phillips.
Available from the National Technical Inform... Service, Springfield, VA 22161 as PB84-21... Price codes: A05 in paper copy, A01 in micro... Completion Report, July, 1981. 97 p, 1 Fi... Tab, 31 Ref, 4 Append. Project No. OWRT E... WYO(1), Contract/Grant No. 14-34-0001-916

Descriptors: *Fish management, *Sport fis... Recreation demand, *Wyoming, Wild fis... Trophy fishery.

The major objective of this study was to dete... whether waters managed under special wild... trophy management programs were attracting ... ermen with interests and preferences cons... with those program objectives. The databas... the study was obtained via a combination o... contact and mail questionnaire survey cond... by the Water Resources Research Institute a... University of Wyoming. A total of 1,104 u... questionnaires were received from fishermen ... pled at four specially managed waters and ... control waters. Both the wild and trophy ma... ment programs had been recently impleme... but had not been publicized. A program to p... cize the specially managed waters was to ... been initiated prior to the study, but problems ... the program caused the publicity program t... delayed. In spite of the absence of the pla... publicity program, results of the study gene... indicate fishermen with wild or trophy inte... were being attracted to the appropriate w... Based on fisherman preferences (preference ... mains determined by cluster analysis techniq... the wild fish managed waters were attracting ... ermen with wild fish interests, and the trophy ... managed waters were attracting fishermen ... trophy fish interests as compared to the interes... fishermen contacted at the two control (l... yield) waters. The authors feel the results o... study would have shown a stronger relation... between the specially managed waters and pr... ences of fishermen using those areas had ... planned publicity programs been implemente... scheduled.
W85-01831

FISHABLE WATERS EVERYWHERE: AN ... PROPRIATE GOAL,
Texas Tech Univ., Lubbock. Dept. of Civil E... neering.
G. F. Lee, and R. A. Jones.
Industrial Water Engineering, Vol. 20, No. 6, p... 16, 1983. 5 Ref.

Descriptors: *Water quality control, *Legisla... *Navigable waterways, *Industrial discharge, I... Channels, Municipal wastes, Wastewater disp...

Two types of situations in which the goal of ... able waters everywhere seems inappropriate ... considered. One is industrial channels and ... other is domestic or certain other wastewater ... charges into natural waters. Industrial channels ... typically man made or man enhanced watercou... traditionally considered to be among the most ... luted waterways in the world. It is questio... whether state pollution control agencies sh... now require that all contaminants discharge... these waters be controlled to the degree neces... to allow fish and other aquatic life to exist wi...

This was not the intended use and design of vaterways, and there would be some doubt ie wholesomeness of fish swimming in these . With regard to waters in the vicinity of ic and certain other wastewater discharges, re two regions of concern: the mixing zone e zone of potential chronic toxicity. As a health preventive measure, industrial chan- d waters just downstream from municipal me industrial wastewater discharges should made into fishable waters. This can be plished by the exclusion of large populations ie fish in these areas which can in turn be y maintaining low dissolved oxygen in the ial channels and normal chlorine concentra- n domestic wastewater discharges. (Baker-

1850

LOPMENT AND FIELD TESTING OF A HODOLOGY FOR ASSESSING COMM- TY READINESS FOR SELF-HELP IN INSTALLATION, MAINTENANCE AND IR OF WATER SUPPLY AND SANITA- FACILITIES,
and Sanitation for Health Project, Arling- A.
imary bibliographic entry see Field 7C.
01980

ER DECADE (LA DECENNIE DE L'EAU),
nission of the European Communities, Brus- Belgium).
igry.
No. 1, p 27-30, 1983. 2 Tab.

iptors: *Water supply development, *Sanita- Developing countries, *Financing, *Europe- onomic Community, Rural areas, Rural soci-

major groupings of developing world coun- re in need of financial aid from the European omic Community (EEC) to develop water y and sewerage systems. These groups in- the Africa-Caribbean-Pacific (ACP) coun- ssociated with EEC under the terms of the d Lome Convention, the eight countries situ- o the south of the Mediterranean basin each hich has a cooperation agreement with the and the non-associated countries of the rest e Mediterranean basin, Latin American and liddle and Far East who meet certain criteria. mportant phases which precede financing in- the programming phase which is an agree- between the parties on the amount of aid to ailable in a particular period and the sectors velopment in which it is to be used, and the ination phase in which the parties jointly ate a project according to certain criteria. problem encountered in the area of water y development and protection has been that eceiving countries themselves are not giving r sufficient priority in the programming phase gh lack of knowledge of the needs. Policies ie water sector are not sufficiently elaborated and therefore do not stimulate the develop- of programs. There has been an acceptance in countries of EEC participation in village r projects which seems the best chance of oving the conditions of life in rural areas e the population may represent up to 80% of nal totals. (Baker-IVI)
-01984

NOMISING WATER AND FIGHTING INST WASTAGE (ECONOMIE D'EAU ET TE CONTRE LE GASPILLAGE),
nnaise des Eaux, Paris (France).
uzias.
a, No. 5, p 215-219, 1983. 2 Fig, 8 Ref.

criptors: *Water resources development, nning, Management, Water management, er supply, Water demand.

easing concentrations of populations and in- sing per capita water consumption have lead he use of water from resources located at nces further and further away from the area of need as well as the use of water resources which require treatment and thereby additional expenditures of money. Before investigating additional resources, efforts should be made to be certain that the resources already employed are being used to their best capacity. Different stages of water movement from the catchment to the tap should be reviewed including production, conveyance, and distribution. Behavior of the users must also be investigated. The effectiveness of such actions as these may help prevent the investment of time and money in producing new systems. (Baker-IVI)
W85-01996

PLANNING, IMPLEMENTATION OF DIRECTIVES AND PIPELAYING STANDARDS,
Service des Eaux, Services Industriels de Geneve (Switzerland).
R. Pfund.
Aqua, No. 5, p 225-229, 1983. 9 Fig.

Descriptors: *Planning, *Pipelines, *Geneva, Standards, Water mains, Water conveyance, Water distribution, Water demand, Water management.

Planning aspects used in Geneva for the replacement of pipes are detailed. A planned approach is outlined for obtaining information on the condition of the distribution system so that replacement decisions can be made. A review is made of systems in Geneva from before 1950 to the present and developments which have taken place are indicated. The advantages of ductile iron pipes are stressed and practical experience given with some suggestions on the correct method of laying pipes. Ductile iron pipes offer very great resistance to all mechanical stresses to which a water main is often subject. If ductile iron pipes are used the spectacular leakages following burst pipes are no longer possible and serious disturbances to the water supply of the community involved are averted. (Baker-IVI)
W85-01998

MATARA WATER SUPPLY PROJECT IN SRI LANKA,
National Water Supply and Drainage Board, Colombo (Sri Lanka).
For primary bibliographic entry see Field 5F.
W85-02013

QUANTIFYING THE RELATIVE PERFORMANCE OF ALTERNATIVE MEASURES FOR FULFILLING INSTREAM USES IN THE PLAINS ENVIRONMENT,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
R. L. Smith.
Water Resources Research Institute, Contribution No. 237, June, 1982. 80 p, 12 Fig, 2 Tab, 16 Ref, 2 Append. Project No. OWRT A-103-KAN(1), Contract/Grant No. 14-34-0001-0118.

Descriptors: *Measuring instream use, *Average annual instream use, *Instream use probabilities, *Instream use, Great Plains, *Kansas.

The increasing demand for more formal recognition of instream use poses the need for a methodology which appraises instream service in an objective fashion. Little prior effort has been directed toward this goal. This project makes no attempt to assess a dollar value to instream benefits, but does present a procedure for determining an index of the average annual fulfillment of instream use. The suggested procedure requires the joint integration of fulfillment based on velocity and depth considerations with the percent of time the several velocities and depths are encountered. The percent of time analysis utilizes 'use specific' flow duration curves representative of the portion of the year deemed critical to the specified instream use. Case studies for ten different streams and 19 different record periods are presented. In aggregate, these studies cover a wide range of hydrologic regimes encountered in Kansas. Predictive functions developed in the study are useful in predicting the service to instream use for Kansas streams under natural conditions of flow. Computer programs are provided which allow determination of fulfillment indices for either natural or altered flow conditions. The required input data includes the flow duration curve for the critical season, and depth-velocity-discharge relation for the channel reach.
W85-02107

6D. Water Demand

WATER SUPPLY IN THE FEDERAL REPUBLIC OF GERMANY,
Deutscher Verein des Gas- und Wasserfaches e.V., Eschborn (Germany, F.R.).
W. Merkel.
Aqua, No. 6, p 265-271, 1983. 9 Fig.

Descriptors: *Water supply development, *Water quality control, *West Germany, Water resources, Water demand, Water treatment.

The water supply situation of the Federal Republic of Germany is discussed. A balance sheet of resources against demand is outlined together with a description of present and possible future water quality problems. The secular annual average for total water resources is 161 billion cubic meters, comprising 208 billion cubic meters of precipitation, less 129 billion cubic meters of evaporation, plus 82 billion cubic meters in flow from upstream. Roughly one quarter of the resource is used for cooling water for power stations, for industrial uses, and for water supplies to the domestic and small business industry sectors. A description of water treatment techniques used in the Republic is given along with typical examples. The overriding guideline is that of protection of the water supply being favorable to water treatment. The quality of surface water has shown a marked improvement over the past ten years as a result of increased construction of sewage treatment plants. Types of utilities in existence in the country are described along with their powers and responsibilities. Water management is viewed as a public responsibility. (Baker-IVI)
W85-02002

COMPARISION OF WATER CATCHMENT AND STORAGE SYSTEMS IN TWO MICRONESIAN ATOLL COMMUNITIES: LAURA AND NAMA,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
R. A. Stephenson, and H. Kurashina.
Water and Energy Res. Inst. of the Western Pacific, Mangilao, Technical Report No. 50, September, 1983. 80 p, 42 Fig, 6 Tab, 19 Ref. Project No. OWRT A-021-GUAM(1), Contract/Grant No. 13-34-0001-0112, 1112.

Descriptors: *Catchment areas, *Water storage, *Social aspects, *Atolls, Water tanks, Water harvesting, Rural areas, Tropical regions, Rainfall, Marshall Islands, Carolinian Islands, Nama Island, Majuro Atoll.

This technical report focuses on; a discussion of freshwater catchment and storage systems in Micronesia. Particular attention is paid to the conditions within two small Micronesian atoll environments, the village of Laura on Majuro atoll in the Marshall Islands and the village community of Nama, a small Carolinian island lying outside of Truck lagoon. Both of the study areas lie within American jurisdication in the western Pacific. Fieldwork at Laura in August 1981 revealed that a paradox exists between the abundant availability of freshwater occurring as rainwater and groundwater on the one hand, and frequent shortage of freshwater on the other. Fieldwork on Nama in August 1982 revealed a similar abundant availability of rainwater, but freshwater shortages were rarely reported. It is suggested that different levels of individual initiative and community response to the need for freshwater are apparent in the two island communities being studied. Particular variables such as access to the district center, availability of construction materials and supplies, community level planning and leadership or lack of the same, and time perspectives may be called upon to help explain variations between the freshwater

catchment and storage systems found at Laura and Nama.
W85-02028

PROJECTED PUBLIC SUPPLY AND RURAL (SELF-SUPPLIED) WATER USE IN FLORIDA THROUGH YEAR 2020,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-02036

QUANTIFYING THE RELATIVE PERFORMANCE OF ALTERNATIVE MEASURES FOR FULFILLING INSTREAM USES IN THE PLAINS ENVIRONMENT,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W85-02107

MANAGING WATER SCARCITY: AN EVALUATION OF INTERREGIONAL TRANSFERS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 6F.
W85-02145

6E. Water Law and Institutions

TORT RECOVERY OF ACID RAIN DAMAGES IN THE UNITED STATES - OBSERVATIONS ON PLAINTIFF'S PRIMA FACIE CASE,
Vermont Law School, South Royalton. Environmental Law Center.
D. R. Honabach.
International Journal of Environmental Studies, Vol. 18, No. 2, p 91-99, 1982. 50 Ref.

Descriptors: *Acid rain, *Judicial decisions, *Damage, *Torts, *Prima facie, Liability, Legal aspects, Decision making, Common law, Air pollution.

An individual acid rain plaintiff in the United States, who would attempt to make a prima facie case in tort to recover damages for harms caused by acid rain must prove that defendant's acid rainmaking activity was a liability-incurring activity; that defendant's acid rainmaking was the proximate cause of harm; and that plaintiff suffered harms of a type for which damages can be recovered. The first two of these problems are the most difficult. Present theories of causation will make it difficult for plaintiff to present adequate proof of cause-in-fact because he must pinpoint the source of the harm. Common law tort doctrine has long supplied a judicially administered vehicle for dealing with harms suffered by one party as a result of the activities of another. As such, it might be used to address the problem of acid rain. Before tort law may be so used, however, a would-be plaintiff must make out a prima facie case. While traditional applications of tort doctrine might effectively prevent plaintiff from doing so, recent court decisions suggest that plaintiff might nevertheless be successful in obtaining at least partial recovery. (Collier-IVI)
W85-01667

ACID RAIN AND FEDERAL COMMON LAW,
Vermont Law School, South Royalton. Environmental Law Center.
J. D. Harper.
International Journal of Environmental Studies, Vol. 18, No. 2, p 101-108, 1982. 32 Ref.

Descriptors: *Acid rain, *Judicial decisions, *Federal common law, Legal aspects, Decision making, Common law, State law, Clean Air Act, Air pollution.

When Illinois v. Milwaukee first came before the Supreme Court in 1972, the court decided, in recognizing the history of federal common law, that federal courts had power to fashion federal common law 'when there is an overriding federal interest in the need for a uniform rule of decision or where the controversy touches basic interests of federalism' 406 U.S. at 105 N.6. When Illinois v. Milwaukee finally reached the Supreme Court again in 1981 after a rather lengthy federal court trial and appeal, the majority, on the basis of statutory amendments passed in the interim, decided that federal clean water legislature amendments preempted or displaced federal common law as that body of law could only be developed by the federal courts where congress had not spoken and occupied the field, and where the varying laws of the states required a uniform federally enunciated principle. The Clean Air Act, which is central to the acid rain dilemma also underwent major restructuring in 1977 and it can be comparatively argued that Illinois v. Milwaukee has inescapable precedent value in the acid rain federal common law Clean Air Act context. If so, the federal forum and uniform rule of law that federal common law gave litigants is no longer available. (Author's abstract)
W85-01668

LEGAL ASPECTS OF ACIDIC PRECIPITATION,
Windsor Univ. (Ontario). Faculty of Law.
J. G. W. Manzig, and J. N. Mulvaney.
International Journal of Environmental Studies, Vol. 18, No. 2, p 117-127, 1982. 1982. 37 Ref.

Descriptors: *Acid rain, *Judicial decisions, *Legal aspects, *Canadian Clean Air Act, *Canada, Decision making, Common law, Clean Air Act, Emission standards, Air pollution.

Acid rain has been discovered to be a serious problem in Eastern Canada. The legislative competence of the Federal Parliament to deal with air pollution is not well established, but recent cases interpreting the federal general power indicate that the scope of general power has been established. Canadian common law remedies are not likely to be successful, for a variety of reasons. The Canadian Clean Air Act, especially with the 1980 amendments lays the basis for possible adoption of emission standards for acid rain as an international pollutant. Ontario's Environmental Protection Act of 1971 may offer a basis for control of emissions resulting in acid rain through regulation of major sources and control orders of medium sized and small sources. One such regulation has already been adopted to apply to the Inco Plant emissions of sulfur oxides. (Author's abstract)
W85-01669

INTERNATIONAL COOPERATION AND ACID RAIN POLLUTION: ESTABLISHING THE FRAMEWORK FOR CONTROL,
Vermont Law School, South Royalton. Environmental Law Center.
F. X. Cameron.
International Journal of Environmental Studies, Vol. 18, No. 2, p 129-134, 1982. 40 Ref.

Descriptors: *Acid rain, *Legal aspects, *International cooperation, International law, Air pollution, Decision making, International agreements.

Acid rain pollution is a classic example of a beneficial economic activity in one nation producing harmful environmental effects in another nation. There has not been a great deal of development in the international legal principles and institutions to address this problem. The international legal principles on State responsibility for environmental damage are still unsettled and substantial procedural and evidentiary obstacles exist to the enforcement of these principles. Regional arrangements that provide a framework for the prevention and control of acid rain offer a promising solution to the problem. An initial step in this regard is the 1979 draft Convention on Long Range Transboundary Air Pollution. The convention calls for the control of air pollution through the exchange of information, research, consultation, and monitoring. The convention is basically concerned with emissions for which it would be difficult to prove damages in any type of judicial or quasi-judicial processing; thus, the emphasis is on prevention. A framework is provided for future action, for more specific agreements on control technologies, [illegible] sion levels, and liability. (Collier-IVI)
W85-01670

EVALUATION OF THE VISIBILITY CR[illegible] RION OF THE MASSACHUSETTS SANI[illegible] CODE FOR SWIMMING IN NATU[illegible] WATERS,
Massachusetts Univ., Amherst. Dept. of Civ[illegible] gineering.
R. R. Noss, and K. Hatfield.
Available from the National Technical Inform[illegible] Service, Springfield, VA 22161 as PB84-2[illegible] Price codes: A03 in paper copy, A01 in micro[illegible] Water Resources Research Center Publicatio[illegible] 146, April 1983. 35 p, 4 Fig, 2 Tab, 40 Ref. P[illegible] No. OWRT A-139-MASS(1), Contract/Gran[illegible] 14-34-0001-2123.

Descriptors: Accidents, Drowning, *Ecor[illegible] justification, *Evaluation, *Institutional [illegible] straints, *Safety, *Swimming, Economic ev[illegible] tion, Liability, Planning, Public acccess, Re[illegible] tion, Recreation demand, Recreation faci[illegible] Regulations, Sediment concentration, *Mass[illegible] setts, *Standards.

The Massachusetts Environmental Code cont[illegible] four-foot visibility requirement for waters c[illegible] nated for primary contact use. This standard [illegible] be limiting state, public, and private effor[illegible] expand recreational swimming in the State of [illegible] sachusetts. The origins of and the rationale be[illegible] the visibility criterion are discerned with an e[illegible] nation of the motivation for adoption of th[illegible] quirement. Literature on the factors affe[illegible] water safety (including water clarity) is revie[illegible] However, no quantitative verification of the v[illegible] safety-water clarity relationship has been pre[illegible] ed. Lakes and ponds with and without autho[illegible] swimming are compared with regard to their [illegible] ity and in terms of the expected percentage fa[illegible] to meet the visibility criterion. Economic cons[illegible] ations associated with existing and alternative[illegible] teria are discussed. The costs connected with [illegible] visibility criterion (short of eliminating the exi[illegible] criterion) cannot be justified on the basis of [illegible] proved water safety alone.
W85-01800

MAJOR INSTITUTIONAL ARRANGEME[illegible] AFFECTING GROUND WATER IN NEW YO[illegible] STATE,
Cornell Univ., Ithaca, NY. Dept. of City and [illegible] gional Planning.
R. S. Booth, and A. Bronson.
Available from the National Technical Informa[illegible] Service, Springfield, VA 22161 as PB84-202[illegible] Price codes: A07 in paper copy, A01 in microfi[illegible] Center for Environmental Research Comple[illegible] Report, December 1983. 125 p, 1 Fig, 70 [illegible] Project No. OWRT A-097-NY(1), Contract/G[illegible] No. 14-34-0001-2134.

Descriptors: *Groundwater, *Institutional arra[illegible] ments, *Regulations, *Government policy, L[illegible] authority, *Institutional constraints, *New Y[illegible] State regulations.

New York State faces a series of problems resp[illegible] ing both the use and quality of its ground w[illegible] resources. Portions of its population rely extens[illegible] ly on ground water as a source of water sup[illegible] The State is heavily populated, has a substan[illegible] industrial base, and has a significant agricult[illegible] industry. Each of these factors contributes to [illegible] growing seriousness of problems in protect[illegible] ground water resources for future use. The ma[illegible] institutional arrangements in New York State re[illegible] ing to management of ground water resources [illegible] analyzed in terms of use and quality. Part I outli[illegible] the objectives and discusses the project's streng[illegible] and limitations. Part II provides a brief overvi[illegible] of the nature of ground water resources in N[illegible] York State, the current use of those resources, [illegible] the current concerns about the quality and use[illegible] ground water resources. Part III reviews [illegible] major, formal institutional/legal arrangeme[illegible] New York State and the federal government h[illegible] created for managing the quality and use of grou[illegible]

ter. Part IV summarizes the responses to a vey of county and district health offices, and t V summarizes a similar survey of regional ices of NYS Dept. of Environmental Conserva-n. Part VI lists the interviews conducted. Part I states the results from the interviews. Part II provides an assessment of the information sented. Part IX states a series of major conclu-ns.
85-01802

ATE LAWS MANDATING WATER CONSER-TION,
aryland Univ., College Park. Dept. of Geogra-y.
W. Sawyer, and A. B. Eney.
vailable from the National Technical Information rvice, Springfield, VA 22161 as PB84-190404, ice codes: A03 in paper copy, A01 in microfiche. aryland Water Resources Research Center, Col-ge Park, Publication No. 80, August, 1983. 20 p, Tab, 6 Ref, 1 Append. Project No. OWRT A-6-MD(1), Contract/Grant No. 14-34-0001-2122.

escriptors: *Water conservation, Water supply stems, Leakage, Water loss, *Legal aspects, ater law, *Maryland, State jurisdiction, *State ater laws, State regulations.

ates have the potential to play a major role in oving water conservation from conferences and ports that identify its advantages to actual prac-e. The states' regulatory, financial, and educa-onal responsibilities make them especially effec-ve in furthering conservation among public pply systems where various constraints and pres-res discourage local initiatives. This research de-rmined the extent and nature of the states' cur-nt efforts to further water conservation among ese municipal supply systems. Arizona, Califor-a, Massachusetts, and New Jersey have multifa-ted programs involving conservation plumbing des, distribution of conservation devices, equip-ent loan and grant programs to aid leak detec-on, grants for system rehabilitation and conserva-on actions, and active information/education out-ach programs for schools, the media, and specific er groups. Approximately 11 other states also ve two or more of these programs. The study entified consistent concern for water conserva-on among water supply planners, but found that ate initiatives are severely restricted by a lack of olitical and financial support.
85-01806

ISHABLE WATERS EVERYWHERE: AN AP-ROPRIATE GOAL,
exas Tech Univ., Lubbock. Dept. of Civil Engi-eering.
or primary bibliographic entry see Field 6B.
85-01850

ASKS OF THE DAM KEEPER (LES TACHES U GARDIEN DE BARRAGE),
ureau d'Ingenieurs-Conseils, Lausanne (Switzer-nd).
or primary bibliographic entry see Field 4A.
85-01859

5F. Nonstructural Alternatives

LOOD ELEVATIONS FOR THE SOLEDUCK IVER AT SOL DUC HOT SPRINGS, CLAL-AM COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Re-ources Div.
For primary bibliographic entry see Field 4A.
85-01773

TRAINING PROGRAMMES IN FEDERAL SYS-TEMS OF GOVERNMENT,
National Water Council, London (England).
W. D. Hughes.
Aqua, No. 3, p 117-119, 1983. 1 Fig.

Descriptors: *Water management, *Training, *Education, *Water supply development, *Government supports, Management, Operation, Developing countries.

In order for developing water systems to be effectively maintained, some degree of training at the local level is necessary. Who is to do the training and who is responsible for seeing that it is carried out are two of the major issues facing water supply development success in various parts of the world. Training, while natural to progress, does not necessarily become naturally organized and therefore the impetus provided by federal or state government is needed to bring control to the scene. A decision must be taken over fundamental issues concerning financing and whether an existing organization or a new one should be specially created and charged with the responsibility for regional if not national training. Managers must be committed to training and need to be helped to understand the significance of maintaining training systems. Analysis of training needs, existing facilities and availability of outside help should be undertaken and a careful assessment made of the most efficient and economic manner in which to progress. A small core of specialist trainers, technically qualified, is of great help to maintain impetus. Good training results from a blend of national effort, local effort and the cooperation of the education service. (Baker-IVI)
W85-01989

MANAGING WATER SCARCITY: AN EVALUATION OF INTERREGIONAL TRANSFERS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
H. J. Vaux, Jr., and R. E. Howitt.
Water Resources Research, Vol. 20, No. 7, p 785-792, July, 1984. 1 Fig, 5 Tab, 25 Ref.

Descriptors: *Interbasin transfers, *California, *Water management, Water supply, Water demand, Groundwater recession, Model studies, Economic aspects, Water rights, Market economy.

An interregional trade model is developed for assessing the potential of limited market institutions to alleviate water scarcity. The model differs from those of Takayama and Judge, since curvilinear demand functions are employed and an unequal number of supply and demand regions are specified. The model is applied to California using regional supply and demand functions estimated for 1980, 1995, and 2020. The results show that water transfers can be substituted for new supplies to the extent that less than 100,000 ac ft (123000000 cu m) of new capacity could be justified by 2020. The net benefits to buyers and sellers total $66 million for 1980 and rise to $219 million by 2020. The work also demonstrates that trade would lead to premature drawdown of groundwater resources in the absence of management and might create excess supply capacity for urban regions. (Author's abstract)
W85-02145

6G. Ecologic Impact Of Water Development

SOME ECOLOGICAL CONSEQUENCES OF A PROJECTED DEEP RESERVOIR IN THE KABALEBO RIVER IN SURINAME,
Waterloopkundig Lab., Delft (Netherlands).
J. A. Van Pagee, S. Groot, R. Klomp, and J. H. G. Verhagen.
Hydrobiological Bulletin, Vol. 16, No. 2-3, p 241-254, December, 1982. 8 Fig, 13 Ref.

Descriptors: *Water resources development, *Environmental effects, *Reservoirs, *Devis Reservoir, *Kabalebo River, *Surinam, Water quality control, Rain forests, Oxygen, Mathematical models.

An overview is offered of some water quality aspects related to the construction and operation of the projected Devis Reservoir in the Kabalebo River. The construction of a deep reservoir for hydropower generation and the consequent inundation of a tropical rain forest will drastically disturb the ecological equilibrium in the Kabalebo River basin. Mathematical modelling techniques are used to predict the water quality in the new Devis Reservoir and the adjacent downstream river. Special attention is given to the oxygen budget as the most critical factor in water quality during the first decennium after the start of filling. In order to minimize the ecological impacts of the reservoir construction, an alternative intake design and a delayed filling period are the most promising remedial measures. (Baker-IVI)
W85-01764

CHANGES IN THE FISH FAUNA OF THE FORMER GREVELINGEN ESTUARY, BEFORE AND AFTER THE CLOSURE IN 1971,
G. Doornbos.
Hydrobiological Bulletin, Vol. 16, No. 2, p 279-283, December, 1982. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Water resources development, *Environmental effects, *Grevelingen Estuary, *Netherlands, *Fish, Aquatic life, Delta plan, Species diversity, Food chains.

Within the scope of the Delta Plan, a number of estuaries in southwestern Netherlands has been closed off. Subsequent changes in the fish fauna in the Grevelingen Estuary are studied. After the closure in 1971 the number of fish species caught declined from 31 to 18, a number which then stabilized by 1978 at 20. When the connection with the North Sea had been renewed for over a whole year, the number of species increased to 26. Before 1971 the Shannon-Weaver index was high, declining in 1972 after the damming was complete. After the closure, the number of small pelagic fish increased enormously. Not only have the number of species and the number of individuals changed over the course of time, but the biomass ratios of the demersal species have also changed. The composition of the fish fauna has drastically changed from larger to smaller species, the diversity has decreased and food chains have become shorter. (Baker-IVI)
W85-01765

BREEDING MALLARD (ANAS PLATYRHYNCHOS) HABITAT SUITABILITY MODEL,
Washington State Univ., Pullman. Dept. of Agricultural Economics.
S. C. Matulich, and J. E. Hanson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202555, Price codes: A05 in paper copy, A01 in microfiche. Washington Water Research Center Report 54, November 1983. 67 p, 23 Fig, 61 Ref. Project No. OWRT B-086-WASH(3), Contract/Grant No. 14-34-0001-9160.

Descriptors: *Habitat suitability index, *Wildlife management, *Mallard, Environmental effects, *Washington, Model studies, Literature reviews, Columbia Basin Irrigation Project.

A habitat suitability index (HSI) model is developed for breeding mallards (Anas platyrhynchos). The HSI model framework follows the Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service. Overall habitat suitability is defined in terms of nesting and brood-rearing life requisites, and the environmental attributes that quantify each cover type's potential for satisfying the breeding season life requisites. A review of literature on breeding mallard habitat requirements is presented, followed by a generic breeding mallard HSI model. This general model is then modified to account for habitat characteristics in the East High area of the Columbia Basin Irrigation Project, Washington.
W85-01792

TROPHIC ECOLOGY OF FISH REARING PONDS,
Ohio State Univ., Columbus. Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W85-01833

TRAVELING SCREENS AS SAMPLING GEAR FOR VERTICAL DISTRIBUTION STUDIES,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
For primary bibliographic entry see Field 7B.
W85-01842

MAN-MADE STRUCTURES ON MARINE SEDIMENTS: EFFECTS ON ADJACENT BENTHIC COMMUNITIES,
Scripps Institution of Oceanography, La Jolla, CA.
N. Davis, G. R. VanBlaricom, and P. K. Dayton.
Marine Biology, Vol. 70, No. 3, p 295-303, 1982. 4 Fig, 3 Tab, 34 Ref.

Descriptors: *Benthic environment, *Marine sediments, *Structures, *Environmental effects, *San Diego County, *California, Scour, Sedimentary structures, Fish, Polychaetes, Benthic fauna, Sea pens, Oil platforms, Pilings, Coastal waters, Particle size.

This study (1975-1977) examines the effect of man-made structures on natural sand bottom communities in shallow water in San Diego County, southern California, USA. While there were shallow scour effects to 15 m around some artificial reefs, the reefs had no measurable effect on sand ripple patterns, grain size, organic carbon or infauna beyond the scoured areas. Foraging by reef-associated fishes produced profound alterations in the epifauna populations of the sea pen Stylatula elongata. The sea pen densities were 4 to 10/sq m before the reefs wer established, but within 5 mo were eliminated from distances greater than 200 m around the reefs. On the other hand, densities of the tube-building polychaetes Diopatra spp. seemed to be enhanced in the immediate vicinity of the artificial reef. Oil platforms and bridge pilings seem to have much more profound effects on the nearby sand communities than do the relatively small artificial reefs. In addition to the elimination of sea pens, Diopatra spp. densities increased from < 1.0/sq m in control areas to as many as 73/sq m in the vicinity of oil platforms. Grain size and infauna were strongly affected by the oil platform. (Author's abstract)
W85-01895

COMMENTARY ON ENVIRONMENTAL IMPACT ASSESSMENT FOR LARGE PROJECTS AFFECTING LAKES AND STREAMS,
British Columbia Univ., Vancouver. Inst. of Animal Resource Ecology.
P. A. Larkin.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 7, p 1121-1127, 1984. 17 Ref.

Descriptors: *Environmental impact statement, *Lakes, *Streams, Water resources development, Planning, Environmental effects.

Environmental impact assessment is examined as it relates to major projects which will have an influence on aquatic environments in Canada. The purpose of the environmental impact assessment is to guard the public interest in the proper use of resources in the aggregate. Although compromises are usually worked out on a local basis for each project, more widely conceived trade-offs are favored. Frequently environmental impact assessments appear to be mere reflections of projects that are going to materialize anyway. It would be preferred if the assessments were to reflect the pattern of activity through the various stages of a project from conception, through modification and into the final stages. The need for follow up on projects underway is emphasized. It is also important to anticipate some impacts which may not be easily foreseen as likely, and include possible means for making appropriate financial provisions should these unlikely events actually occur. Assessment of potential impacts should no longer be seen as a substitute for research that would lead to new understandings of ecological systems but rather should be increasing in its contribution to the field of environmental research. (Baker-IVI)
W85-01920

CHANGES IN THE NAIAD FAUNA OF THE CUMBERLAND RIVER BELOW LAKE CUMBERLAND IN CENTRAL KENTUCKY,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
A. C. Miller, L. Rhones, and R. Tippit.
Nautilus, Vol. 98, No.3, p 107-110, July, 1984. 2 Fig, 9 Ref.

Descriptors: *Environmental effects, *Water resources development, *Dam effects, *Mussels, *Cumberland River, *Kentucky, Wolf Creek Dam, Clams, Mollusks.

A survey for live mussels was conducted below Wolf Creek Dam, miles 460.8 to 393.2 on the Cumberland River, Kentucky, in October of 1982 to determine if mussel recruitment had taken place following completion of the dam in 1952. Two live mussels were collected, the Spectacle Case and the Purple Pimpleback, found at miles 409.5 and 403.4, respectively. These mussels were lying on, not buried in, the substrate in water that was 50 cm deep or less. The umbones on the latter were deeply eroded and the periostracum on the former were heavily worn, indicating the erosive action of turbulent water in the river. The Asian Clam was the only other live bivalve collected during the study. Turbulent water, fluctuating water levels, and temperatures which remain below 20 degrees C throughout the year are not conducive to mussel recruitment in this area. When the dam was completed, unionid recruitment essentially ceased and existing mussels were gradually lost because of adverse conditions, predation, or natural mortality. (Baker-IVI)
W85-01921

LAND USE EFFECTS ON SEDIMENT YIELD AND QUALITY,
British Columbia Univ., Vancouver. Dept. of Geography.
O. Slaymaker.
Hydrobiologia Vol. 91, p 93-100, July, 1982. 13 Fig, 4 Tab, 68 Ref.

Descriptors: *Sediment yield, *Water quality, *Land use, Sediment transport, Model studies, Environmental effects.

Attempts to establish land use effects on sediment yield and water quality require consideration of backgrouna biogeochemical cycling, quantitative land use mapping, selection of appropriate transport and attenuation models, and the assessment of critical or threshold amounts and types of land use change. Progress in each of these problem areas is reviewed. Specifics considered include the defining of the nature of the processes and the rates of transformations in the biogeochemical cycle in the absence of land use change; defining land use categories and changes in sufficiently specific and, where possible, quantitative ways so that the resulting levels achievable in this measurement are compatible with those of land use measurements; define the most appropriate transport and attenuation models which describe the movement of water, sediment, ions, and pollutants through a basin; and defining the criteria by which critical thresholds of land use change can be recognized. (Baker-IVI)
W85-02060

7. RESOURCES DATA

7A. Network Design

DATA BANK FOR WATERWORKS AND FACILITIES - GOALS AND PROBLEM-SOLVING CONCEPT (DATENBANK WASSERWERKE UND ANLAGEN - AUFGABEN UND LOSUNGSKONZEPTION),
Institut fuer Wasserwirtschaft, Berlin (German D.R.).
For primary bibliographic entry see Field 5F.
W85-01969

7B. Data Acquisition

SATELLITE-TRACKED CURRENT DRIF
IN LAKE MICHIGAN,
National Oceanic and Atmospheric Adm
tion, Ann Arbor, MI. Great Lakes Environ
Research Lab.
R. L. Pickett, J. E. Campbell, A. H. Clites, a
M. Partridge.
Journal of Great Lakes Research, Vol. 9, N
106-108, 1983. 2 Fig, 4 Ref.

Descriptors: *Satellite technology, *Lake
gan, Water circulation, Remote sensing,

Satellite-tracked current drifters were test
use in monitoring near-surface currents in
Michigan. Each unit consists of a surface
containing the transmitter and batteries, and
length of line down to a weighted 1 x 4 m
chute. Satellite-determined positions of the d
were found to be within 0.5 km. Positions
obtained every two hr. Four drifters were
on a transect halfway across southern Lake
gan and tracked. The median current speed
mined from the drifters was 17 cm/s. The
lengths over the first two months ranged fro
to 700 km. The drifters appear to be ide
monitoring nearsurface lake currents and
hydrodynamic lake models. (Moore-IVI)
W85-01760

INSTRUMENTATION USED FOR HYD
LIC TESTING OF POTENTIAL WATER-B
ING FORMATIONS AT THE WASTE IS
TION PILOT PLANT SITE IN SOUTHE
ERN, NEW MEXICO,
Geological Survey, Albuquerque, NM. Wate
sources Div.
J. A. Basler.
Available from the OFSS, USGS, Box 25425,
Ctr. Denver, CO 80225. USGS Open-file R
83-144, 1983. 29 p, 16 Fig, 6 Ref.

Descriptors: *Aquifer tests, *Transmissivity,
wells, Data logger, Strip chart recorder, Amp
Pressure transmitter, Dead weight tester, Infla
packers, Barometer bailing test, Waste Isol
Pilot Plant, *New Mexico, Eddy County.

Requirements for testing hydrologic test we
the proposed Waste Isolation Pilot Plant a
Carlsbad, New Mexico, necessitated the u
inflatable formation packers and pressure tran
ers. Observations during drilling and initial d
opment indicated small formation yields w
would require considerable test times by cor
tional open-casing methods. A pressure-monit
system was assembled for performance evalu
utilizing commercially available components.
mation pressures were monitored with a d
hole strain-gage transducer. An inflatable p
equipped with a 1/4-inch-diameter steel tub
tending through the inflation element perm
sensing formation pressures in isolated test z
Surface components of the monitoring system
vided AC transducer excitation, signal condi
ing for recording directly in engineering units,
both analog and digital recording. Continuous
face monitoring of formation pressures provid
means of determining test status and projec
completion times during any phase of testing.
imum portability was afforded by battery
ation with all surface components mounted
small self-contained trailer. (USGS)
W85-01827

TRAVELING SCREENS AS SAMPLING G
FOR VERTICAL DISTRIBUTION STUDIES.
North Carolina State Univ. at Raleigh. Dep
Zoology.
R. A. Rulifson, and B. J. Copeland.
Estuaries, Vol. 5, No. 2, p 82-94, June, 1982
Fig, 9 Ref.

Descriptors: *Traveling screens, *Impingm
*Sampling, *Vertical distribution, Intakes, Diu
variation, Powerplants, Aquatic life, Screens.

npling technique has been developed for in-
ng the information gathered during routine
oring of impingement at water intake struc-
Samples from impingement catches on trav-
screens were taken from the sluiceway of the
wick Steam Electric Plant near Southport,
Carolina during the screen wash process so
divide the catch into vertical catch compo-
. Each component represented 1.2 m of the
column. Results showed differences in day
ight vertical distributions of impinged orga-
according to the spatial preferences of each
es. Impingement during daytime was lower
during night. Impingement of surface-oriented
es during daytime occurred at mid-depth,
ater species near the bottom, and bottom
es were seldom impinged. During the night
ce-oriented species were impinged at the sur-
midwater species at mid-depth, and bottom
es near the bottom. Residue (animals and
s) which remained within the screen wash
m from collection of the previous sample, and
organisms which became impinged on the
ns during retrieval of the sample, were used
lculate the rate of 'continuous impingement'
e traveling screens. These rates were com-
l to the impingement catch in order to deter-
biases in the vertical catch components. Com-
on of these rates indicated that impingement
ates determined by routine monitoring meth-
nay underestimate true impingement rates for
in species. This sampling technique for moni-
g impingement at intake structures will in-
e knowledge of the local biologic system
minimizing the cost of obtaining the informa-
The technique will also aid in pinpointing
fic impingement problems which may be cor-
d through modifications to the design of the
e structure. (Author's abstract)
-01842

LICATION OF REMOTE-SENSING TECH-
UES TO HYDROLOGIC STUDIES IN SE-
TED COAL-MINED AREAS OF SOUTH-
TERN KANSAS,
logical Survey, Lawrence, KS. Water Re-
ces Div.
primary bibliographic entry see Field 5B.
-01947

GLET OXYGEN IN SURFACE WATERS -
T I: FURFURYL ALCOHOL AS A TRAP-
G AGENT,
genoessische Anstalt fuer Wasserversorgung,
asserreinigung und Gewaesserschultz, Due-
lorf (Switzerland).
primary bibliographic entry see Field 2K.
-01964

GLET OXYGEN IN SURFACE WATERS -
T II: QUANTUM YIELDS OF ITS PRO-
TION BY SOME NATURAL HUMIC MA-
IALS AS A FUNCTION OF WAVE-
NGTH,
genoessische Anstalt fuer Wasserversorgung,
asserreinigung und Gewaesserschultz, Due-
lorf (Switzerland).
primary bibliographic entry see Field 2K.
-01965

TOMATED WATER LABORATORY -
AT BENEFIT TO THE CONSUMER,
sex Water Authority, Bristol (England). Bris-
Avon Div.
. Jones.
a, No. 6, p 321-331, 1983. 12 Fig, 3 Tab, 5 Ref.

criptors: *Automation, *Laboratory equip-
t, *Laboratories, *England, Drinking water,
nitoring, Water quality management,.

a very long time it has been claimed that the
ity of potable water in the United Kingdom is
nd to none - a very subjective statement,
ch tends to have been born out by the lack of
ances of widespread outbreaks of waterborne
ase. In recent years attempts have been made
egislate on the chemical and bacterial quality of
h treated drinking waters and the raw waters from which these were derived through EEC Directives. It has been the long standing practice in the UK to adopt the WHO and European Standards for chemical quality and Report 71 recommendations for both frequency of monitoring and bacterial quality. Much dependence is placed on the sample of water that is taken for analysis, and on the data that the laboratory produces. The scientific implications of the results are again crucial along with any course of remedial action that may be necessary to overcome a deficiency in the sample. In turn these data have to be transmitted to field staff, during working hours - perhaps to change a treatment process or to undertake a flushing operation of the distribution system. It is interesting to reflect on what action can be taken, say on a failed bacteriological sample, outside normal laboratory working hours, bearing in mind that traditional bacteriological analysis takes at least 18 hours to produce a result. It has long been the quest of the water scientist to produce the necessary analytical data as quickly as possible in order to minimize the risk of unsatisfactory potable water being passed into the distribution systems. Recent advances in computers and analytical instrumentation have enabled the quest to be brought nearer to reality. This paper outlines the work that has been carried out by Wessex Water in an attempt to achieve that goal. (Author's abstract)
W85-02011

ALTITUDE OF THE TOP OF THE MATAWAN GROUP-MAGOTHY FORMATION, SUFFOLK COUNTRY, LONG ISLAND, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
R. K. Krulikas, E. J. Koszalka, and T. P. Doriski.
USGS Open File Report 83-137, 1983. 1 Map, 1 Fig, 9 Ref.

Descriptors: Areal hydrogeology, *Aquifer systems, Geohydrologic units, *Maps, Magothy aquifer, Suffolk Country, *New York.

The Magothy aquifer, with its irregular surface and deeply eroded buried valleys, has become the major source of fresh water in most of Suffolk Country. With the availability of recent data from deep wells and test holes, refinement of the surface-altitude contours has been possible and resulted in substantial revision in some areas. This 1-sheet map delineates the surface altitude of the Magothy aquifer (Matawan Group-Magothy Formation) and includes a brief text and bibliography. (USGS).
W85-02030

EVALUATION OF ELECTRODE METHODS FOR DETERMINING TOTAL RESIDUAL CHLORINE IN VARIOUS WATER MATRICES,
Benedict Coll., Columbia, SC. Dept. of Chemistry.
J. T. Kinard, F. Jackson, and C. Stackhouse.
Journal of Environmental Science and Health, Vol. A19, No. 6, p 735-755, 1984. 7 Tab, 5 Fig, 19 Ref.

Descriptors: *Electrodes, *Industrial wastewater, *Residual chlorine, Titration, Chlorine, Pollutant identification, Drinking water, Potable water, River water.

Five electrode systems and procedures that are widely marketed for routine determination of total residual chlorine have been evaluated in a variety of water matices. The performance, in terms of accuracy, precision, and sensitivity, has been determined for the Orion 97-70 Residual Chlorine Electrode, Chlortect Monitor, Lazar 136A Chlorine Electrode, the forward amperometric titration method, and the back amperometric titration method. Response times for the former two systems were comparable and ranged for 20-100 seconds for chlorine concentrations ranging from 0.3-7 ppm in all water matrices. The Lazar electrode had considerably longer response times. The Chlortect Monitor and the forward amperometric titration method gave the highest sensitivity with values of plus or minus 0.005 and 0.01 ppm, respectively, at the 1 ppm level. However, the Lazar Electrode could not be completely evaluated because of inconsistencies in the marketed procedures. (Author's abstract)
W85-02123

MICROWAVE MEASUREMENTS OF MOISTURE DISTRIBUTIONS IN THE UPPER SOIL PROFILE,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W85-02160

7C. Evaluation, Processing and Publication

EVOLVING DATA PROCESSING ENVIRONMENT FOR COMPUTATIONAL HYDRAULICS SYSTEMS,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
W. James, and A. Unal.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 187-195, June, 1984. 25 Ref.

Descriptors: *Data processing, *Hydraulics, *Hydrologic data, *Hydrology, Computers, Fortran, Data aquisition, Automation, Meteorology, Fluid mechanics, Model studies, Data base management, Local area networks, Continuous modelling, Time series analysis.

Inevitably, distributed data processing will evolve using multi-microcomputer-based data management systems for civil engineering computational hydraulics and hydrology. Research and development groups will adopt networked data management systems including 500K-byte 16-bit and 64K-byte 8-bit microcomputers, FORTRAN as the high level language, and a 60 megabyte central hard disc with boss microcomputer using UNIX-type operating systems. Applications include: data acquisition, management, archiving, and presentation; application programs in areas such as meteorology, hydrology, hydraulics, water quality modelling, fluid mechanics, and coastal and ocean engineering; program maintenance and support; documentation and text processing; and real-time control. Hardware and software systems are undergoing rapid development in all these areas. Emerging techniques make it possible to supplant event modelling, and its associated design storm methodology, with more rational continuous modelling, using archived data, statistical processing of output, and graphics input/output. Continuous modelling, however, leads to data management difficulties. Special software for time series management is essential. Sophisticated data base management systems and local area networks permit improved cost performance for concurrent process control and modelling. Each desk-top computer would be individually assigned hydrological modules, communicating with a central hard disk boss microcomputer. (Collier-IVI)
W85-01709

PREDICTING VARIABILITY IN A LAKE ONTARIO PHOSPHOROUS MODEL,
Michigan State Univ., East Lansing. Dept. of Resource Development.
For primary bibliographic entry see Field 2H.
W85-01758

QUALITY-ASSURANCE DATA FOR ROUTINE WATER ANALYSIS IN THE LABORATORIES OF THE U.S. GEOLOGICAL SURVEY FOR WATER-YEAR 1982,
Geological Survey, Denver, CO. Water Resources Div.
D. B. Peart, and N. A. Thomas.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4264, 1983. 112 p, 180 Fig, 6 Tab, 7 Ref.

Descriptors: Alkalinity, *Chemical analysis, Dissolved solids, Heavy metals, Laboratories, Probability distribution, Quality control, Specific conductivity, Statistics, Trace elements, Trace metals,

*Water analysis, *Quality assurance, *Data collections.

The U.S. Geological Survey maintains a quality-assurance program based on the analysis of reference samples for its two water-analysis laboratories located in Atlanta, Georgia, and Denver, Colorado. Reference samples containing inorganic constituents are prepared at the U.S. Geological Survey's Ocala, Florida, office and disguised as routine samples, and sent daily to each laboratory through other U.S. Geological Survey offices. The results are permanently stored in the National Water Data Storage and Retrieval System (WATSTORE), the U.S. Geological Survey's data base for all water data. These data are analyzed statistically for precision and bias. The results of these statistical analyses are presented for data collected during the 1982 water year. In addition, one sample containing known concentrations of trihalomethanes was analyzed in both laboratories, and these results also are presented. (USGS)
W85-01768

TRUE LOCATION AND ORIENTATION OF FRACTURES LOGGED WITH THE ACOUSTIC TELEVIEWER (INCLUDING PROGRAMS TO CORRECT FRACTURE ORIENTATION),
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01780

REGIONAL GEOHYDROLOGY OF THE NORTHERN LOUISIANA SALT-DOME BASIN, PART III, POTENTIOMETRIC LEVELS OF THE WILCOX-CARRIZO AND SPARTA AQUIFERS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01785

COMPUTER PROGRAM AND DATA LISTING FOR TWO-DIMENSIONAL GROUND-WATER MODEL FOR LARAMIE COUNTY, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. A. Crist.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4137, 1983. 137 p, 3 Tab, 3 Ref.

Descriptors: *Computer programs, Fortran, Simulation, *Wyoming, Laramie County, *Model studies, Data collections, *Groundwater flow, Hydrologic conditions, *Two-dimensional model.

This is a supplement to the report, 'Effect of pumpage on ground-water levels as modeled in Laramie County, Wyoming,' published as U.S. Geological Survey Water-Resources Investigations Open-File Report 80-1104. The computer program and data used to model ground-water conditions in post-Cretaceous rocks in Laramie County are listed. (USGS)
W85-01787

MACHINE-READABLE DATA FILES FROM THE MADISON LIMESTONE AND NORTHERN GREAT PLAINS REGIONAL AQUIFER SYSTEM ANALYSIS PROJECTS, MONTANA, NEBRASKA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING,
Geological Survey, Denver, CO. Water Resources Div.
J. S. Downey.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 82-4107, 1982. 26 p, 10 Fig, 4 Tab, 11 Ref.

Descriptors: *Water levels, Head data, Basic data, Geologic data, *Hydrologic data, Montana, Nebraska, North Dakota, South Dakota, Wyoming, Data base, *Northern Great Plains, Madison Limestone.

Lists of machine-readable data files were developed for the Madison Limestone and Northern Great Plains Regional Aquifer System Analysis (RASA) projects. They are stored on magnetic tape and available from the U.S. Geological Survey. Record format, file content, and size are given for: (1) Drill-stem-test data for Paleozoic and Mesozoic formations, (2) geologic data from the Madison Limestone project, (3) data sets used in the regional simulation model, (4) head data for the Lower and Upper Cretaceous aquifers, and (5) geologic data for Mesozoic formations of the Northern Great Plains. (USGS)
W85-01790

HYDROLOGY OF LAKE PADGETT, SAXON LAKE, AND ADJACENT AREA, PASCO COUNTY, FLORIDA,
Geological Survey, Lakewood, CO. Water Resources Div.
S. E. Henderson.
USGS WRI/Open-File Report 82-759, 1983. 1 Map Sheet, 12 Fig, 3 Tab, 23 Ref.

Descriptors: *Lakes, *Surface-ground water relationships, Limnology, Dredging, Lake stages, Bathymetry, Aquatic plants, Hydrologic budget, Lake Padgett, Lake Saxon, Pasco County, Southwest Florida Water Management District, *Florida.

Development of lakeshore areas and nearby well fields could adversely affect Lake Padgett and Saxon Lake. The hydrology of the lake basins and the effects of present and future ground-water withdrawals were evaluated using available data and computer models developed for other investigations. Parts of both lake bottoms were dredged in 1967 and the lakes were connected by a canal. Dredging was more extensive in Saxon Lake than in Lake Padgett and the maximum depth of Saxon Lake was increased from an estimated 20 feet below mean stage to 30 feet below mean stage. Water-quality data indicate an increase in specific conductance, alkalinity, and organic nitrogen in Lake Padgett between 1964 and 1980, probably a result of residental development. Both lakes have extensive aquatic plant growth that may impede recreation in some areas. Fecal coliform counts infrequently exceed State criteria for waters used for recreation and for propagation and management of fish and wildlife. Well-field pumping at rates presently allowed will not affect the stage of the lakes. Increased pumping from South Pasco and Cypress Creek well fields would probably cause lake stages to decline by increasing leakage from the lakes to the underlying Floridan aquifer. (USGS)
W85-01826

RATIONALIZATION OF CENTRAL PLANNING IN WATER MANAGEMENT THROUGH THE INTRODUCTION OF EDP (RATIONALIZIERUNG DER ZENTRALEN PLANUNG IN DER WASSERWIRTSCHAFT DURCH EINSATZ DER EDV),
G. Stoye.
Wasserwirtschaft-Wassertchnik, Vol. 34, No. 2, p 34-35, February, 1984. 2 Fig.

Descriptors: *Planning, *Water management, *Data processing, *East Germany, Computers, Data acquisition, Data storage and retrieval.

The water-management industry in the German Democratic Republic has been using an electronic data processing (EDP) system capable of generating data to integrate annual plans for individual facilities into the general annual plan for the entire industry. The necessary short analysis time can only be achieved by distributing the load, i.e., by using computer facilities both at individual plants and centrally at the Ministry. A three-dimensional matrix was developed, consisting of data, column, and facility, in which the column entries included the base year, plan price basis 1, plan price basis 2, and government task/obligation (STAG/STAL). Because economic circumstances did not always allow each column corresponding to a data entry to be filled out, some columns (fields) had to be blocked by the computer. Generation of data corresponding to various demands of the plan made possible by changing the matrix. The Uni Planning Project (UPP) used today is an expans of the matrix designed to reduce the number error corrections that must be made at the cen computer facility by its two-stage nature: data c lection, data check, and initial interpretation at individual facility; integration and interpretatio individual plan data for the entire water indus by a central computer. A KRS 4200 computer used in both stages with the ALGOL 4200 ope ing system. STAG/STAL data is collected machine-readable data carriers and transmitted the facilities for completion of the project. Inte tion of investment planning is facilitated by a ri ly programmed three-stage EDP project. (G IVI)
W85-01879

THREE-DIMENSIONAL DIGITAL-COMPU ER MODEL OF THE PRINCIPAL GROUN WATER RESERVOIR OF THE SEVI DESERT, UTAH,
Geological Survey, Salt Lake City, UT. Wa Resources Div.
W. F. Holmes.
Available from the OFSS, USGS, Box 25425, F Ctr. Denver, CO 80225. USGS Water-Resour Investigations Report 83-4179, 1983. 123 p, 8 Fi Tab, 15 Ref.

Descriptors: *Groundwater, *Model stud Groundwater movement, *Groundwater recha *Potentiometric level, Great Basin, *U *Groundwater budget, Sevier Desert.

The principal ground-water reservoir in part of Sevier Desert, Utah was modeled using a thr dimensional finite-difference model. The mo was calibrated by comparing computed and served water-level measurements in 1952, simu ing results of aquifer tests, and simulating grou water withdrawals during 1952-81 and compar computed water-level changes during 1952-82 observed changes. The results indicate the mode capable of predicting future water-level chan The report includes a complete listing of the mo data for the 1952-82 simulation. (USGS)
W85-01925

WATER-LEVEL MAPS OF THE ALLUVI AQUIFER, NORTHWESTERN MISSISSIP APRIL, 1982,
Geological Survey, Jackson, MS. Water Resour Div.
D. Darden.
Available from the OFSS, USGS, Lakewood, 80225, Price: $1.75 in paper copy, $1.00 in mic fiche. USGS Water-Resources Investigati Report 82-4061, 1982. 1 Sheet Map, 1 Fig, 1 Tab Ref.

Descriptors: *Mississippi, Water resour *Groundwater, *Maps, *Aquifer, *Water lev Mississippi River valley, *Alluvial aquifer, Qu ternary aquifers.

Water levels were measured in about 500 wells the Mississippi River valley alluvial aquifer northwestern Mississippi during the period A 12-23, 1982. The water-level change from A 1981 to April 1982, showed a general decline, the water-level change from September 1981 April 1982 showed some recovery. Water levels the Delta were higher along the Mississippi Ri and Bluff Hills. Historically, water levels decl and rise as the amount of precipitation decreases increases. Recently, continuous heavy pumping irrigation has caused general water-level decli in the alluvial aquifer. (USGS)
W85-01926

DISTRIBUTION OF SELECTED CHEMIC CONSTITUENTS IN WATER FROM T FLORIDAN AQUIFER, SOUTHWEST FLO DA WATER MANAGEMENT DISTRICT,
Geological Survey, Tallahassee, FL. Water sources Div.
M. A. Corral, Jr.

lable from the OFSS, USGS, Box 25425, Fed. Denver, CO 80225. USGS Water-Resources tigations Report 83-4041, 1983. 1 Map, 4 Fig, f.

riptors: *Water quality, *Aquifer characteris- Southwest Florida Water Management Dis- *Florida, *Maps.

ralized maps showing variations in concentra- of chlorides, sulfates, hardness, and dissolved s in the Floridan aquifer have been prepared rt of a cooperative program with the South- Florida Water Management District. This t covers 10 counties and parts of 6 others rising the District. Data used to develop the t were retrieved from the water-quality files e U.S. Geological Survey. Considerable verti- nd areal variation of chemical constituents found in ground water of the Floridan aquifer. neral, ground water becomes more mineral- with increasing depth and with increasing nce from recharge areas due to solution of rals from the aquifer. Ground water was also mineralized with proximity to the coast, due ltwater intrusion. (USGS)
-01928

A FOR GROUND-WATER TEST HOLE R NICOLAUS, CENTRAL VALLEY AQUI- PROJECT, CALIFORNIA,
ogical Survey, Menlo Park, CA. Water Re- ces Div.
French, R. W. Page, and G. L. Bertoldi.
lable from OFSS, USGS, Box 25425, Fed. Denver, CO 80225. USGS Open-File Report 73, September 1983. 60 p, 14 Fig, 10 Tab, 23

criptors: *Test hole, *Electrical well logging, oactive well logging, Piezometers, *Water- fluctuations, Water-quality data, Sacramento ey, Central Valley, *California.

minary data are provided for the third of n test holes drilled as a part of the Central ey Aquifer Project which is part of the Na- l Regional Aquifer Systems Analysis Pro- n. The test hole was drilled in the SW 1/4 NE sec. 2, T.12N., R.3E., Sutter County, Califor- about 1 1/2 miles northwest of the town of olaus. Drilled to a depth of 1,150 feet below surface, the hole is cased to a depth of 100 feet equipped with three piezometer tubes to hs of 311, 711, and 1,071 feet. A 5-foot well en is set in sand at the bottom of each piezome- Each screened interval has a cement plug ve and below it to isolate it from other parts of aquifer, and the well bore is filled between the s with sediment. Thirty-one cores and 34 side- cores were recovered. Laboratory tests were e for minerology, consolidation, grain-size dis- ution, Atterberg limits, X-ray diffraction, ther- conductivity, and chemical analysis of water. physical and thermal gradient logs were made. hole is sampled periodically for chemical anal- of the three tapped zones and measured for er level. This report presents methods used to in field samples, laboratory procedures, and data obtained. (USGS)
5-01929

DROLOGIC MAPS OF THE HIGH PLAINS UIFER, JANUARY 1981, SOUTHWESTERN NSAS,
ological Survey, Lawrence, KS. Water Re- rces Div.
. Spinazola.
ilable from the OFSS, USGS, Lakewood, CO 25. USGS Water-Resources Investigations ort 82-4079, 1982. 8 Sheet Maps, 2 Fig, 5 Ref.

criptors: *Approximation method, *Hydrolog- lata, Water distribution (applied), Water man- ment (applied), *Maps, Kriging, Southwest nsas Groundwater Management District No. 3, nsas, *High Plains aquifer.

nathematical technique, called kriging, has been d in the form of a computer program to interpo- hydrologic data based on a network of 562 measured values. The computer program generated estimated values at the center of each 1-mile section in the Southwest Kansas Groundwater Management District No. 3 and facilitated contouring of selected hydrologic data that are needed in the effective management of ground water for irrigation. The kriging technique produced various maps that illustrate hydrologic conditions in the High Plains aquifer, the principal source of water in southwestern Kansas. Maps of the aquifer included the water-table altitudes, which ranged from about 2,040 feet to about 3,580 feet during January 1981, and saturated thickness, which ranged from 0 to over 600 feet during January 1981. (USGS)
W85-01930

TRENDS AND FLUCTUATIONS IN THE POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, WEST-CENTRAL FLORIDA, 1961-80,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. K. Yobbi.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 82-4086, 1983. 1 p, 8 Fig, 1 Tab, 13 Ref.

Descriptors: Potentiometric surface, *Potentiometric flow, Hydrology, Hydrogeology, Floridan aquifer, *Florida.

Trends and fluctuations of water levels in wells tapping the Floridan aquifer in west-central Florida during 1961-80 are described in this report. Water levels in most of the study area have not changed appreciably, except in parts of Hardee, Hillsborough, Manatee, Polk, and Sarasota Counties. In these areas, ground-water pumpage by industry and agriculture caused long-term declines of water levels. The largest declines are centered in the agricultural area of southern Hillsborough and northern Manatee Counties where pumpage lowered water levels more than 30 feet since 1964. Hydrographs of 10 wells show that, during 1976-80, the downward water-level trend discontinued in areas of heavy pumpage and, in areas not affected by pumping, water levels remained fairly unchanged. Water levels rose more than 20 feet from May 1975 to May 1980 in southwest Polk, Hardee, northeast Sarasota, northeast Manatee, and southwest Hillsborough Counties. In the heavily pumped area of northern Hillsborough County, water levels rose 5 to 10 feet. From September 1975 to September 1980, water levels in southwest Polk County rose more than 10 feet. (USGS)
W85-01940

DATA FOR GROUND-WATER TEST HOLE NEAR BUTTE CITY, CENTRAL VALLEY AQUIFER PROJECT, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. J. French, R. W. Page, G. L. Bertoldi, and R. P. Fogelman.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 83-697, October, 1983. 54 p, 12 Fig, 10 Tab, 23 Ref.

Descriptors: *Test hole, *Electrical well logging, Radioactive well logging, Piezometers, *Water-level fluctuation, Water-quality data, Sacramento Valley, Central Valley, *California.

This report provides preliminary data for the third of seven test holes drilled as part of the Central Valley Aquifer Project which is part of the National Regional Aquifer Systems Analysis Program. The test hole was drilled in the SW 1/4 NE 1/4 sec. 32, T. 19 N., R. 1 W., Glenn County, California, about one-half mile south of the town of Butte City. Drilled to a depth of 1,432 feet below land surface, the hole is cased to a depth of 82 feet and equipped with three piezometer tubes to depths of 592 feet, 968 feet, and 1,330 feet. A 5-foot well screen is at the bottom of each piezometer. Each screened interval has a cement plug above and below it to isolate it from other parts of the aquifer, and the well bore is filled between the plugs with sediment. Nine cores and 49 sidewall cores were recovered. Laboratory tests were made for mineralogy, hydraulic conductivity, porosity, consolidation, grain-size distribution, Atterberg limits, X-ray diffraction, and chemical quality of water. Geophysical and thermal gradient logs were made. The hole is sampled periodically for chemical analysis and measured for water level in the three tapped zones. This report presents methods used to obtain field samples, laboratory procedures, and the data obtained. (USGS)
W85-01941

WATER-LEVEL MAPS OF THE ALLUVIAL AQUIFER IN NORTHWESTERN MISSISSIPPI, APRIL 1983,
Geological Survey, Jackson, MS. Water Resources Div.
D. M. Sumner.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4285, 1984. 1 Sheet, 4 Fig, 9 Ref.

Descriptors: *Potentiometric level, Aquifers, *Water level, *Alluvial aquifers, Mississippi River valley alluvial aquifer, Quaternary aquifers, *Mississippi.

Water levels were measured in about 500 wells in the Mississippi River valley alluvial aquifer in northwestern Mississippi during April 1983. Ground-water levels have declined in some areas in recent years as a result of heavy irrigation pumpage from this aquifer. Near the areas of principal recharge, along the major rivers, and near the Bluff Hills, ground-water levels appear to be relatively unaffected by the large aquifer drafts; whereas away from the areas of recharge, in the interior of the basin, ground-water levels have shown a long-term decline. (USGS)
W85-01944

MAJOR AQUIFERS IN MINER COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01950

DEVELOPMENT AND FIELD TESTING OF A METHODOLOGY FOR ASSESSING COMMUNITY READINESS FOR SELF-HELP IN THE INSTALLATION, MAINTENANCE AND REPAIR OF WATER SUPPLY AND SANITATION FACILITIES,
Water and Sanitation for Health Project, Arlington, VA.
R. B. Isely.
Aqua, No. 1, p 3-10, 1983. 4 Fig, 2 Tab, 8 Ref.

Descriptors: *Community involvement, *Water distribution, *Water treatment, *Wastewater disposal, *Developing countries, *Social aspects, Algorithms, Maintenance, Costs, Public participation, Rural areas, Public health.

A particular gap in the planning capabilities of water and sanitation agencies of developing countries is the ability of field workers to systematically gather and use data on the capabilities of communities to organize efforts to install, maintain and repair water and sanitation facilities. In rural areas, determination of self-help capabilities of the community to formulate plans and take action often depends on the leadership of trained field workers (sanitarians, public health personnel, agricultural extension workers). A field data-collection instrument and a decision-making algorithm were developed to assist these field workers in selecting optimum modes of intervention in community actions. Development of adequate water supplies, maintenance of water delivery systems, and sewage treatment facilities are concerns detailed in plans for rural community involvement. (Wheatley-IVI)
W85-01980

GEOHYDROLOGIC DATA FOR TEST WELL USW G-4, YUCCA MOUNTAIN AREA, NYE COUNTY, NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
C. B. Bentley.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 84-063, 1984. 48 p, 21 Fig, 6 Tab, 6 Ref.

Descriptors: *Aquifer tests, *Hydraulic conductivity, *Water-level, *Geophysical logging, *Chemical analyses, *Nevada, Crater Flat Tuff, Yucca Mountain, Nevada Test Site, Nye County.

Data are presented on drilling operations, lithology, borehole geophysics, hydrologic monitoring, core analysis, water chemistry, pumping tests, and packer-injection tests for test well USW G-4. The well is one of a series of test wells drilled in and near the southwestern part of the Nevada Test Site, Nye County, Nevada, in cooperation with the U.S. Department of Energy. These test wells are part of the Nevada Nuclear Waste Storage Investigations to identify suitable sites for underground storage of high-level radioactive wastes. Test well USW G-4 was drilled to a total depth of 915 meters through volcanic rocks, consisting mostly of ash-flow tuff. Depth of water in the well during and after drilling and testing ranged from 538 to 544 meters below land surface, at approximate altitude of 728 meters above sea level. Drawdown in the well was about 3 meters after test pumping more than 5,000 minutes at a rate of 16 liters per second. A borehold-flow survey indicated that almost all water withdrawn from the well was contributed by the zone between a depth of about 865 and 915 meters below land surface. Analysis of a composite water sample collected after well completion showed the water to contain 216 milligrams per liter of dissolved solids, with relatively large concentrations of silica, sodium, and bicarbonate. (USGS)
W85-02031

DATA FOR GROUND-WATER STUDIES OF THE SAN JUAN BASIN, NEW MEXICO (1982-83),
Geological Survey, Albany, NY. Water Resources Div.
R. L. Klausing, and G. E. Welder.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 84-135, 1983. 46 p, 3 Fig, 2 Pl, 5 Tab, 2 Ref.

Descriptors: *Groundwater, Hydrographs, Observation wells, Water quality, *Data collections, *New Mexico, San Juan Basin, San Juan County, Four-corners area.

Ground-water data that can be used for futher hydrologic studies in the San Juan structural basin of New Mexico are reported. Descriptions and a location map of 64 observation wells, a list of water levels measured in the observation wells, water-level hydrographs of 32 wells, 15 partial chemical analyses of water samples from wells, and descriptions and a location map of 264 potential observations wells are included. The latter are wells for which good records exist. Their potential for use as observation wells needs to be verified in the field. (USGS)
W85-02034

PROJECTED PUBLIC SUPPLY AND RURAL (SELF-SUPPLIED) WATER USE IN FLORIDA THROUGH YEAR 2020,
Geological Survey, Tallahassee, FL. Water Resources Div.
S. D. Leach.
Florida Department of Natural Resources (Bureau of Geology) Map Series Number 108, 1984. 1 Map, 4 Fig, 2 Tab, 10 Ref.

Descriptors: *Florida, *Water use, *Public water supply, Rural (self-supplied), Hydrology, *Water supply, *Projection, Florida.

This report portrays Florida's past, present, and future freshwater requirements for public supplies and for rural domestic and livestock self-supplied use. The combined freshwater use by public supplies and rural domestic and livestock use increased from 225 million gallons per day (Mgal/d) to 1,672 Mgal/d in 1980, and is projected to reach 3,235 Mgal/d by the year 2020. In addition to the stress on the overall freshwater supply resulting from population growth, average per capita use for public supplies and rural use increased from 81 gallons per day (gal/d) in 1950 to 172 gal/d by 1980. This increase in per capita use has been leveling off for the past several years prior to 1980 and is expected to show only a small increase in future years. (USGS)
W85-02036

OCCURRENCE, QUALITY, AND USE OF GROUND WATER IN ORCAS, SAN JUAN, LOPEZ, AND SHAW ISLANDS, SAN JUAN COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
K. L. Whiteman, D. Molenaar, G. C. Bortleson, and J. M. Jacoby.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4019, 1983. 12 Maps, 19 Fig, 15 Tab, 30 Ref.

Descriptors: *Groundwater, Hydrogeology, *Water quality, *Saline water intrusion, Bacteria, Water use, San Juan County, *Washington, Lopez Island, Orcas Island, San Juan Island, Shaw Island.

Ground water, which supplies most of San Juan County's water needs, occurs in both bedrock and glacial drift. Water in the bedrock occurs in fractures in the otherwise dense, poorly permeable rock. Deposits of sand and gravel in the glacial drift provide the best yields to wells drilled into unconsolidated materials. Specific capacities of bedrock wells are typically low, and those of glacial-drift wells considerably higher. Ground water is high in dissolved solids and hardness; 29 of 56 wells sampled had water classified as very hard. Sixteen percent of the 171 ground-water sites tested for indicator bacteria had positive counts of one or more of these bacteria: total coliform, fecal coliform, fecal streptococcus. Nine percent of the 279 wells sampled for chloride in September 1981, appear to be affected by seawater intrusion. All of these wells are located within a mile of the coast; 60 percent of these wells are on Lopez Island. In 1980 an estimated total of 220 million gallons of ground water was withdrawn for all uses. Ninety percent of all ground-water use is for domestic and public supply purposes. Heavy pumpage on northern and southern Lopez Island correlates with areas having high chloride concentrations. (USGS)
W85-02043

DRAINAGE BASINS IN DUVAL COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. B. Stone, and J. B. Largen.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations 82-4069, 1983. 1 Map, 1 Fig, 1 Tab.

Descriptors: *Surface drainage, Drainage, *Florida, River systems, *Watersheds (basins), *Drainage systems, Drains, Atlantic coastal plain, Coastal plains, Drainage water, Flood plains, Small watersheds, Tributaries, Lake basins, St. Johns River basin, Nassau River basin, St. Marys River basin, Coastal area, Duval County, Drainage divide, Subbasin, Intracoastal Waterway, Southeast United States, Jacksonville.

The drainage basins and subbasins in Duval County, Florida, are delineated on this atlas map. The county's 840 square-mile area is drained by three major river systems; the St. Johns, 668 square miles; Nassau, 113 square miles; and St. Marys, 59 square miles. The remainder of the county is drained by a network of small streams that flow into either the Intracoastal Waterway or directly into the Atlantic Ocean. The sub-basins range in size from less than one square mile to more than 50 square miles. (USGS)
W85-02046

RECHARGE AND DISCHARGE AREAS THE FLORIDAN AQUIFER IN THE JOHNS RIVER WATER MANAGEMENT TRICT AND VICINITY, FLORIDA,
Geological Survey, Tallahassee, FL. Water sources Div.
G. G. Phelps.
USGS Water-Resources Investigations Report 4058, 1984. 1 Map, 4 Fig, 2 Tab, 37 Ref.

Descriptors: *Groundwater recharge, *Gro water discharge, Water balance, *Florida, Flor aquifer, St. Johns River Water Management trict.

The Floridan aquifer is the principal sourc most of the freshwater used in the St. Johns R Water Management District. An important ste managing water resources is the delineation recharge and discharge areas. Geohydrologic tors to be considered when delineating rech and discharge areas include: altitude and con ration of the potentiometric surface; direction magnitude of the gradient between the water t and the potentiometric surface; and thickness permeability of the overlying sediments. Rech to the aquifer comes almost entirely from rai within the Water Management District. Signifi recharge occurs where the aquifer is at or near land surface, and where the overlying ments are very permeable sand so that rech takes place downward leakage. Recharge occurs through sinkholes, sinkhole lakes, and c lakes that have a good connection to the aqu Major recharge areas are delineated on the Discharge occurs in areas of artesian flow (w the potentiometric surface is above land surf primarily by diffuse upward leakage and by charge from springs. Fifty-five springs, with discharge of about 1,600 million gallons per are in the Water Management District. Area discharge and the location of springs are show the map. In 1980, total pumpage in the W Management District was about 1,000 million lons per day. Under predevelopment conditi discharge by springs and upward leakage appr mately balanced recharged. Additional disch by pumpage may or may not be balanced decreased spring discharge of increased downw leakage. Examination of long-term water l trends can indicate if recharge and discharge ance. Graphs of rainfall, water levels, and mu pal pumpage for Jacksonville, Orlando, and D tona Beach are shown on the map. (USGS)
W85-02049

ALTITUDE AND GENERALIZED CONFI RATION OF THE TOP OF THE FLORI AQUIFER, ST. JOHNS COUNTY, FLORI
Geological Survey, Jackson, MS. Water Resou Div.
R. M. Spechler.
Available from OFSS, USGS, Box 25425, Ctr. Denver, CO 80225. USGS Water-Resou Investigations Report 83-4101, 1983. 1 Map, 3 1 Tab, 9 Ref.

Descriptors: Geology, Stratigraphy, *Aqui *Maps, Groundwater, *Floridan aquifer, St. J County, *Florida.

The Floridan aquifer is the principal sourc freshwater to wells in most of St. Johns Co The aquifer consists of a thick sequence of i bedded limestone and dolomite of Eocene age. top of the Floridan aquifer, which is irreg throughout St. Johns County, ranges from than 90 feet below sea level in the extreme sou tern part to more than 360 feet below sea lev the northern part. (USGS)
W85-02050

COMPUTATION OF CONTINUOUS STRE FLOW RECORDS,
Geological Survey, Reston, VA. Water Resou Div.
For primary bibliographic entry see Field 2E.
W85-02053

ENGINEERING WORKS

. Structures

ISMIC DESIGN CRITERIA FOR BURIED ATER PIPELINE IN PUERTO RICO,
erto Rico Univ., Mayaguez. Dept. of Civil Engiring.
Jimenez-Perez.
ailable from the National Technical Information vice, Springfield, VA 22161 as PB84-212380, ce codes: A02 in paper copy, A01 in microfiche. ter Resources Research Institute Completion port, August 1983. 21 p, 9 Fig, 2 Tab, 15 Ref. ject No. OWRT A-076-PR(1), Contract/Grant . 14-34-0001-2141.

scriptors: *Pipelines, *Seismic properties, sign criteria, Puerto Rico, Water supply.

e primary objective of this report was to deter- ne the effect of earthquakes on buried pipelines nstructed in Puerto Rico. The work established design earthquake parameters required togeth- with a simplified dynamic analysis technique t considers the effect of the time history varia- n of the earthquake and of different soil layers ng the conduit alignment. The simplified thod assumes that the soil mass and the pipeline ct to the earthquake ground excitation as a unit l that there are no relative displacements be- een the soil and the pipeline. The simplified del was used to determine the maximum axial ains for pipelines placed in homogeneous or in ferent soil masses. The study concluded that the al strain is smaller for stiffer soils regardless of pipe length embedded in the soil mass. The al strains determined from this analysis can be nbined with the additional stresses to determine failure criteria for the pipeline.
85-01821

EBUILDING OF THE HYDRO-ELECTRIC WER STATION OF SPIEZ (KRAFTWERK IEZ ERNEUERUNG 1982-1985),
rnische Kraftwerke A.G. (Switzerland).
Hartmann.
asser, Energie, Luft, Vol. 76, No. 3/4, p 29-30, 84. 2 Fig.

escriptors: *Hydroelectric plants, *Water re- urces development, *Spiez, *Switzerland, Hy- oelectric Plant, Simme River, Kander River, nstruction, Turbines, Pipes, Dam construction.

e hydroelectric power station of Spiez was built ginally in 1899 on the River Kander. In 1908 the tion was expanded by adding runoff from the tershed of the River Simme. Currently, rebuild- ; is again underway, having begun in 1982 and pected to be completed by 1985. Rebuilding will lude both the control dams of the Kander and Simme. The previous four feeding water pipes ll be replaced by a single pressure pipe. The mer power house is to be replaced with a new wer station holding two Francis turbine groups a power level of 18.2 MW. This will replace former six rotary current groups and the mer three monophase current groups for rail- ay supplies. The rest water left in the River nme will power a small power station using a ad of 15 m. Annual energy production, which d been 74 GWh, will be increased to 93 GWh. aker-IVI)
85-01857

EINZODL POWER STATION ON THE MUR AS KRAFTWERK WEIZODL AN DER MUR),
iselectra Ingenieurunternehmung A.G., Basel.
Kaufmann.
asser, Energie, Luft, Vol. 76, No. 3/4, p 49-51, 84.

escriptors: *Weinzodl, *Mur river, *Austria, Hydroelectric plants, Turbines, Coatings, Turbine ckets, Catchment area, Small head hydropower, esign flow.

ne Weinzodl power station is situated on the Mur ver in the Steiermark region of Austria. It consists of a machine house with two Straflo turbines (horizontal axle, double regulation, outer-rim generator) on the left bank with an adjoining three-sectional weir having a 7.5-m-high baffle plate. A mill canal branches off from the right weir pier; the 2.3-m head thereby created is utilized by a small power station (0.2 MW output, 11 cu m/sec usable water volume, 1 Straflo turbine). The main power station is designed for a maximum reservoir level of 364 m, a head of 10 m, and a design flow of 180 cu m/sec. Design flow is reached or exceeded on 42 days in an average year; mean annual flow is 115 cu m/sec, and flood flow can reach 1,800 cu m/sec. Output of the main power station is 25.0 GWh in the 6-mo winter season and 50.0 GWh in summer at the small power station, it is 1.5 GWh annually. The catchment area comprises 7,000 sq km. The facility is situated in a groundwater-conservation area, which necessitated special studies and procedures. Swiss companies played a significant role in design and construction and supplied the turbines. Of particular interest are the measures for inner conservation of the turbines and the coating of the rust-free stainless-steel turbine buckets at this and other power stations on the Mur. (Gish-IVI)
W85-01860

CONSTRUCTION OF THE ALICURA HYDROELECTRIC FACILITY IN ARGENTINA (DER BAU DER WASSERKRAFTANLAGE ALICURA IN ARGENTINIEN),
Electrowatt Engineering Services Ltd., Zurich (Switzerland).
H. Busenhart.
Wasser, Energie, Luft, Vol. 76, No. 3/4, p 57-60, 1984. 4 Fig.

Descriptors: *Hydroelectric plants, *Alicura, *Argentina, *Dam construction, Transmission lines, Earth dams, Outlets, Gates, Intakes, Cofferdams.

The Alicura hydroelectric facility, which is soon to begin operating, is situated on the Limay river in southern Argentina and is the uppermost of a chain of four such facilities. It is designed for an output of 1,000 MW and will produce 2,500 GWh per year. A 500-kV transmitter is under construction that will by 1985 cover the 1,700 km to Buenos Aires. The earth dam is 120 m high with a volume of 13 million cu m; its reservoir capacity is 2.4 billion cu m. At the dam site, the river curves sharply; the bank on the inner side is steep (50% gradient) with a plateau at the top, on which the intake and flood-control facilities are built. One of the two diversion pipes used during construction is now the bottom outlet. The coffer dams were integrated into the body of the main dam. At the intersection of the bottom outlet and grout curtain, two synchronously controlled operating gates and two gates for repair purposes were installed, each 2.4 m wide and 3.0 m high. The power house with its 116-m head and 4 250-MW Francis turbines lies on the left bank. Its water is channeled from reservoir to intake facility and via four pressure pipes to the power house. Both intakes are below the grout curtain. The distance between intake and power house is thus so short that no water tower is needed; however the disadvantage is that the channel in this area must be carefully sealed and drained. The entire project lies in an area of sandstone with layers of clay. Companies from Europe, the USA, and Japan, as well as Argentina (which contributed most of the personnel) participated in the project. Switzerland contributed 6% of the effort but retained 100% of the responsibility. (Gish-IVI)
W85-01862

HYDROELECTRIC POWER STATION AT THE NETSTAL LIME FACTORY (DAS WASSERKRAFTWERK DER KALKFABRIK NETSTAL AG),
Electroplan, Basel (Switzerland).
E. Pucher.
Wasser, Energie, Luft, Vol. 76, No. 5/6, p 99-102, 1984. 6 Fig, 1 Tab, 3 Ref.

Descriptors: *Hydroelectric plants, *Netstal, *Switzerland, Turbines, Trash rakes, Automation, Intakes, Gates, Overflow valves, Hydroelectric power, Generators.

A new hydroelectric power station was designed at the site of an old one at the Nestal lime factory on the Linth river, Switzerland. The object was to expand water-flow utilization while retaining the old weir, intake site, and reservoir capacity. The application of innovative devices (floating beam, steel cantilever sill, new type of overflow valve floating-matter transporter, automated control room) can result in an economically viable facility even in unfavorable circumstances. Reservoir capacity remained at 457.35 m, usable water volume was increased from 4.0 to 4.0-20.0 cu m/sec, a horizontal Kaplan-S pipe turbine replaced the old Francis shaft turbine, turbine output rose from 132 to 802 kW, generator output increased from 85-110 kW to 148-660 kW, average output was 530 kW (90 kW at the old facility), and annual energy production was 4.2-4.5 GWh as compared to 0.9-1.05 GWh previously. The inlet facility consists of a rake, its cleaning machine, overflow valve, and scour gate. Floating matter caught in the rake is thrown into a 1-m-wide channel, which can be heated. From here it is driven by a motorized transporter into a trench. This device obviates the necessity for an inclined channel and conserves rinse water; in winter, ice problems are avoided. The automated control room allows the facility to be operated by one man. Power-house construction cost was 5 million Swiss Francs; investment cost excluding headwater channel was 5,350 Francs/kW. (Gish-IVI)
W85-01866

PROGRESS IN ROCKFILL DAMS,
Cooke (J. Barry), Inc., San Rafael, CA.
J. B. Cooke.
Journal of Geotechnical Engineering, Vol. 110, No. 10, p 1383-1414, October, 1984. 10 Fig, 2 Tab, 28 Ref.

Descriptors: *Dam construction, *Rockfill dams, *Reviews, Embankments, Design criteria, Construction, Performance evaluation.

The contributions of Karl Terzaghi, a major contributor to progress in embankment dams, are noted and a history of parallel development of earth core and concrete-face rockfill dams is presented along with an analysis of the impact of compacted rockfill on the concrete face rockfill dams. Emphasis is directed towards the concrete face type of rockfill dam. The early period from 1850 to 1940 stressed mainly the construction of dumped rockfill dams. The transition period from 1940-1965 saw developments in the area of engineered rockfill dams. The modern period from 1965 to 1982 has enjoyed widespread use of compacted rockfill dams of earth core and concrete face type. Recent progress in the design and construction of this type of dam is outlined. Design trends and performance data are reviewed. Specific areas of concern include the use of water in compacted rockfill, rock quality, use of gravel, modern earth core compacting techniques, modern concrete face rockfill dam construction, cold weather sites, seismic resistance of compacted rockfill, pumped storage cyclic operation, toe slab foundations, stability, upstream face rockfill, face slab placement, construction scheduling, river handling, and rockfill placement. (Baker-IVI)
W85-01870

SHEETPILE INTERLOCK TENSION IN CELLULAR COFFERDAMS,
Southern Illinois Univ. at Edwardsville. Dept. of Civil Engineering
M. P. Rossow.
Journal of Geotechnical Engineering, Vol. 110, No. 10, p 1446-1458, October, 1984. 13 Fig, 10 Ref.

Descriptors: *Cofferdams, *Construction, *Tension, *Sheetpile interlock tension, Design criteria, Dams, Analytical methods, Mathematical equations.

An analytical method is presented for the calculation of the interlock tension in the sheetpile walls of a cellular cofferdam. The method is based on the assumption that the walls act as inextensible membranes offering no resistance to bending about

a vertical axis. A set of governing equations has been derived by stating the condition of equilibrium and compatibility. Examination of the calculations for an example problem reveals that the method provides theoretical backing for Swaket's equation for the force in the common wall (Swatek, E.P., Cellular Structure Design and Installation, Proceedings of the Conference on Design and Installation of Pile Foundations and Cellular Structures, Envo Publishing Co., Inc. Pennsylvania, 1970, pp. 413-423.). The calculations also suggest how Swatek's equation may be generalized to allow the value of the fill pressure in the arc-cell to differ from that in the main-cell. The calculations in the example also confirm the previously observed importance of the rotation of the Y connection in carrying the loads. Although the method has been presented here for the particular sheetpile wall configuration corresponding to a circular cofferdam, the basin approach also applies to other sheetpile structures. Since the method's predictions of interlock forces depend crucially on the specification of the fill pressure acting on a wall, the confidence to be placed in the predictions is directly related to the confidence with which a single number can be used to represent the complex soil-structure interaction which occurs in a flexible earth-retaining structure. (Baker-IVI)
W85-01872

MICROCOMPUTER PROGRAMS FOR DESIGNING WATER SYSTEMS,
Public Works Dept. of Malaysia, Kuantan.
E. S. Koh, and D. R. Maidment.
Journal of the American Water Works Association, Vol. 76, No. 7, p 62-65, July, 1984. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Computers, *Design, *Water distribution, Developing countries, Water demand, Water supply, Pumps, Pipelines, Storage reservoirs, Cost analysis.

The use of microcomputers can help engineers and planners in designing water supply systems, especially for developing countries. Five programs written for microcomputers (DEMAND, YIELD, MAINS, RESERV, AND COSTS) deal with a sequence of problems in the design of a water supply system: projecting demand, determining the yield of a water source, calculating pump and pipeline capacities, sizing a storage reservoir at the location of demand, and performing an economic analysis of alternative designs. (Moore-IVI)
W85-01903

CORROSION AND PROTECTION OF PIPES IN DEVELOPING COUNTRIES,
A. Baltes.
Aqua, No. 4, p 161-167, 1983. 12 Fig, 17 Ref.

Descriptors: *Pipelines, *Pipes, *Corrosion control, *Protection, Cathodes, Coatings, Conveyance structures, Water transport, Water mains, Developing countries, Soil resistivity, Cathodic protection.

For effective protection against corrosion of cast iron and steel water pipelines in developing countries - where soils are often highly corrosive - the use of high-grade coating materials and cathodic protection, as well as regular maintenance, is vital. In soils of low resistivity the annual rate of corrosion may be as high as 1 mm. Pipes are coated by bituminous or plastic material to isolate the metal from the soil. The impact strength and the compressive strength of the coating material and coating application in accordance with standards and specifications are vital for effective protection. Measures taken to protect the inner surface of water pipelines from corrosion and encrustation include grout lining. For effective cathodic protection at acceptable cost, pipelines must be conductive, they must be isolated from grounded pipeline components, and the resistivity of the coating material used must be sufficiently high. Pipelines may be protected cathodically by impressed current systems or by sacrificial anode systems. If power supply or spares pose a problem, the use of galvanic anodes in low-resistivity soils may be a reasonable option. Like other plants and installations, cathodic protection systems must be monitored and maintained. Cathodic protection engineers, who may be company trained or trained at specialized institutions are needed for the operation of cathodic protection systems. In many applications, effective and economic protection is achieved by combining pipeline coating and cathodic protection. (Collier-IVI)
W85-01991

COMPARISON OF WATER MAINS CLEANING TECHNIQUES - THE EXPERIMENT OF BEGLES (COMPARAISON DES TECHNIQUES DE CURAGE DES CONDUITES D'EAU POTABLE - L'EXPERIENCE DE BEGLES),
Lyonnaise des Eaux, Bordeaux (France).
J. Petry, and Ph. de La Clergerie.
Aqua, No. 5, p 231-233, 1983. 6 Fig.

Descriptors: *Pipelines, *Cleaning, *Water mains, Water conveyance, Water distribution.

The practice of replacing water pipes is not only expensive, but it also causes great inconvenience for those relying on the use of those pipes. Costs of iron, excavating, road repairing and manpower have all increased over the past few years. Managers of water supply systems are compelled to clean pipes, if possible, rather than to replace them. The three methods of soft scrapers, rods, and metal scrapers were used to clean various heavily encrusted pipes in the district of Begles, part of the Urban Community of Bordeaux. A comparison of the effectiveness of these three methods is offered. (Baker-IVI)
W85-01999

WORLD'S LONGEST TUNNEL,
Helsinki Metropolitan Area Water Co. (Finland).
P. Erkola.
Aqua, No. 6, p 272-274, 1983. 2 Fig.

Descriptors: *Tunneling, *Helsinki, *Finland, Lake Paijanne, Construction, Water distribution, Water supply, Water conveyance.

The Paijanne Tunnel was constructed in Finland to transport water and to ensure the supply to Helsinki for many years in the future. The tunnel is 120 km long through solid rock from Lake Paijanne to the outskirts of the city. Removal of half a million lorry loads (10 cu m) of rubble was necessary for the tunnel to be built. Quarrying activities alone occupied one and a half million manhours and 40,000 blasting operations. The cost was in US dollars, 113 million. Work was begun in 1973 and completed in 1982. The work, when completed, produced the world's longest continuous rock tunnel. (Baker-IVI)
W85-02003

8B. Hydraulics

MODELLING CRITERIA FOR BUBBLE PLUMES - A THEORETICAL APPROACH,
National Water Research Inst., Burlington (Ontario).
G. Tsang.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 293-298, June, 1984. 1 Fig, 9 Ref.

Descriptors: *Bubble plumes, *Model studies, Bubbles, Plumes, Buoyancy, Gases, Expansion, Theoretical analysis.

A theoretical investigation is made to derive the parameters that govern the dynamic similarity between prototype and model bubble plumes. It is shown in the study that, for a complete similarity between the prototype and the model, the buoyancy flux from the source, the size of the bubbles, and the expansion of gas bubbles all have to be simulated. This is translated into the observation of the Froude law, the Weber law, and the expansion law in the model study. The expansion law requires that, for a reduced model, the study be conducted under partial vacuum and, for an enlarged model, the study be conducted under pressure. The physical properties of common fluids impose severe constraints in the model stud
Weber law is to be satisfied, the smalles
permissible will only be half the prototype
conduct experiments under partial vacu
boiling of the model liquid has to be co
with. For practical reasons, a certain de
violation of the similarity laws seems to
avoidable. The theoretical investigation
systematic experiments to examine the qua
effect of the different similarity parameters
degree of violation of the similarity laws p
ble in solving practical problems. (Auth
stract)
W85-01715

**HYDRODYNAMIC OF CIRCULAR PR
CLARIFIERS,**
Windsor Univ. (Ontario). Dept. of Civil E
ing.
For primary bibliographic entry see Fi
W85-01716

MECHANICS OF MUDFLOWS,
Washington State Univ., Pullman. Dept.
and Environmental Engineering.
J. D. Higgins, B. Naik, S. V. Mills, H. Cop
A. Roberson.
Available from the National Technical Infc
Service, Springfield, VA 22161 as PB84
Price codes: A07 in paper copy, A01 in mic
Washington Water Research Center Re
October 1983. 116 p, 29 Fig, 3 Tab, 49
Append. Project No. OWRT C-10110-V(
Contract/Grant No. 14-34-0001-1463.

Descriptors: *Mudflows, Hydrodynamic
characteristics, *Hazard assessment, Stea
motion, *Fluid mechanics, Hydrome
Model studies, Bingham model, Rheolog
bulent flow, Velocity profiles, Friction.

The mudflow hazard associated with volc
otherwise is real, yet little is understoo
fluid mechanics governing the flow. Tv
were investigated in this research. First,
characteristics of sites where mudflows h
curred and mud material properties wer
ined. Second, the equations for the func
hydromechanics phenomena of mudflow
steady-state motion were developed. A I
model was adopted for the study of rheol
fluid mechanics of mudflows. A method
veloped to estimate Bingham constant
water content and the grain-size distrib
solids. A fluid mechanics theory of Bingh
flow in a wide open channel was devel
well as equations for predicting the transit
laminar to turbulent flow. These were
through experiments in a flume using a mu
Theories of transitional and turbulent unifc
in smooth and rough open channels wer
oped. Velocity profiles and friction factors
ed by the theories were verified with expe
data. The methodologies developed to
the flow rates for a given depth, channel ch
istics, and fluid characteristics are presen
computer program.
W85-01816

**BASIC CONCEPTS OF KINEMATIC
MODELS,**
Geological Survey, Lakewood, CO. W
sources Div.
For primary bibliographic entry see Field
W85-02035

8C. Hydraulic Machinery

**ASYNCHRONOUS GENERATOR; AN
NATIVE TO THE SYNCHRONOUS G
TOR FOR SMALL HYDROELECTRIC
STATIONS WITH OUTPUT UP TO 20
(DER ASYNCHRONGENERATOR; EI
TERNATIVE ZUM SYNCHRONGENE
FUR KLEINE WASSERKRAFTANLAG
EINER LEISTUNG BIS 20000 KW),**

rown, Boveri und Cie A.G., Baden (Switzerund).
.. Kallmann.
Vasser, Energie, Luft, Vol. 76, No. 3/4, p 33-43, 984. 21 Fig, 9 Ref.

escriptors: *Hydroelectric powerplants, *Asynhronous generators, *Switzerland, Small hydroectric plants, Costs, Overspeed stress.

ecreases in the energy supply and increases in its ost have combined to make small hydroelectric ower stations (HEP; output 10,000-20,000 kW) ore viable. Such a facility with an asynchronous enerator (AG) is competitive with one having a ynchronous generator (SG) due to favorable inallation costs, despite the necessary compensating ondensors. AGs are mechanically robust and ractically maintenance-free (as are SGs); have no ecial requirements regarding moment of inertia Gs require a minimum flywheel mass); have a nall air gap that must sometimes be enlarged due overspeed, which influences performance; are perior to SGs at the same output in terms of ass, space requirements, and economy; require active power via condensors or the network Gs can put out or take in reactive power); need ljustable condensors or saturation throttles to aintain tension when operating alone with varile loads; have condensors requiring power-surge otection; need no synchronizing device (SGs quire one for parallel operation); and, unlike Gs, do not require frequency regulation during andalone operation. The best conditions for inallation of an AG are parallel operation with a ort feed line or an SG nearby to provide reactive ower. The AG can then be operated with conant or variable load. At the end of 1980, there ere 78 AGs operating in small HEPs in Switzerand, of which 24 were installed after 1971. Techcal and economic power-output limitations, hich are determined mechanically by overspeed ress rather than electrically, are about 24, 30, and MW for AGs with 4, 6, and 8 poles, respective(Gish-IVI)
85-01858

UMPS FOR LIQUIDS, ESPECIALLY FOR ASTEWATER (PUMPEN FUR FLUSSIGKEIEN, INSBESONDERE FUR ABWASSER),
antonales Amt fuer Gewasserschutz, Sankt allen (Switzerland).
Weber.
asser, Energie, Luft, Vol. 76, No. 5/6, p 77-80, 84. 10 Fig.

escriptors: *Pumps, *Wastewater facilities, ater conveyance, Piston pumps, Centrifugal mps, Particulates, Hydraulic machinery.

mps designed for various branches of the water d wastewater industries are described and illusted. Next to the electric motor, the pump is nsidered the most versatile machine. Of the ny types of pump, the piston and centrifugal mps are the most important. In the water supply dustry, automatic hydraulic controllers are ofred as a unit and are used mainly when the water pply is reliable but water pressure is not; the unit mprises a pump and pressure tank with air cushn and controller mounted on a shock-absorbent se. The Hany standard pump is used in clean or htly polluted liquids without coarse particles, as rculation and pressure-raising pumps in water pply, heating installations, and industry; depend g on engine revolution and power, pumping caity is 3-380 cu m/hr (0.8-100 l/sec). In the astewater industry, specialized pumps are eded. For polluted, untreated media containing reign bodies as big as the pressure-connection ameter, a clog-free passage is of primary impornce. The 'Turo' free flow pump fulfills this criten, is also economical, and runs quietly; power nsfer to the pumped medium occurs according the hydraulic coupling principle; and performce is 1-150 l/sec. The 'Ama-Drainer' is an underter pump suited to empty and automatically ep dry excavations, shafts, and subterranean pasges. It can be used in the industrial and municipal lds for lightly polluted water with solid particles to 10 mm in diameter. The 'Biral' wastewater d feces pump has a two-polar motor and a choice of four wheels (swivel, single-,double-, or multichannel) as well as free passage corresponding to the pressure-connection diameter guaranteed for the first three wheel types. Wastewater with solids can be pumped without clogging with the single channel or swivel wheel with a four-pole motor. (Gish-IVI)
W85-01864

PUMP STATION DESIGN: THE BENEFITS OF COMPUTER MODELING,
Pirnie (Malcolm), Inc., Newport News, VA.
M. P. Robinson, Jr., and R. E. Blair, Jr.
Journal of the American Water Works Association, Vol. 76, No. 7, p 70-77, July, 1984. 7 Fig, 5 Tab.

Descriptors: *Computer models, *Pumping plants, *Design, *Norfolk, *Virginia, Hydraulic machinery, Mathematical models, Pumps, Valves, Water distribution.

The Norfolk, Virginia water system serves the city's residential, commercial, and industrial demands, and in addition, serves the south Hampton Roads naval facilities and provides wholesale supply to the city of Virginia Beach. Concern about the city's ability to meet the increasing demand from Virginia Beach while maintaining reliable service to retail customers led to the use of a distribution system mathematical model for a refined analysis of explicit pump station design criteria. Specific emphasis is given to: selection of optimum efficiency design points and pump characteristics curves; selection of the most efective combination of pumps; and determination of backpressure valve control settings for the ground-level tank replenishment process. The effort expended in developing and applying mathematical models to distribution system and pump station design analyses is well repaid in the savings that result from improved design and operation. (Moore-IVI)
W85-01905

8D. Soil Mechanics

SEISMIC DESIGN CRITERIA FOR BURIED WATER PIPELINE IN PUERTO RICO,
Puerto Rico Univ., Mayaguez. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8A.
W85-01821

EARTH FOUNDATION TREATMENT AT JEBBA DAM SITE,
Montreal Engineering Co. Ltd., St. Catharines (Ontario).
Z. V. Solymar, B. C. Iloabachie, R. C. Gupta, and L. R. Williams.
Journal of Geotechnical Engineering, Vol. 110, No. 10, p 1415-1430, October, 1984. 16 Fig, 1 Tab, 4 Ref.

Descriptors: *Dam construction, *Jebba Dam, *Niger River, *Nigeria, *Foundation rocks, *Sand, Alluvial soils, Blasting, Vibrocompaction.

The Jebba Main Dam is founded on alluvial sands up to 230 feet in depth. In situ deep densification of loose, clean sands was required to depths as great as 131 ft below the original river bottom to provide safe foundation support for this dam on the Niger River. The required depth of treatment was unprecedented, and the volume of sand to be densified made this one of the largest in place densification projects ever undertaken. Deep blasting was used to densify the sand in the depth range of 82 ft to 131 ft below original bottom. Calculations based on measured settlements show that average improvement, in terms of relative density due to blasting over the full depth of the affected material, varies between 5 and 16 for an average of 10 percentage points. Both the treatment depth and the magnitude of explosive charges exceeded the corresponding values on previous projects by a factor of about two. Vibrocompaction was used to achieve the required densification to depths of 98 ft beneath the ground surface. The sand at this site was well suited for densification by this means, with some problems arising at the beginning when procedures had to be developed to facilitate probe penetration to the required depth. Site mapping of the initial sand density from definition of zones to be densified was done using the Static Cone Penetration Test. While densification occurred immediately after blasting and during vibrocompaction, increases in penetration resistance continued over substantial time periods of weeks to months in duration. Account of this time effect should be taken in the specification and evaluation of sand densification. (Baker-IVI)
W85-01871

8F. Concrete

MEASUREMENT OF CONCRETE PERMEABILITY,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
B. B. Hope, and V. M. Malhotra.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 287-292, June, 1984. 5 Fig, 1 Tab, 3 Ref. D.S.S. contract OSU80-00104.

Descriptors: *Concrete testing, *Permeability, Concrete technology, Permeability coefficient, Water/cement ratio.

Because of the generally low permeability of concrete, either the length of path along which permeability is to be measured must be relatively small or the driving force must be relatively large to avoid an undue length of time for the test. In the proposed method, the concrete samples are cast in epoxy resin before insertion in a pressure cell. Uniaxial water flow, under pressures up to 3.5 MPa, is ensured by O-ring seals. The higher pressures which can be used with this method mean that larger, more representative speciments can be used and test results obtained in a reasonable length of time. The test method and apparatus appears to present a valid means of determining coefficient of permeability for concrete mixes with a wide range of water/cement ratios and air contents. The test is adaptable in that the hydraulic gradient applied to the sample can be varied as well as the fluid used for testing. The effect of a fluid other than water, or the addition of chemicals to the water used, can be examined. (Moore-IVI)
W85-01714

CONCRETE IN HYDRAULIC ENGINEERING FOR A BETTER ENVIRONMENT (BETON IM WASSERBAU FUR BESSERE UMWELT),
G. Brux.
Wasser, Energie, Luft, Vol. 76, No. 3/4, p 53-56, 1984. 5 Fig, 1 Tab.

Descriptors: *Concrete construction, *Hydraulic engineering, *Germany (Federal Republic), Wastewater treatment facilities, Water treatment facilities, Dam construction, Arch dams.

The Kohlbrandhoft (K) wastewater treatment facility handles 88% of Hamburg's (Federal Republic of Germany) municipal wastewater (0.5 million cu m/day) and is situated on an artificial peninsula at the confluence of the Norderelbe and Kohlbrand (Suderelbe) rivers. With the 1973 expansion of the Nord plant, lack of space meant the abandonment of conventional construction techniques: very deep preliminary-treatment basins with funnels in the center, block construction of the activation facility, and tertiary-treatment tanks built on top of one another. Similar conditions existed during construction of the activation facility, and tertiary-treatment tanks built on top of one another. Similar conditions existed during construction of the biological stage at K Sud (start-up in 1983), which has double-decker tertiary treatment, small settling tanks with horizontal flow built in block fashion behind larger, vertical-flow tanks, and six activation tanks with five aeration cycles operated in cascade form. The phosphate-removal facility at the 4-sq-m Tegelersee in West Berlin comprises an intake complex and a filtration/flocculation facility. The North Trench complex (intake facility, macrorake, intake basin, sludge bins, weir, outlet facility, and cascades) is situated

in the lake inflow and is constructed of water-repellent concrete parts with anchored sheet pilings. The rake has a 12-m-high aluminum-coated steel construction to prevent weather-related damage. The concrete filtration/flocculation plant consists of three 43 x 47 x 8 m underground boxes, each containing 6 filter chambers and a sludge and pure-water tank, with flocculation basins above them, forming a triangular hall containing a distribution tower. The high steel content in the filter foundations (380 kg/cu m concrete) made construction difficult. The 185-m high Oymapinar arch dam in a gorge of the Manavgat river in southern Turkey is 25 m thick at the foot and 5 m thick at the crown, requiring 0.65 million cu m concrete. Intake and outlet structures, flood control overflow, the stilling basin, and power station used 0.25 million cu m steel concrete. (Gish-IVI)
W85-01861

8G. Materials

CORROSION AND PROTECTION OF PIPES IN DEVELOPING COUNTRIES,
For primary bibliographic entry see Field 8A.
W85-01991

USEFULNESS OF MEASURING THE CORROSION RATES OF SOILS (UTILITE DES MESURES DE CORROSIVITIE DES SOLS),
Naples Univ. (Italy). Facolta di Ingegneria.
M. Arpaia.
Aqua, No. 4, p 168-172, 1983. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Corrosive soils, *Pipes, *Coatings, Soil chemistry, Soil physical properties, Resistivity, Hydrogen ion concentration, Soil water, Sulfates, Chlorides, Soil bacteria.

Soil corrosivity can be a problem for buried pipes, and it is difficult to predict the corrosivity of soils based upon their physical and chemical characteristics. Soil factors which may be used to determine the corrosivity include: electrical resistivity, soil water, pH, sulfates, chlorides, sulfate and iron bacteria, and oxygen content. Different types of pipe coatings have been used to protect buried pipes, including adherent and nonadherent coatings, and passive and active coatings. Engineers can use information on the corrosivity of soils to determine what kind of protection may be necessary for water distribution networks, but there are questions as to whether getting information on soil corrosion rates is economical. (Moore-IVI)
W85-01992

CORROSION BEHAVIOUR OF CAST IRON PIPES,
Swiss Corrosion Commission, Zurich.
F. Stalder.
Aqua, No. 4, p 183-187, 1983. 9 Fig, 3 Tab, 9 Ref.

Descriptors: *Pipelines, *Corrosion, Pipes, Soil properties, Resistivity, Concrete, Gravel.

Pipelines made of grey or ductile cast iron exhibit very good corrosion resistance in soils, provided that the formation of macro-elements as a result of non-homogeneous bedding or an electrical contact with foreign cathodes or stray current effects can be avoided. Stray current effects and macro-element formation have electrochemically the same reaction mechanism. Stray current corrosion is induced by the voltage drop in the rail, whereas macro-element formation is a galvanic effect, the driving force for which stems from the corrosion potential difference. Various possibilities exist for the protection against macroelement formation, such as high-resistivity homogeneous backfill for the pipeline or the insulation of the pipeline from the soil. In the presence of foreign cathodes the high resistivity backfill provides a sure method of protection. Other methods of protection against the action of stray currents include reduction of the longitudinal conductivity as well as the drainage and forced drainage which are using the stray current as protective current for the pipeline. (Baker-IVI)
W85-01994

VARIOUS COATING MATERIALS FOR POTABLE WATER CONCRETE STORAGE RESERVOIRS - EXPERIENCES IN GERMANY, SWITZERLAND AND AUSTRIA,
Vandex Isoliermittel G.m.b.H., Hamburg (Germany, F.R.).
H. Pfundt.
Aqua, No. 5, p 235-236, 1983. 2 Fig.

Descriptors: *Water storage, *Water quality control, *Linings, *Storage reservoirs, Reservoirs, Construction, Pipelines, Coatings.

In order for water to maintain its quality during storage after treatment, the lining of reservoirs and pipes is particularly important. A coating must be waterproof, with smooth surface and good appearance, insoluble in water, and shall not contain any toxic or other harmful components, have a long life, not give rise to microbial growths, be easy to apply and be economical. Current mortar linings have advantages over other types of coatings as they contain no organic matter and there is therefore no danger from microbial growth as with organic coatings. Current slurry coatings are easy to apply but the preparation work necessary on surfaces to ensure a satisfactory result is extensive. (Baker-IVI)
W85-02000

9. MANPOWER, GRANTS AND FACILITIES

9B. Education (In-House)

WATER RESOURCES DIVISION TRAINING CATALOG,
Geological Survey, Lakewood, CO. Water Resources Div.
W. R. Hotchkiss, and L. A. Foxhoven.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Geological Survey Open-File Report 83-945, 1984. 162 p, 2 Fig, 3 Tab.

Descriptors: *Training, *Education, Water resources, *Catalogs, Training manuals, Training facilities, Federal agencies.

The National Training Center provides technical and management sessions nesessary for the conductance of the U.S. Geological Survey's training programs. This catalog describes the facilities and staff at the Lakewood Training Center and describes Water Resources Division training courses available through the center. In addition, the catalog describes the procedures for gaining admission, formulas for calculating fees, and discussion of course evaluations. (USGS)
W85-02032

9D. Grants, Contracts, and Research Act Allotments

HIGHLIGHTS OF THE 1983 FEDERAL-STATE COOPERATIVE WATER RESOURCES PROGRAM,
Geological Survey, Reston, VA. Water Resources Div.
B. K. Gilbert, and T. J. Buchanan.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 83-763, 1983. 36 p, 4 Fig, 5 Tab, 3 Ref.

Descriptors: *Water resources, *Federal-State cooperation, *Hydrologic data, State governments, Local agencies.

The U.S. Geological Survey Federa
erative Water Resources Program
1983 continued to concentrate on inv
highest priority to the Nation. Hy
collection and interpretive studies w
in every State, Puerto Rico, and seve
tories with focus on such current
ground-water contamination, floods
toxic wastes, acid precipitation, and s
During the year, this 50-50 matching
carried out in working partnership w
800 State, regional, and local agencie
ing from all sources totaled appro
million. Details of the program are m
tiated at the working level by repre
the Survey and representatives of th
agencies. The pooling of interests re
anced effort that directs combined
hydrologic investigations having the
cance to both parties. A few of the
FY 1983, and how the program is de
other agencies are described. (USGS)
W85-01829

10. SCIENTIFIC AND TECHNICAL INFORM

10C. Secondary Publicatio And Distribution

ACTIVITIES OF THE ALASKA WATER RESOURCES DIVISION, LOGICAL SURVEY, 1984.
Geological Survey, Anchorage, AK
sources Div.
Available from the OFSS, USGS, Bo
Ctr. Denver, CO 80225. USGS Oper
84-246, 1984. 34 p. Snyder, E.F., comp

Descriptors: Hydrology, Project plan
raphies, *Alaska, *Water resources pr

Twenty-two projects active in 1984 a
Each description includes information
project, chief, funding sources, locat
current status, and published or pla
The compilation also contains a bib
reports published by the Alaska Distr
through 1983. (USGS)
W85-01825

**SELECTED BIBLIOGRAPHY OF
SOURCES PUBLICATIONS FOR M**
Geological Survey, Jackson, MS. Wat
Div.
G. G. Parker, Jr., D. Walker, and C. M
USGS Open-File Report 84-062, 1984
1 Tab.

Descriptors: *Bibliographies, Publicat
sippi.

The first edition of the Mississippi Wa
bibliography lists publications that c
broad spectrum of sources and var
content. Many of the reports are U.S
Survey publications that interpret an
the results, or present the basic data
the cooperative programs that are jo
with State, local, and other federal a
bibliography also includes selected
lished by State and local agencies i
and adjoining states, and other fede
The basic criteria used for inclusion
tion were that the report: (1) con
interpretative information related t
sources or (2) the report be useful i
additional data or interpretative studi
water resources. To allow easy entry
the bibliography is organized into fou
titled Master List, Disciplines, River
Geographical Areas. (USGS)
W85-02033

I 94/2:
85

BOOKSTACKS
DOCUMENTS

PB85-910205

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 18, NUMBER 5
MAY 1985

DEPOSITORY
APR 24 1985
UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

5-02172 -- W85-02695
DEN: SWRABW

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Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is printed on the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 18, NUMBER 5
MAY 1985

W85-02172 -- W85-02695

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1985.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

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SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

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AUTHOR INDEX

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ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

BOUSSINESQ'S EQUATION SOLUTIONS FOR SEMI-INFINITE AQUIFER,
National Technical Univ., Athens (Greece). Dept. of Civil Engineering.
G. Noutsopoulos, T. Papathanassiadis, and I. Gavriilidis.
Journal of Hydraulic Engineering, Vol. 110, No. 8, p 1155-1161, August, 1984. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Unsteady flow, *Unconfined aquifers, *Mathematical equations, *Boussinesq's equation, Flow, Aquifers.

The problem of unsteady flow in an unconfined semi-infinite aquifer adjacent to a surface reservoir, both resting on a horizontal impervious stratum, has attracted the interest of many investigators. If the system of aquifer-reservoir is initially considered at rest with a horizontal free water surface throughout, flow in the aquifer may be initiated under the following conditions: changes of water level in the reservoir; artificial or natural recharge of the aquifer; and any combination of these conditions. The proposed approximate analytical solutions for the case of instantaneous lowering of the free surface in a reservoir are critically reviewed and compared to the more accurate numerical ones for the purpose of defining the best approximate analytical solution. The problem is mathematically formulated on the basis of hydraulic theory for homogeneous and isotropic porous medium. (Baker-IVI)
W85-02269

SUGGESTION FOR A COUPLED MODEL OF SURFACE AND GROUNDWATER SIMULATION ON A WATERSHED (PROPOSITION D'UN MODELE COUPLE POUR LA SIMULATION CONJONTE DES ECOULEMENTS DE SURFACE ET DES ECOULEMENTS SOUTERRAINS SUR UN BASSIN HYDROLOGIQUE),
Ecole Nationale Superieure des Mines de Paris, Fontainebleau (France). Centre d'Information Geologique.
J. Ledoux, G. Girard, and J. P. Villeneuve.
La Houille Blanche, No. 1/2, p 101-110, 1984. 15 Fig, 1 Ref.

Descriptors: *Model studies, *Surface water, *Flow, *Groundwater flow, Drainage, Runoff.

An integrated modelling method is described for surface water and groundwater flow in a drainage area. The model is based on a breakdown of the water cycle in spatial terms. Theoretical principles with respect to the way the model's structure was computed are examined. Attention is also given to the calculation of the groundwater inventory at ground level, run-off to the unsaturated zone and associated surface and subsurface flow patterns. Practical application is described based on the Aramy drainage area in the South of France. How the coupled model is applied to a structure which has very heterogeneous physiographical and hydrological characteristics is considered. (Baker-IVI)
W85-02354

TREATMENT OF EVAPOTRANSPIRATION, SOIL MOISTURE ACCOUNTING, AND AQUIFER RECHARGE IN MONTHLY WATER BALANCE MODELS,
Geological Survey, Reston, VA. Water Resources Div.
J. M. Alley.
Water Resources Research, Vol. 20, No. 8, p 1137-1149, August, 1984. 5 Fig, 6 Tab, 31 Ref.

Descriptors: *Evapotranspiration, *Soil water, *Aquifer recharge, *Hydrologic budget, Model studies, Precipitation, Drought, Thornthwaite-Mather model, Palmer model, Thomas abcd model, Forecasting, Groundwater storage.

Several two- to six-parameter regional water balance models are examined by using 50-year records of monthly streamflow at 10 sites in New Jersey. These models include variants of the Thornthwaite-Mather model, the Palmer model, and the more recent Thomas abcd model. Prediction errors are relatively similar among the models. However, simulated values of state variables such as soil moisture storage differ substantially among the models, and fitted parameter values for different models sometimes indicated an entirely different type of basin response to precipitation. Some problems in parameter identification are noted, including difficulties in identifying an appropriate time lag factor for the Thornthwaite-Mather-type model for basins with little groundwater storage, very high correlations between upper and lower storages in the Palmer-type model, and large sensitivity of parameter a of the abcd model to bias in estimates of precipitation and potential evapotranspiration. Modifications to the threshold concept of the Thornthwaite-Mather model were statistically valid for the six stations in northern New Jersey. The abcd model resulted in a simulated seasonal cycle of groundwater levels similar to fluctuations observed in nearby wells by with greater persistence. These results suggest that extreme caution should be used in attaching physical significance to model parameters and in using the state variables of the models in indices of drought and basin productivity. (Author's abstract)
W85-02370

TESTS FOR DETECTING A SHIFT IN THE MEAN OF HYDROLOGICAL TIME SERIES,
Royal Netherlands Meteorological Inst., De Bilt.
T. A. Buishand.
Journal of Hydrology, Vol. 73, No. 1/2, p 51-69, July, 1984. 3 Fig, 2 Tab, 16 Ref.

Descriptors: *Hydrologic models, *Mathematical studies, Time series analysis, Statistical methods, Rainfall-runoff relationships.

A practical problem in time series analysis of hydrological and meteorological data is to find statistical techniques for testing for an abrupt change in the mean at an unknown time. Suitable techniques have been developed in the situation of a single time series. Attention is paid to the likelihood ratio statistic and to a Bayesian statistic. Critical values are derived for the latter. Testing for a systematic change in a linear regression model is discussed. Examples are presented of annual precipitation and runoff from the River Colorado Basin near Grand Canyon, Arizona and the January precipitation and runoff for the River Thames Basin above Teddington, England. Regression of streamflow data on precipitation data gives a variance reduction which improves the power of statistical tests. Another reason for using a regression relation between streamflow and precipitation is to eliminate serial correlation effects. (Baker-IVI)
W85-02458

SYSTEMATIC PROBLEM-ORIENTED APPROACH TO HYDROLOGICAL DATA REGIONALISATION,
Vrije Univ., Amsterdam (Netherlands). Dept. of Hydrogeology and Geographical Hydrology.
I. Simmers.
Journal of Hydrology, Vol. 73, No. 1/2, p 71-87, July, 1984. 1 Fig, 5 Tab, 62 Ref.

Descriptors: *Regionalization, *Decision making, Reviews, Hydrologic data collections, Mapping, Statisitcal studies, Remote sensing.

The development of hydrological data regionalization is reviewed and, on the basis of recent work, attempts are made to rationalize the steps involved in its practical application. A systematic problem-oriented matrix is presented which enables the user to readily identify techniques at present most appropriate to a given problem. The overall process can be viewed as an hierarchical problem-oriented decision-making procedure which does not allow development of a single robust universally-applicable model. In most cases the process is optimally suited to an integrated multidisciplinary systematic approach, involving a combination of mapping, statistical and remote-sensing techniques. (Baker-IVI)
W85-02459

EFFECT OF PRECIPITATION MAXIMUMS ON THE SPECIES SYNTHESIS OF THE AGROPHYTOCENOSES OF THE SAND RIDGE BETWEEN THE DANUBE AND TISZA,
Gy. Bodrogkozy.
Acta Biologica (Nova Series), Vol. 29, No. 1-4, p 101-116, 1983. 13 Fig, 1 Tab, 9 Ref.

Descriptors: *Precipitation, *Hungary, *Vegetation, *Agrophytocenoses, Sand, Ecological distribution, Soil type.

In lowland regions, water has the greatest effect on the plant species synthesis. In the southern regions of the sand ridge located between the Danube and Tisza of the Great Hungarian Plain a study of precipitation maximums and their effects was carried out. During the course of evaluating the changes in the species of agrophytocenoses, 30 subunits were formed, which fall into 10 categories according to moisture demand. A correlation was noted between certain Consolido-Eragrostion minoris and Tribulo-Eragrostion minoris associations and the range of their soil- and subtypes. With the help of a vegetation map prepared for the area around the village of Tazlar, conclusions may be drawn regarding the various degrees of the danger of inland waters arising from precipitation maximums. (Baker-IVI)
W85-02474

APPLICATIONS OF THE LOG PEARSON TYPE-3 DISTRIBUTION IN HYDROLOGY,
Asian Inst. of Tech., Bangkok (Thailand).
H. N. Phien, and T. Jivajirajah.
Journal of Hydrology, Vol. 73, No. 3/4, p 359-372, August, 1984. 10 Tab, 12 Ref.

Descriptors: *Hydrological models, *Flood frequency, Distribution, Rainfall, Precipitation, Rainfall intensity, Streamflow, *Statistical models, *Pearson distribution.

Although the log Pearson (LP3) type-3 distribution was recommended specifically for flood-frequency analysis, its applicability to annual maximum rainfall, annual streamflow and annual rainfall was also considered. Three methods which were found to be best for estimating the parameters of the LP3 distribution are summarized for use in fitting this distribution to several samples of annual flood, annual maximum rainfall, annual streamflow and annual rainfall selected from different sources. The chi-square and Kolmogorov-Smirnov tests are used to evaluate the goodness-of-fit involved. The method of maximum likelihood, with the new method of solution based upon the Newton-Raphson procedure may fail to converge more often than the other two methods of mixed moments. With respect to the goodness-of-fit tests, the LP3 distribution is applicable to all the above four data types. For annual flood and annual maximum rainfall intensities, the existence of an upper bound, corresponding to the occurrence of negative values for the shape parameter a, may cause some concern. For those cases where a is negative, the LP3 distribution should be considered unsuitable. In contrast to the aforementioned two types of maximum values, the existence of an upper bound is well accepted for annual streamflow data, and possibly for annual rainfall data as well. It seems then that the LP3 distribution is suitable for these two data types, especially when one remembers that it is more flexible than the Pearson type-3 distribution. (Baker-IVI)
W85-02494

NOTE ON ESTIMATING THE UNIT HYDROGRAPH (EFFECTIVE RAINFALL UNKNOWN),
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
W. E. Bardsley, and R. A. Petch.
Journal of Hydrology, Vol. 73, No. 3/4, p 383-388, August, 1984. 1 Tab, 3 Ref.

Descriptors: *Hydrologic models, *Hydrographs, *Rainfall, Computers, Linear programming, Optimization.

When effective rainfalls are unknown, estimates of the unit hydrograph can be made using general

nonlinear optimization techniques. Such techniques have a disadvantage in that there is no guarantee against convergence to a suboptimal solution. An alternative approach is outlined where the original problem is reformulated so as to be amenable to solution by a mixed integer linear programming algorithm. The alternative method can approximate the optimum solution to any degree of accuracy, subject to computer requirements. The procedure outlined is not the only form of linear approximation available. The present approach is more natural in that a discrete approximation to the unit hydrograph can be readily visualized. The methodology is similar to that of applying linear programming techniques to a discrete form of the tritium input function. An advantage of the integer hydrograph is that an impression is gained of the accuracy of the corresponding estimate of the unit hydrograph. (Baker-IVI)
W85-02496

FROM EXCESS INFILTRATION TO AQUIFER RECHARGE: A DERIVATION BASED ON THE THEORY OF FLOW OF WATER IN UNSATURATED SOILS,
Colorado State Univ., Fort Collins.
H. J. Morel-Seytoux.
Water Resources Research, Vol. 20, No. 9, p 1230-1240, September, 1984. 7 Fig, 3 Tab, 27 Ref. NSF grant CEE-8212668.

Descriptors: *Groundwater recharge, *Infiltration, *Unsaturated flow, Mathematical models, Percolation, Soil water, Aquifers.

A practical and versatile tool was developed to predict aquifer recharge from excess infiltration rates. The excess infiltration rate is the flux of water at a depth such that water below it is no longer subject to evapotranspiration. The approximate unit hydrograph of aquifer recharge due to effective percolation is derived from a theory describing flow of water in unsaturated soils. The parameters appearing in the expression of the unit hydrograph have physical meaning. Comparison of the theory with field observations indicates that the theory works well. The method is versatile because it can be adapted to almost any time step. It accounts for the seasonal character of the phenomenon. It is practical because the expression of the S curve is analytical and for a given soil and a given water table it depends on only two parameters. (Moore-IVI)
W85-02665

2B. Precipitation

RELATING RAINFALL EROSIVITY FACTORS TO SOIL LOSS IN KENYA,
Office of International Cooperation and Development (USDA), Washington, DC.
For primary bibliographic entry see Field 2J.
W85-02322

NOTE ON THE FORM OF DISTRIBUTIONS OF PRECIPITATION TOTALS,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
W. E. Bardsley.
Journal of Hydrology, Vol. 73, No. 1/2, p 187-191, July, 1984. 1 Fig, 8 Ref.

Descriptors: *Precipitation, *Distribution patterns, *Poisson ratio, Mathematical studies.

This note is concerned with drawing attention to some properties of Poisson random sums which permit a few general statements to be made concerning the form of distributions of precipitation totals, independent of the knowledge of distributions of precipitation depth. A suggestion is also made for an estimation procedure for quantiles of rainfall totals, again independent of distributions of precipitation depth. For Poisson-distributed numbers of independent precipitation events, the precipitation totals are either approximately normally distributed (asymptotic case) or distributed with a positive skew and kurtosis greater than 3 (subasymptotic case). This result applies regardless of the forms of the unknown distributions governing precipitation amount per event. (Baker-IVI)
W85-02466

COMMON RELATIONSHIP BETWEEN PRECIPITATION AND GRASSLAND PEAK BIOMASS FOR EAST AND SOUTHERN AFRICA,
California Univ., Berkeley. Dept. of Zoology.
I. K. Deshmukh.
African Journal of Ecology, Vol. 22, No. 3, p 181-186, September, 1984. 2 Fig, 1 Tab, 18 Ref.

Descriptors: *Precipitation, *Africa, *Grasslands, Plant populations, Primary productivity, Vegetation, Biomass.

A compilation of data from East and southern Africa is used to establish a relationship between precipitation and peak biomass above ground in the herb layer to serve as a crude measure of primary production. Despite some scatter, the correlation between peak biomass and precipitation is highly significant when graphed. The least-squares regression line has a highly significant slope which predicts approximately 800 kg/ha peak biomass of vegetation for every 100 mm of rainfall received. The zero biomass intercept is equivalent to 23 mm of precipitation which closely agrees with earlier predictions of 20 mm. (Baker-IVI)
W85-02544

PHOSPHORUS BUDGETS OF INDOOR RESERVOIR MODELS VARYING IN SEDIMENT COMPOSITION AND WATER INLET SITE,
Ehime Univ., Matsuyama (Japan). Dept. of Environment Conservation.
For primary bibliographic entry see Field 2H.
W85-02620

2D. Evaporation and Transpiration

DATA REQUIREMENT FOR EVAPOTRANSPIRATION ESTIMATION,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
S. F. Shih.
Journal of Irrigation and Drainage Engineering, Vol. 110, No. 3, p 263-274, September, 1984. 2 Tab, 31 Ref.

Descriptors: *Evapotranspiration, *Estimating, *Climatology, Mathematical equations, Temperature effects, Solar radiation.

Various approaches based on climatological data (CD) have been used to estimate evapotranspiration (ET). A multiple regression with the ordinary least square (OLS) analysis has been commonly used to assess the relative importance of the CD which should be included in the ET equation. It is difficult to assess their relative importance in the OLS analysis when multicollinearity exists among the CD. This multicollinearity problem can be overcome by a statistical method called ridge regression analysis. Two years of daily climatological data in southern Florida are used to demonstrate the technique. Multicollinearity between air temperature and solar radiation was not observed, and the multiple correlation coefficient (R2) value in the case with these two variables is almost as good as in the case with all the variables. These results imply that the air temperature and solar radiation should be chosen as two important predictors for estimating the ET. For future improvement of the CD collecting programs, the air temperature and solar measurements should be urgently implemented. The multicollinearity problem existing among the CD is somewhat site-specific. In choosing an ideal ET equation, one should minimize input of the CD variables without affecting the accuracy of estimation, so that not only the multicollinearity problem can be eliminated but also the CD availability can be improved considerably. (Baker-IVI)
W85-02445

EVAPOTRANSPIRATION UNDER EXTREMELY ARID CLIMATES,
King Saud Univ., Riyadh (Saudi Arabia). D
Civil Engineering.
A. M. A. Salih, and U. Sendil.
Journal of Irrigation and Drainage Engine
Vol. 110, No. 3, p 289-303, September, 1984.
7 Tab, 11 Ref.

Descriptors: *Evapotranspiration, *Estim
*Saudi Arabia, Water supply, Developing
tries, Arid regions, Irrigation requirements,.

Five estimation methods were evaluated fo
mating monthly values of reference evapotra
ation (ETR) in a small catchment in Central
Arabia. The selected methods are Class A
Jensen-Haise, Hargreaves, Modified Penma
three versions of Blaney-Criddle. There were
siderable differences in ETR values estimat
the methods. Comparative analyses were
formed between the results estimated by dif
methods in each of the three inspected neighb
stations (Riyadh, Kharj, and Dirab) and b
same methods in different stations. Satisfa
correlations were noticed from all methods, e
for Class A Pan whose values reflected do
results. There was a high degree of correl
between the monthly values estimated by Cl
Pan, Jensen-Haise, and Hargreaves methods,
at Hofuf and Riyadh with Kharj as a refe
station. Although between them these me
have indicated remarkable correlation, each o
them has suggested a different value for
Such differences are very serious when noting
most of these methods are currently used fo
mating irrigation water requirements in man
tremely arid areas. Each of the methods indi
much lower ETR values than those obtaine
direct measurement. An evaluation of the ind
ual methods has ranked Jensen-Haise metho
top, followed by Class A Pan, Hargreaves me
in third place, Modified Penman in fourth
Blaney-Criddle methods on the bottom of
scale. (Baker-IVI)
W85-02447

RESPONSES OF STOMATA AND LEAF EXCHANGE TO VAPOUR PRESSURE D CITS AND SOIL WATER CONTENT, I. S CIES COMPARISONS AT HIGH SOIL WA CONTENTS,
Commonwealth Scientific and Industrial Rese
Organization, Wembley (Australia).
N. C. Turner, E.-D. Schulze, and T. Gollan.
Oecologia, Vol. 63, No. 3, p 338-342. August,
5 Fig, 1 Tab, 17 Ref.

Descriptors: *Transpiration, *Leaf water poter
*Leaf gas exchange, Water potential, Cond
ance, Vapor pressure, Photosynthesis, Soil w

Using well watered plants of the herbaceous
cies and members of the woody species ha
either sclerophyllous leaves or mesomor
leaves, the responses of photosynthesis, transp
tion and leaf conductance to changes in va
pressure deficit were followed. Leaf conducta
and net photosynthetic rate of the leaf decrease
all species when the vapor presssure deficit of
air around a single leaf in a cuvette was va
from 10 to 30 k/Pa in 5 Pa k/Pa steps. Transp
tion rate increased initially with increase in va
pressure deficit in all species, but in several spe
a maximum transpiration rate was noted at 20 t
Pa k/Pa. An increase in the vapor pressure de
decreased leaf water potential in all species, be
greatest in woody species and least in herbace
species. Increasing the external vapor presss
deficit lowered the water potential of the lea
the cuvette in the woody species and induce
decrease in leaf conductance in some, but not
species. At least in the woody species studies,
increase in the vapor pressure deficit around a
will decrease leaf gas exchange through a di
effect on the leaf epidermis and sometimes a
tionally through a lowering of the mesophyll wa
potential. (Baker-IVI)
W85-02561

E. Streamflow and Runoff

ERTURBATION SOLUTION FOR DAM-REAK FLOODS,
anterbury Univ., Christchurch (New Zealand).
ept. of Civil Engineering.
or primary bibliographic entry see Field 8B.
'85-02264

WO-DIMENSIONAL FLOOD ROUTING ON TEEP SLOPES,
ost, Buckley, Schuh and Jernigan, Inc., Tampa, L.
or primary bibliographic entry see Field 6F.
'85-02267

ONATION OF MOSSES AND LICHENS LONG THE SALMON RIVER IN IDAHO,
ontana Univ., Missoula. Dept. of Botany.
. Rosentreter.
orthwest Science, Vol. 58, No. 2, p 108-117, ay, 1984. 4 Fig, 1 Tab, 19 Ref, 1 Append.

escriptors: *Salmon River, *Idaho, *Mosses, *Li-ens, *Zonation, *River flow, Ecological distri-tion, High flow, Channel capacity, Substrate ability, Flood levels, Species composition.

he Salmon River in Idaho is the largest river in e western United States that does not have regu-tory dams. Zonation of mosses and lichens ccurs on both granite and basalt along the course the river. Communities of mosses and lichens low high water mark form distinct associations. hese zones may be as much as several meters in pth. Based on the species present and on fluctu-ing water levels, four zones were found. Results om paired transects indicate that stability of the bstrate, force of the current, and distance above e low water level determine species dominance. ompared to the headwaters, the lowest reaches of e river have more favorable conditions for owth of mosses and lichens and for development zonation patterns. The moss 'Barbula'-high ood zone could be used as an indicator of channel pacity and of high flood level at ungaged sites. t any given site and date, the water level could compared to the vegetational zones, thereby aluating the flood state. The frequency of high ood that determines the Barbula-high flood zone uld, in the future, be calculated by correlating e Barbula level to flood levels at a gauged site. ecies composition at any given site could give dication of the stability of that substrate and the rce of the current at that site. (Collier-IVI)
'85-02330

UMERICAL MODELLING OF A STEADY TATE FLOW IN A FREE SURFACE LOOPED YDRAULIC NETWORK UNDER FLUVIAL ONDITIONS (MODELISATION NUMERI-UE D'UN ECOULEMENT PERMANENT ANS UN RESEAU HYDRAULIQUE MAILLE SURFACE LIBRE, EN REGIME FLUVIAL),
-P. Baume, and M. Poirson.
ouille Blanche, No. 1/2, p 95-100, 1984. 5 Fig, 1 ab, 6 Ref.

escriptors: *Model studies, *Steady flow, Mathe-atical equations, Computers, Automation, Fluvial diments.

he computerized calculation of steady state flow free surface looped hydraulic networks is assist-l by an iterative method which is based on the lution of a system of linearized equations. The arse matrix of this system is broken up into ocks as opposed to investigating an overall solu-n. A special classification of equations and un-owns is employed and only discharges are und. This simplification saves both computer ne and memory storage. (Baker-IVI)
'85-02353

LTERATION OF STREAMFLOW CHARAC-ERISTICS FOLLOWING ROAD CONSTRUC-ION IN NORTH CENTRAL IDAHO,
Intermountain Forest and Reange Experiment Station, Moscow, ID. Forestry Sciences Lab.
J. G. King, and L. C. Tennyson.
Water Resources Research, Vol. 20, No. 8, p 1159-1163, August, 1984. 1 Fig, 2 Tab, 11 Ref.

Descriptors: *Streamflow, *Idaho, *Forest management, *Access roads, *Road construction, Forest watersheds, Watersheds, Watershed management, Maximum flow, Minimum flow, Water yield.

Effects of logging access roads on seven streamflow variables were monitored on six forested headwater watersheds in north central Idaho. The streamflow variables were: annual maximum streamflow; date of maximum streamflow; annual minimum streamflow; annual water yield; and streamflow equaled or exceeded 5% of the year, 25% of the year, and 75% of the year. The watersheds, ranging in area from 28.3 to 147.7 ha, had less than 5% of their area in roads. Two statistically significant (alpha = 0.05) changes occurred following road construction: an increase in the 25% exceedance flows in one watershed and a decrease in the 5% exceedance flows in another watershed. No significant changes were detected in other flow parameters on any of the watersheds. The results indicate that the hydrologic behavior of small forested watersheds may be altered when only a small area is disturbed by roads. (Author's abstract)
W85-02372

CUT-THROAT FLUME CHARACTERISTICS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 7B.
W85-02453

INDICES OF FLOW ASYMMETRY IN NATURAL STREAMS: DEFINITION AND PERFORMANCE,
Sheffield Univ. (England). Dept. of Geography.
A. D. Knighton.
Journal of Hydrology, Vol. 73, No. 1/2, p 1-19, July, 1984. 6 Fig, 2 Tab, 18 Ref.

Descriptors: *River flow, *Flow asymmetry, *Streamflow, Meanders, Velocity, Mathematical equations, Fluid mechanics.

While asymmetric flow in streams is well known, particularly in the context of meandering, there is no formal quantitative definition of that asymmetry. Four indices are derived based on discharge differences between two sides of a flow cross section and velocity displacement relative to the channel centerline. The indices are assessed by comparing values for artificially-constructed flow cross-sections and by analyzing field data obtained as spatial series along two lengths of a gravel-bed stream, which involves both correlation and spectral analysis. In both respects one index stands out as providing the best overall measure of flow asymmetry. The asymmetry indices could provide a means of testing current hypotheses and of generating new ones, especially as regards relationships between flow pattern, the distribution of effective stresses and adjustment of channel form. Applications dealing with asymmetry variation along relatively short reaches or at the same station as discharge changes are probably the most tractable. Although potentially valuable, the analysis of flow asymmetry as a spatial series presents logistic difficulties when measurements need to be made at many sections at the same stage. (Baker-IVI)
W85-02456

TRIBUTARY DEVELOPMENT ALONG WINDING STREAMS AND VALLEYS,
State Univ. of New York at Buffalo. Dept. of Geography.
A. D. Abrahams.
American Journal of Science, Vol. 284, No. 7, p 863-892, September, 1984. 15 Fig, 4 Tab, 24 Ref.

Descriptors *Tributaries, *Streams, *Valleys, Geomorphology, Meanders, Channels, Valleys, Sinuosity.

Factors which control the formation of tributaries along winding streams and valleys are investigated. Emphasis is on winding streams and valleys, where the channel trace more or less coincides with the valley axis. The locations of tributaries along such streams are strongly influenced by the valley morphology while the position of the stream on the valley floor is irrelevant except where it is actively undercutting the valley side. The location of tributaries along manifestly underfit streams and streams meandering across the floors of meander trenches will be largely conditioned by the shape of each valley wall and will be essentially independent of the channel platform. Where the configurations of opposing valley walls are unrelated, tributary development on opposite sides of the stream will also be unrelated. Partial and multiple correlation analyses of 40 stream reaches indicate that 81% of the variation in the percentage of tributaries on the concave side of bends can be explained by the mean number of tributaries per bend, valley sinuosity, and the rate of bend migration. Seventy-two percent of the variation in the percentage of trans links can be accounted for by the percentage of tributaries on the concave side of bends, mean number of tributaries per bend, and valley sinuosity. The variable mean number of tributaries per bend represents both the availability of space on the convex of bends relative to that required for a tributary to form and the ratio of the mean bend length to mean chain length, which affects the convergence and divergence of runoff down valley sides. There is a tendency for cis links to form near bend apexes and trans links near bend inflections. The locations of tributaries along main streams can be understood largely in terms of the operation of four factors: the spatial requirements of tributaries, the sinuosity of the main valley, the lengths of the valley bends, and the rate of bend migration. Although an element of uncertainty that necessitates the use of stochastic models may be unavoidable in the study of channel networks, this element is much smaller than has hitherto been appreciated. (Baker-IVI)
W85-02469

MEANDERING-BRAIDED RIVER THRESHOLD: A REAPPRAISAL,
McGill Univ., Montreal (Quebec). Dept. of Geography.
M. A. Carson.
Journal of Hydrology, Vol. 73, No. 3/4, p 315-334, August, 1984. 8 Fig, 1 Tab, 33 Ref.

Descriptors: *Rivers, *Meanders, *Braided streams, Slopes, Bed load, Slope, Flow discharge, Sediments.

The concept of a threshold discharge slope combination that separates braided from meandering streams is critically re-examined. It is argued that discriminant functions that use mean annual discharge provide a poor physical basis for interpretations based on natural processes, while bankfull discharge is also deficient because it is not a fully independent variable. The common use of channel (rather than valley) slope adds a further misleading component because channel slope is partly dependent on channel pattern sinuosity. Two major points from this study are that the prerequisite for braiding is local shoaling of the thalweg (high relative width), and this is less dependent on a threshold hydraulic condition (for example stream power) than upon a threshold state of bed material transport, though often the two are related. Secondly, any hydraulic threshold will vary significantly with bed and bank material sediment, so that it is meaningless to seek a general threshold for all streams, unless those factors are considered. (Baker-IVI)
W85-02492

MODELS FOR NONLINEAR CATCHMENT ANALYSIS,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulics and Water Power.
R. F. Muftuoglu.
Journal of Hydrology, Vol. 73, No. 3/4, p 335-357. August, 1984. 4 Fig, 2 Tab, 15 Ref.

Descriptors: *Catchments, *Rainfall-runoff relationships, *Hydrograph analysis, *Model studies,

Precipitation, Water storage, Precipitation, Evaporation,.

Two nonlinear functional models which taken into account nonlinear storage and translation effects are developed for catchment analysis. The first model is a second-order superposition integral, of which the kernel function can be interpreted as the two-dimensional unit hydrograph, defined, in general, as a family of hydrographs, each member of which results from a unit of effective precipitation under the effect of antecedent unit effective precipitations. The second model, developed by modification of the first, is a functional series with linear and second-order functionals covering the delayed and immediate response periods, respectively. The results of the applications have indicated that the model represents catchment behavior with reasonable accuracy, even if evaporation is neglected. It is not much more complicated that the unit hydrograph model, and seems promising for practical applications. (Baker-IVI)
W85-02493

ECOLOGICAL TYPES OF RUNNING WATER BASED ON STREAM HYDRAULICS IN THE NETHERLANDS,
Rijksinstituut voor Natuurbeheer, Leersum (Netherlands).
L. W. G. Higler, and A. W. M. Mol.
Hydrobiological Bulletin, Vol. 18, No. 1, p 51-57, June, 1984. 4 Fig, 6 Ref.

Descriptors: *Streamflow, *Netherlands, *Hydraulics, *Ecology, Streams, Rivers, Water quality, Velocity, Manning's formula, *Surface-groundwater relations.

Except for the large rivers, all running waters in The Netherlands are fed by groundwater. The ground water level in its turn is fed by the precipitation surplus averaging some 200-400 mm/yr. This is the main climatological parameter determining the discharge of Dutch streams. The spatial and temporal characeristics of discharge areas directly influence the dimensions of streams of which the hydraulic radius is an important mean. Together with the slope of the terrain, this radius determines the stream velocity as indicated by the well-known formula of Manning. The factors determining life conditions in running waters can be arranged in a hierarchical scheme. One of the main factors is stream velocity. By transformation of Manning's formula a set of variables is acquired with which a diagram is constructed to contain all hydraulic conditions in running water. By measuring the ground slope and hydraulic radius at a certain station this station can be placed in the diagram. Data from Dutch streams and rivers form definite clusters enabling one to describe types of running waters on this basis. The distribution patterns of stream organisms in accordance with stream hydraulics can be fit into the diagram as well. (Baker-IVI)
W85-02504

STREAM ECOSYSTEMS IN MOUTAIN GRASSLAND (WEST CARPATHIANS); 2. HYDROLOGICAL CHARACTERISICS,
Institute for Land Reclamation and Grassland Farming, Wroclaw (Poland).
S. Kurek, and J. Pawlik-Dobrowolski.
Acta Hydrobiologica, Vol. 24, No. 4, p 307-320, 1982. 1 Fig, 6 Tab, 9 Ref.

Descriptors: *Land use, *Erosion, *Runoff, *Precipitation, *West Carpathians, *Poland, Evapotranspiration, Infiltration, Lithology, Catchment basins, Water balance.

Emphasis is placed on the runoff and agents affecting its spatial and time differentiation. The magnitude of runoff is one among several important factors causing changes in the chemical and biological relationships of the water environment. Data are collected from 20 years of study of precipitation and runoff. The variability of precipitation was affected by height above sea level and mezorelief, while that of runoff is influenced by varied precipitation, evapotranspiration, and varying conditions of infiltration due to differentiation of the lithology, tectonics, the kinds of soil, and the degree of forestation of the catchment basin. The greatest differences in runoff between particular catchment basins are to be observed in the case of extreme runoff and in the size of underground runoff. (Baker-IVI)
W85-02513

THROUGHFLOW INVESTIGATIONS IN 'VORDERER FINSTERTALER SEE' (TYROL) BY URANIN DYE (DURCHFLUSSUNTERSUCHUNGEN AM VORDEREN FINSTERTALER SEE (KUEHTAI, OSTERREICH) MIT URANINFAEBVERSUCHES),
G. Hadl, and M. Katzmann-Hambock.
Archiv fur Hydrobiologie, Vol 101, No 1/2, p 105-112, 1984. 4 Fig, 7 Ref.

Descriptors: *Streamflow, *Lakes, *Mixing, *Vorderer Finstertaler See, *Austria, Stratification, Velocity, Dye dispersion, Tracers, Dyes.

Data were sought which could be related to the inflow speed of water passing through the lake, Vorderer Finstertaler See. Uranin was used in the inflow and closely observed as the water carried the dye into the lake. Measurements demonstrated a body of water passing through the lake reaching down to 5 m below the surface, corresponding to the epilimnion. Uranin concentration was highest near the shore and gradually reduced toward the center of the lake. Only 10% of the total volume of the lake was affected by the inflow. At an average current velocity of about 5 cm per second, the point of outflow was reached after 5 hr. (Baker-IVI)
W85-02524

EPILITHIC AND EPIPELIC DIATOMS IN THE SANDUSKY RIVER, WITH EMPHASIS ON SPECIES DIVERSITY AND WATER POLLUTION,
Bowling Green State Univ., OH. Dept. of Biological Sciences.
R. J. Stevenson.
Hydrobiologia, Vol. 114, No. 3, p 161-175, July, 1984. 7 Fig, 3 Tab, 32 Ref.

Descriptors: *Species diversity, *Diatoms, *Rivers, *Sandusky River, *Ohio, *Water pollution effects, Seasonal variation, Water quality, Population dynamics.

Benthic diatom communities were collected seasonally from silty and rocky substrates to survey the water quality of the Sandusky River. Benthic diatom communities on natural substrates were sampled at 10 stations along a 180 km stretch of the river into which treated sewage is loaded at three sites. Species composition of diatom communities was commonly highly variable along the river, but recurrent changes in relative abundances of specific diatom species and over all community composition did indicate where loading of treated sewage affected water quality in the Sandusky River. Species diversity of diatom communities increased and decreased in response to impacts of treated sewage. (Baker-IVI)
W85-02545

PRIMARY PRODUCTION IN RATTLESNAKE SPRINGS, A COLD DESERT SPRINGSTREAM,
Battelle Pacific Northwest Labs., Richland, WA. Environmental Sciences Dept.
C. E. Cushing, and E. G. Wolf.
Hydrobiologia, Vol. 114, No. 3, p 229-236, July, 1984. 6 Fig, 4 Tab, 32 Ref. AEC contract AT(45-1)-1830.

Descriptors: *Primary productivity, *Respiration, *Rattlesnake Springs, *Washington, Deserts, Ecosystems, Springs, Desert streams.

Data for annual community metabolism for several streams situated in either true deserts (Sycamore, Pinto, and Deep Creeks, Rattlesnake Springs) or in open, arid regions (Oklahoma, Kansas) are tabulated. Both annual gross productivity and respiration of Rattlesnake Springs are within the reported ranges of these streams. Net daily metabolism Rattlesnake Springs is positive and supports argument that autotrophy is prevalent in l order, arid streams, but contrary to the gene contention that low order streams are heterot phic. It appears that streams in cold and hot dese have several attributes in common, including do nance of autotrophic processes, flushing, or setting, of the systems by flash-floods, but differ to whether they are net importers or exporters organic matter on an annual basis. (Baker-I W85-02547

SPATIAL VARIABILITY OF LOW FLOW ACROSS A PORTION OF THE CENTRA SOUTHERN ALPS, NEW ZEALAND,
Ministry of Works and Development, Chri church (New Zealand). Water and Soil Div.
I. E. Whitehouse, M. J. McSaveney, and G. A. Horrell.
Journal of Hydrology, Vol. 22, No. 2, p 123-1 1983. 6 Fig, 1 Tab, 7 Ref.

Descriptors: *Streamflow, *Southern Alps, *Ne Zealand, *Low flow, Mountain streams, Rak River, Hokitika River, Waitaha River, Mikor River, Seasonal variation.

Flows were measured in 48 tributaries of t Rakaia, Hokitika, Waitaha and Mikonui Rivers 21 March 1978 during a period of extreme summ low flow, and on 54 tributaries on 17 July 19 during winter low flow. In tributaries of t Rakaia, Hokitika, Mikonui and Waitaha Rive specific discharge in extreme summer low flo varies approximately linearly with mean annu precipitation. Most of the variation in specific stantaneous discharge at low flow is explained variation in estimated basin mean annual precipit tion in a given empirical relationship. There a small but significant differences in the expone and coefficient of the power law for tributaries ea and west of the main divide. These differenc probably result from different regional recessi constants reflecting differences in regolith thic ness, which controls catchment storage, east a west of the main divide. Specific discharge summer low flow may be interpolated betwe points of measurement in the central Southe Alps with a standard error of about 10 to 309 Winter low flows are not related to precipitatio basin altitude, or summer low flow and do n appear to be correlated with any known, easi measured basin parameter. Low flows of the wes ern basins were typically 3 times those of easte basin for the same average basin altitude. Wint and summer low flows are members of differe populations and so should be treated separately the prediction of extremes. (Baker-IVI)
W85-02556

SENSITIVITY OF FLOW MEASUREMENT T STAGE ERRORS FOR NEW ZEALAN CATCHMENTS (NOTE),
Ministry of Works and Development, Wellingto (New Zealand).
H. J. Freestone.
Journal of Hydrology, Vol. 22, No. 2, p 175-18 1983. 2 Fig, 4 Tab, 2 Ref.

Descriptors: *Streamflow, *Measuring instru ments, *New Zealand, Mathematical equation Sensitivity, Catchments, Errors, Water level.

Records from fifty automatic water-level record ing stations representative of stations presently i operation within New Zealand were studied t determine the effect of water-level reading preci sion on the accuracy of flow records. The influ ence of stage-reading precisions of + or - 1 mm, + or - 3 mm and + or - 10 mm on mean flow, media flow and the flow exceeded 95% of the time wer tested. Basins most sensitive to stage measurin error were those which has small flows. Gain from the installation of weirs and flumes did no usually result in increased accuracy sufficient t offset the decreased sensitivity due to the smalle range of stage that occurrs with very small flows Stations with catchment areas less than about 50 s km show errors greater than 5% at condition where flow exceeded 95% of the time for a wate

vel reading precision of + or - 3 mm. Although e 50 stations used are only 6% of the total twork, their selection was designed so that the dings might be applied to the whole network. ie findings indicate which stations in the rest of e network are likely to be most affected by stage easurement errors. Application of the method ould take the form of investigating individual es to calculate sensitivity at given flows. (Baker-I)
85-02559

ASONAL PHYSICAL, CHEMICAL AND GAL CHANGES IN FIVE RIVERS FLOW-G THROUGH THE OIL SANDS REGION OF BERTA, CANADA,
berta Univ., Edmonton. Dept. of Botany.
E. D. Charlton, and M. Hickman.
ternationale Revue der Gesamten Hydrobiolo-, Vol. 69, No. 3, p 297-332, 1984. 28 Fig, 3 Tab, Ref.

escriptors: *Rivers, *Alberta, *Seasonal vari-ons, *Algal growth, Chemical analysis, Tem-ratures. Conductance, Calcium, Potassium, dium, Magnesium, Iron, Manganese, Sulfate, Ni-te, Chloride, Population dynamics.

asonal studies concentrating on physical and emical parameters and the epilithic algal com-nity were conducted at specific sites in five butary rivers flowing through the oil sands gion of northeastern Alberta, Canada into the habasca River. Water discharge proved to be st important in controlling the chemical status the water with most parameters (except nitrate) ng inversely related to discharge in a logarith-c manner. Seasonal fluctuations in algal species mposition and numbers are also described and cussed in relationship to the physical and chemi- changes. Physically disruptive forces (current locity and discharge) appeared more important n dissolved nutrients in affecting the growth of ae populations. (Baker-IVI)
85-02562

ODEL FOR FLOW IN MEANDERING REAMS,
ashington Univ., Seattle.
D. Smith, and S. R. McLean.
ater Resources Research, Vol. 20, No. 9, p 1301-15, September, 1984. 10 Fig, 13 Ref, 1 Append.
SF grant ENG 7816977.

escriptors: *Streamflow, *Tidal channels, tream erosion, *Sediment deposition, Meanders, ear stress, Topography, Channels, Mathematical odels, Bed slope.

vers and tidal channels in estuaries do not vays follow straight paths; rather they often take shapes characterized by sequences of smooth nds. Erosion and deposition patterns in streams d tidal channels are sensitive to spatial variations boundary shear stress, which in turn, can be duced by the complex interplay between the w and bed and bank topography. A method ereby variations in boundary shear stress can be lculated is presented for flows that are broad in ation to their depth and for which the bed slopes e small. The formal scheme employs a regular rturbation expansion around a zero-order state t includes vertically integrated, topographically duced convective accelerations. Use of a zero-der velocity field that includes these accelerative ects yields a model that is applicable to streams th typical bed slopes and channel curvatures, e that can be employed in the majority of situa-ns of interest to geomorphologists, sedimentolo-sts, and hydraulic engineers concerned with flu-l and estuarine systems. Specific flow character-ics can be related, at least qualititively, to par-ular external parameters in channels wiht typical pographic features. Externally induced variation the complex interplay amoung important flow aracteristics can substantially alter patterns of undary shear stress in natural sediment-trans-rting systems; hence they can change the ero-n-deposition patterns and result in adjustments ward new equilibrium states. (Moore-IVI)
85-02671

2F. Groundwater

APPROXIMATE SOLUTION OF FRESH WATER-SALT WATER INTERFACE IN CONFINED AQUIFERS (IN JAPANESE),
Ehime Univ., Matsuyama (Japan). Dept. of Ocean Engineering.
T. Kakinuma, K. Inouchi, and Y. Dohgane.
Japanese Journal of Limnology, Vol. 45, No. 2, p 100-110, April, 1984. 2 Fig, 9 Ref.

Descriptors: *Saline-freshwater interfaces, *Confined aquifers, Interface, Mathematical analysis, Model studies, Physical properties, Viscosity, Aquifers.

A new method for solving the problem of the unsteady motion of the interface between fresh and salt waters in aquifers is presented, using the following three approximations: 1) The viscosity of salt water is equal to that of fresh water; 2) the compressibility of the granular skeleton of the medium and the compressibility of the fluid in the salt water region are equal to those in a fresh water region; 3) in the equation for the thickness of the salt water layer, the term containing the storage coefficient is ignored. The numerical solutions by the new method are compared with the ones obtained by solving directly basic equations. For the special case of non-pumping and one-dimension, an analytical solution is found. It is in good agreement with the numerical solution by Sa Da Costa and Wilson (Sa da Costa, A. A. G. and J. L. Wilson, 1979. Massachusetts Institute of Technology, Cambridge, p 1-245), and Lui et al (Lui, P. L.-F., A. H.-D. Cheng, J. A. Liggett, and J. H. Lee, 1981. Wat. Resour. Res., Vol. 17, p 1445-1452), and it is similar to the experimental result by Bear and Dagan (Baer, J. and G. Dagan, 1964. Proc. A.S.C.E., J. Hydraul. Div., Vol. 90, No. HY4, p 193-216). (Author's abstract)
W85-02252

REGIONAL UNSTEADY FRESH WATER-SALT WATER INTERFACE IN CONFINED AQUIFERS (IN JAPANESE),
Ehime Univ., Matsuyama (Japan). Dept. of Ocean Engineering.
T. Kakinuma, K. Inouchi, and Y. Dohgane.
Japanese Journal of Limnology, Vol. 45, No. 2, p 144-152, April, 1984. 11 Fig.

Descriptors: *Naka River, *Japan, *Saline-freshwater interface, *Confined aquifers, Finite element method, Chlorides, Estuarine environment.

The authors presented a new method, which will appear in this Journal, to solve the problem of the unsteady motion of the interface between fresh water and salt confined aquifers. In this study, the Galerkin-finite element method is used to simulate the two-dimensional movement of the interface in a confined aquifer in the estuary of the Naka River, Tokushima Prefecture. The distributions of the chloride concentration predicted with the numerical model were in satisfactory agreement with the results of field observation. (Authors abstract)
W85-02256

PREDICTING GROUND-WATER RESPONSE TO PRECIPITATION,
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
D. A. Sangrey, K. O. Harrop-Williams, and J. A. Klaiber.
Journal of Geotechnical Engineering, Vol. 110, No. 7, p 957-975, July, 1984. 12 Fig, 1 Tab, 10 Ref.
USGS grant 9-6102-05813.

Descriptors: *Slope stability, *Dam failure, *Precipitation, Groundwater movement, Drainage, Aquifers, Water levels, Evapotranspiration, Model studies.

High ground-water levels are a principal cause of slope instability and of significance in other geotechnical engineering problems. A methodology has been developed for predicting the fluctuation of ground-water levels as a function of precipitation. The approximate method uses measured characteristics of the site or region and a short period of calibration from a well record. The linkage of precipitation to ground water fluctuation can be used in either deterministic or probabilistic methods. The new methodology has been tested by application in several different geological and climatological areas. Different evapotranspiration models can be used in the method. Certain evapotranspiration models work better under given conditions than others. The aquifer drainage time can be evaluated by iteration using ground water records. Values of the drainage time for a similar region are similar thus providing a basis for extending this methodology to regional studies. The required calibration period can be defined according to the reliability desired. This method can be applied in risk-oriented probabilistic studies. The predictability of ground water fluctuations with precipitation can exceed 90%. Extreme events also can be modeled with similar reliability if sufficient data area available. (Baker-IVI)
W85-02260

BOUSSINESQ'S EQUATION SOLUTIONS FOR SEMI-INFINITE AQUIFER,
National Technical Univ., Athens (Greece). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W85-02269

GROUND WATER REDOX REACTIONS: AN ANALYSIS OF EQUILIBRIUM STATE APPLIED TO EH MEASUREMENTS AND GEOCHEMICAL MODELING,
Colorado Univ. at Boulder. Dept. of Geological Sciences.
R. D. Lindberg, and D. D. Runnells.
Science, Vol. 225, p 925-927, August, 1984. 2 Fig, 1 Tab, 25 Ref.

Descriptors: *Groundwater, *Chemical analysis, *Geochemistry, *Oxidation reduction potential, Model studies, Water analysis.

Computer modeling of 611 high-quality analyses of normal ground waters from diverse geographic areas reveals that aqueous oxidation-reduction reactions are generally not at equilibrium. Multiple redox couples present in individual samples yield computed Nernstian Eh (redox potential) values spanning as much as 1000 millivolts. The computed Eh values do not agree with each other, nor do they agree with the single 'master' value measured in the field with a platinum electrode. Because of internal disequilibrium, the use of any measured Eh values as input to equilibrium hydrogeochemical computer models will generally yield misleading results for normal ground waters. (Author's abstract)
W85-02357

ANALYTICAL SOLUTION FOR THE EFFECTS OF ABSTRACTION FROM A MULTIPLE-LAYERED CONFINED AQUIFER WITH NO CROSS FLOW,
Institute of Hydrology, Wallingford (England).
R. S. Wikramaratna.
Water Resources Research, Vol. 20, No. 8, p 1067-1074, August, 1984. 3 Fig, 3 Tab, 6 Ref, 1 Append.

Descriptors: *Confined aquifers, *Model studies, *Abstraction, *Drawdown, *Cross flow, Multiple layered aquifers, Aquifers, Aquifer characteristics.

A new analytical solution was developed which describes the drawdown in and around a fully penetrating abstraction well in a two-layered confined aquifer with no cross flow. The solution accounts for storage of water within the well; it can thus be applied both to large- and small-diameter wells. It is in the form of an infinite real integral which gives the drawdown at any point in the aquifer at any given time. The solution could be used as the basis for a type curve method of determining aquifer parameters by using data from the well and from one or more observation piezometers in each of the aquifer layers. For a constant abstraction rate the solution for the aquifer response was simplified to give an expression for the drawdown in the well. For certain special cases

the two-layered solution reduces to an existing solution for the equivalent single-layered aquifer. (Collier-IVI)
W85-02363

FLOW TO A PARTIALLY PENETRATING WELL IN A DOUBLE-POROSITY RESERVOIR,
Princeton Univ., NJ. Dept. of Civil Engineering.
D. E. Dougherty, and D. K. Babu.
Water Resources Research, Vol. 20, No. 8, p 1116-1122, August, 1984. 6 Fig, 1 Tab, 20 Ref.

Descriptors: *Double-porosity, *Aquifers, *Groundwater movement, *Well hydraulics, Model studies, Laplace equation, Van Everdingen Model, Fracture permeability.

Analysis of flow in a fractured porous reservoir forms the basis for investigations of chemical and energy transport in such media. Numerical models are often employed to analyze these geohydrologic systems. In this paper a well hydraulics problem is solved using the Laplace transformation and the double-porosity concept. The transient solution is obtained by numerical inversion of the Laplace transform. Solutions to slug test problems indicate that the head response due to fracturing is distinct from the response due to partial penetration or skin effect. An alternative to the commonly used van Everdingen model of skin effect is given. No method for identifying fractured porous reservoir parameters from slug tests has been developed. The results of this paper may be applied to test numerical models of flow in fractured porous media. (Author's abstract)
W85-02367

BOUNDARY INTEGRAL SOLUTION TO SEAWATER INTRUSION INTO COASTAL AQUIFERS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
A. E. Taigbenu, J. A. Liggett, and A. H.-D. Cheng.
Water Resources Research, Vol. 20, No. 8, p 1150-1158, August, 1984. 15 Fig, 20 Ref. NSF grant CEE-7902803.

Descriptors: *Saline water intrusion, *Coastal aquifers, *Boundary element analysis, *Boundary integral equation, Mathematical models, Groundwater movement, Saline-freshwater interfaces, Hydrogeology, Finite element method, Finite difference methods, Model studies.

A three-dimensional boundary element analysis of seawater intrusion into freshwater aquifers is slightly more complex than a two-dimensional finite element analysis or finite difference analysis. Frequently, if detailed solutions are required, the knowledge of underground geology and accuracy of physical characteristics of the aquifer are insufficient and a more sophisticated program is required. The boundary integral equation method (BIEM) was used to solve problems of seawater intrusion into a freshwater aquifer that is being pumped. The transient problem of intrusion (lens type) into a deep aquifer was solved, as was the steady state problem of intrusion (wedge type) into a shallow aquifer. The Dupuit-Forchheimer approximation reduces the three-dimensional problem to two dimensions and the Ghyben-Herzberg approximation simplifies the treatment of flow in the saltwater region. A 'special potential' eliminates the need to track explicitly the freshwater-saltwater interface. The numerical program adds to the capability of the general groundwater basin model, which was based on the same techniques. The BIEM represents savings in data preparation, computer storage, computer time, and data interpretation compared to finite difference and finite element models. (Collier-IVI)
W85-02371

THREE-DIMENSIONAL MODEL OF A SKIMMING WELL,
Sind Agriculture Univ., Tandojam (Pakistan). Dept. of Irrigation and Drainage.
B. A. Chandio, and B. E. Larock.
Journal of Irrigation and Drainage Engineering, Vol. 110, No. 3, p 275-288, September, 1984. 8 Fig, 12 Ref.

Descriptors: *Skimming, *Wells, *Model studies, Unconfined aquifers, Computers, Finite element method, Mathematical studies, Developing countries, Water supply development, Salinity.

Partially penetrating wells called skimming wells are one important tool that can be used to develop water supplies from sources where a thin layer of fresh water lies directly above a layer of saline water. A three-dimensional model of skimming well operation in a shallow, unconfined, fresh water layer is presented. Preliminary numerical experiments indicate that the transient growth of salinity toward the partially penetrating well has been correctly simulated with a miscible flow model in the relatively thin upper layer. Computer programing features are described that allow one to operate the program on a moderate-size computer, such as ones that private engineering organizations and the governments of developing countries may be able to use. The magnitudes of the changes in salinity as a function of well and aquifer geometry are significant. (Baker-IVI)
W85-02446

ISOTOPIC ANALYSES AND HYDROCHEMISTRY OF THE THERMAL SPRINGS ALONG THE EASTERN SIDE OF THE JORDAN DEAD SEA - WADI ARABA RIFT VALLEY,
Jordan Univ., Amman. Water Research and Study Center.
E. Salameh, and O. Rimawi.
Journal of Hydrology, Vol. 73, No. 1/2, p 129-145, July, 1984. 6 Fig, 3 Tab, 36 Ref.

Descriptors: *Thermal springs, *Jordan, *Wadi Araba, Water chemistry, Isotope studies, Precipitation chemistry, Groundwater, Rift valley, Geohydrology.

The isotopic composition of the present precipitation as well as the groundwaters of Jordan lies between the eastern Mediterranean and the meteoric water lines. Water precipitated on the mountainous area infiltrates the bedrock, flows in an easterly direction, through several aquifers, then flows westerly and discharges along the steep slopes of the Dead Sea escarpment. This flow and discharge is controlled mainly by the prominent geologic structures of the Jordan-Dead Sea Rift Valley. The dissolved solids of the waters are derived primarily from the Upper Cretaceous sediments covering the infiltration area. These waters mix with hypersaline water present in the Lower Cretaceous or older rocks. The amount of total dissolved solids increases with increasing temperatures. The elevated temperature of many spring waters is the result of deep circulation under the normal geothermal gradient. The isotopic composition of precipitation in Jordan lies between the eastern Mediterranean and the meteoric water lines. It differs from one storm to another and shows a distinct quantitative effect - the higher the rainfall the less enriched the isotopic composition. The groundwaters of the surface aquifers also lie between the eastern Mediterranean and the meteoric water lines. In southern Jordan, the isotopic composition is shifted closer to the meteoric line. The deep sandstone aquifer contains water mixed from two members, a major one infiltrating from the Tertiary-Upper Cretaceous aquifers of central Jordan and a minor one originating from the sandstone suface aquifers of southern Jordan. The latter flows northeast where it mixes with the major members south of the latitude of Azraq, turns gradually to the west and discharges along the slopes above the Dead Sea. (Baker-IVI)
W85-02462

FRESHWATER 'CENTRAL LENS' OF BERMUDA,
Bermuda Public Works Dept., Hamilton.
M. Rowe.
Journal of Hydrology, Vol. 73, No. 1/2, p 165-176, July, 1984. 6 Fig, 1 Tab, 22 Ref.

Descriptors: *Aquifer recharge, *Water t
*Bermuda, *Central Lens, *Water managem
Water supply, Permeability, Geology, Groundw
er recharge.

In the Central Lens area of Bermuda there are
major rock bodies and these belong to the Belm
and Paget Groups. They form adjacent para
aquifers of greatly contrasting permeability.
older Belmont Limestone has undergone gre
solutional alteration and is the more permea
Under steady state conditions the Central L
configuration supports the Ghyben-Herzb
theory. On a yearly average basis, the degree
disequilibrium is substantial. The water table is
more responsive to variations in recharge tha
the interface. In relatively wet years the wa
table height above sea level can be 50% above
of dry years. Due to a vertical zonation of fl
activity, the effect of an event at the water ta
only manifests itself at the interface after consid
able dampening and lagging. A possible cause
this could be the development of a higher-perm
ability zone at the water table, but the presence
lack of such a feature, which has been observed
other environments, has yet to be proved in B
muda. On less than a yearly average basis
water table levels are dominated by the influe
of sea level, which cannot be readily removed a
therefore presents a major obstacle to short te
studies. Demonstration of a relatively stable l
thickness, below sea level, allows a less cautio
approach to management of pumping rates th
had been previously taken. A maximum permi
ble thinning of the lens is considered as 45%
fresh areas and 60% in brackish areas. Under th
conditions it is calculated that about 75% of
charge could be abstracted. (Baker-IVI)
W85-02464

**SIMPLIFIED GRAPHICAL SOLUTION
THE THEIS EQUATION,**
Victoria State Rivers and Water Supply Comm
sion, Tatura (Australia).
For primary bibliographic entry see Field 4B.
W85-02465

**NONEQUILIBRIUM AND EQUILIBRIU
SORPTION WITH A LINEAR SORPTION IS
THERM DURING MASS TRANSPOR
THROUGH AN INFINITE POROUS MEDIU
SOME ANALYTICAL SOLUTIONS,**
California Univ., Berkeley. Lawrence Berkel
Lab.
C. L. Carnahan, and J. S. Remer.
Journal of Hydrology, Vol. 73, No. 3/4, p 227-25
August, 1984. 1 Fig, 28 Ref. 3 Append. DO
contract DE-AC03-76SF00098.

Descriptors: *Solute transport, *Groundwat
flow, *Isotherms, Porosity, Mathematical equ
tions, Mass transfer, Path of pollutants.

Analytical solutions have been developed for th
three-dimensional axisymmetric problem of solu
transport in a steady field of groundwater flo
with nonequilibrium mass transfer of a radioactiv
species between fluid and solid phases, and wit
unequal longitudinal and lateral hydrodynamic di
persion. Interphase mass transfer is described by
first-order rate expression. Solutions are presente
also for the case of equilibrium distribution
solute between fluid and solid phases. Three type
of release from a point source were considered
instantaneous release of a finite mass of solut
continuous release at an exponentially decayin
rate, and release for a finite period of time. Compu
tational results for point-source solutions show th
expected variation of sorptive retardation effect
progressing from the case of no sorption, throug
cases of nonequilibrium sorption, to the case o
equilibrium sorption. The point-source solution
serve as standards for checking, and comparison
with, numerical models with second-order rat
laws for sorption, now being studied. The point
and line-source solutions are useful approxima
tions, in the far field, to solutions of linear trans
port problems involving source functions fo
which a total rate of release of sorbate can b
specified. The point-source solutions are directly
applicable to the development of analytical solu

ons of problems involving source functions occu-
ying finite regions of the space in which transport
kes place. (Baker-IVI)
/85-02488

**TRESSES AND DISPLACEMENTS IN AN AQ-
IFER DUE TO SEEPAGE FORCES (ONE-DI-
ENSIONAL CASE),**
niversidad Nacional Autonoma de Mexico,
exico City. Facultad de Ingenieria.
Juarez-Badillo, and G. E. Figueroa-Vega.
ournal of Hydrology, Vol. 73, No. 3/4, p 259-288,
ugust, 1984. 10 Fig, 2 Tab, 16 Ref.

escriptors: *Aquifers, *Groundwater movement,
ubsidence, *Seepage loss, *Stress, Cracks,
rainage, Mathematical studies, Pumping.

he extraction of water from aquifers by pumping
oduces settlement and cracking in the subsoil.
ettlement due to pumping is fairly well under-
ood, but cracking had no appropriate theories to
plain it. Seepage-force-induced cracks are ana-
zed in an aquifer divided by a well line which is
proximated by a line drain. Mathematical expres-
ons for the stresses and displacements in the
uifer due to seepage forces for the steady and
steady one-dimensional cases are presented. The
uifer is assumed to be constituted by a linearly
astic material. The study showed that stress and
splacements in an aquifer may be estimated con-
dering some ideal cases and their asymptotic solu-
ons. An important ideal case is when the rigidities
the confining strata are very high compared to
e ridigity of the aquifer. For this ideal case there
ists a critical volume rate of flow which should
t be surpassed if sliding of the aquifer towards
e well line is to be avoided. (Baker-IVI)
85-02489

**FLUENCE OF SEEPAGE ON THE DEPTH
F WATER TABLES IN DRAINAGE,**
stituut voor Cultuurtechniek en Waterhuishoud-
g, Wageningen (Netherlands).
r primary bibliographic entry see Field 4B.
85-02490

**PACE-TIME FINITE-ELEMENT MODEL FOR
VO-STREAM UNCONFINED AQUIFER SYS-
EMS,**
ile Univ., Santiago. Centre de Recursos Hidrau-
os.
Cabrera, and G. Matthey.
urnal of Hydrology, Vol. 73, No. 3/4, p 239-314,
gust, 1984. 10 Fig, 2 Tab, 15 Ref.

escriptors: *Finite element method, *Model stud-
, *Aquifers, Unconfined aquifers, Water levels,
iltration, Computers.

finite-element model has been developed to rep-
ent water-table fluctuations in a two-stream un-
nfined aquifer system due to recharge from infil-
tion. Linear approximation functions of space
d time within elements, the Galerkin residual
thod and the Newton-Raphson method of solu-
n for the resultant nonlinear system of equations
re used. The model has shown good agreement
th available analytical solutions and gives rea-
nably good results when applied to other cases
ch as variable infiltration, evaporation, and flood
ves in the streams. Computer times involved,
wever, as compared with a finite-element finite-
ference model, are at least twice as long, de-
nding on the time-domain size. Approximations
the analytical solutions are similar in all cases. A
tter approach to the problem would be to take
ite elements with higher-order approximation
nctions in space and finite differences in time, in
der to represent more adequately, for example,
nes of high hydraulic gradients, and to obtain
orter computer times. (Baker-IVI)
85-02491

**JOYANT CONTAMINANT PLUMES IN
ROUNDWATER,**
rza Engineering Co., Chicago, IL.
r primary bibliographic entry see Field 5B.
85-02660

**EFFECT OF TORTUOSITY ON FLUID FLOW
THROUGH A SINGLE FRACTURE,**
California Univ., Berkeley. Lawrence Berkeley
Lab.
Y. W. Tsang.
Water Resources Research, Vol. 20, No. 9, p 1209-
1215, September, 1984. 7 Fig, 2 Tab, 20 Ref. DOE
contract DE-AC03-76SF00098.

Descriptors: *Tortuosity, *Fluid flow, *Geologic
fractures, Groundwater movement, Connectivity,
Flow rate, Mathematical studies, Apertures, Geo-
thermal energy.

The movement of fluids through fractures in very
low permeability rock is important in many areas
of practical interest, such as the isolation of hazard-
ous wastes in geological structures, the recovery of
fossil fuels, and the development of geothermal
energy. Mathematical modeling of flow through a
fractured medium invariably requires the assump-
tion of a physical law which governs the fluid
movement through one single fracture. The effects
of path tortuosity and connectivity on fluid flow
rate through a single rough fracture were studied.
The flow paths are represented by electrical resis-
tors placed on a two-dimensional grid, and the
resistances vary as the inverse of the fracture aper-
ture cubed. The electric current through the cir-
cuit bears a one-to-one correspondence to the fluid
flow rate. Both fracture apertures derived from
measurements and from hypothetical analytic func-
tions were used in a parameter study to investigate
the dependence of tortuosity on fracture roughness
characteristics. The more small apertures there are
in the aperture distribution, the larger is the effect
of tortuosity. When the fraction of contact area
between the fracture surfaces rises above 30%, the
aperture distributions are invariably large at small
apertures, and the effect of fracture roughness and
flow path tortuosity depresses flow rate from the
value predicted by the parallel plate representation
of a fracture by three or more orders of magnitude.
Since the fraction of contact area of the rough
fracture is the contrlling factor to determine the
magnitude of the effect of tortuosity, the question
of whether tortuosity is important or not in flow
through real fractures points to the question of
how the fractional contact area of a fracture varies
as a function of stress. (Moore-IVI)
W85-02662

**FLOW TOWARD STORAGE TUNNELS BE-
NEATH A WATER TABLE; 2. THREE-DIMEN-
SIONAL FLOW,**
Tel-Aviv Univ. (Israel). Faculty of Engineering.
For primary bibliographic entry see Field 4B.
W85-02663

**SCALES FOR DOUBLE-DIFFUSIVE FINGER-
ING IN POROUS MEDIA,**
Wisconsin Univ.-Madison. Dept. of Civil and En-
vironmental Engineering.
T. Green.
Water Resources Research, Vol. 20, No. 9, p 1225-
1229, September, 1984. 2 Fig, 13 Ref.

Descriptors: *Diffusion, *Porous media, *Double-
diffusive fingering, Groundwater movement,
Mathematical models.

The influence of the double-diffusive process of
fingering on vertical transport in a porous medium
is examined, using a very successful model bor-
rowed from oceanic salt finger theory. The results
suggest that fluxes associated with double-diffusive
fingering may well be important, at least in regions
where the porous medium is saturated. The effect
of horizontal dispersion remains to be accounted
for and will probably place limits on the efficiency
of the process. (Author's abstract)
W85-02664

**ANALYSIS OF THE INFLUENCE OF FRAC-
TURE GEOMETRY ON MASS TRANSPORT IN
FRACTURED MEDIA,**
British Columbia Univ., Vancouver. Dept. of Geo-
logical Sciences.
L. Smith, and F. W. Schwartz.
Water Resources Research, Vol. 20, No. 9, p 1241-
1252, September, 1984. 10 Fig, 6 Tab, 9 Ref.

Descriptors: *Geologic fractures, *Fracture geom-
etry, *Mass transport, Stochastic process, Model
studies, Fracture aperture, Connectivity, Disper-
sion.

A stochastic modeling technique has been devel-
oped to investigate mass transport within a net-
work of discrete fractures. The fracture network is
composed of two orthogonal fracture sets, with
fracture length, location, and aperture character-
ized by appropriate probability distributions. Em-
phasis is placed on understanding how fracture
geometry influences mass transport within a net-
work of discontinuous fractures. The network is
aligned in such a manner that one fracture set (set
one) forms the dominant pathway for transport.
The primary role of the second fracture set is to
provide connecting pathways between the discon-
tinuous fractures of set one. Results suggest that
mass transport can be described in terms of direct-
ness of the connection between the upstream and
downstream boundaries. Variations in fracture ge-
ometry which have the effect of increasing the
probability that a relatively indirect or circuitous
pathway exists through the network generally lead
to an increase in both the mean and the standard
deviation in the arrival time of various break-
through fractions. Examples include a reduction in
the number of fractures forming the set aligned
with the direction of the hydraulic gradient or a
decrease in the average length of fractures forming
that set. Variations in fracture geometry which
have the effect of increasing the probability that a
relatively direct pathway will exist through the
network have the opposite effect. Transport is
sensitive to the variability in fracture aperture. The
connectivity of the fracture network is also shown
to influence the magnitude of dispersive effects.
(Author's abstract)
W85-02666

**DISPERSION OF TRACE SOLUTES IN FLOW-
ING GROUNDWATER,**
Wisconsin Univ.-Madison. Dept. of Chemical En-
gineering.
For primary bibliographic entry see Field 5B.
W85-02667

**LINEARIZATION TECHNIQUES AND SUR-
FACE OPERATORS IN THE THEORY OF UN-
CONFINED AQUIFERS,**
Oregon State Univ., Corvallis.
G. Bodvarsson.
Water Resources Research, Vol. 20, No. 9, p 1271-
1276, September, 1984. 2 Fig, 8 Ref. NSF grant
EAR 8023850.

Descriptors: *Aquifers, *Mathematical equations,
*Groundwater movement, *Linearization, Free
surface, Fluid flow, Differential equations.

The theory of Darcy type fluid flow in unconfined
homogenous aquifers is of considerable importance
in the modeling of many hydrological and geother-
mal systems. In the case of slow, small free surface
displacement amplitudes, it is possible to linearize
the free surface condition and depend on rather
simple analytical and numerical methods to solve
the flow equations governing such models. Defin-
ing a new type of cross-surface differential opera-
tors, the linearized free surface condition on the
boundary surface can be interpreted as a new type
of partial differential equation. For the linearization
procedure to be applicable, there is an upper
limit to the total liquid withdrawal that can take
place during any fixed period of time. It has not
been possible to provide a simple expression for the
criterion, and the condition will have to be used on
a trial basis. (Moore-IVI)
W85-02669

**BOREHOLE METHODOLOGY FOR HYDRO-
GEOCHEMICAL INVESTIGATIONS IN FRAC-
TURED ROCK,**
National Hydrology Research Inst., Ottawa (On-
tario).
For primary bibliographic entry see Field 7B.
W85-02670

ANISOTROPY IN THE IRONTON AND GALESVILLE SANDSTONES NEAR A THERMAL-ENERGY-STORAGE WELL, ST. PAUL, MINNESOTA,
Geological Survey, St. Paul, MN.
R. T. Miller.
Ground Water, Vol. 22, No. 5, p 532-537, September-October, 1984. 5 Fig, 3 Tab, 5 Ref. DOE contract DE-AC06-76RLO 1830 subcontract B-97601-A-C.

Descriptors: *Anisotropy, *Thermal energy storage, *St. Paul, *Minnesota, Injection wells, Aquifers, Transmissivity, Storage coefficient.

The U.S. Geological Survey is studying the potential for storage of heated water in a sandstone aquifer in St. Paul, Minnesota. The efficiency of the aquifer to the store thermal energy is related, in part, to the hydrogeologic characteristics of the aquifer. The movement of heat away from the injection well is directly related to the anisotropy. Aquifer tests were conducted to determine the anisotropy near the heated-water injection well. The maximum and minimum values of transmissivity along the principal directions of the hydraulic conductivity tensors of the Ironton and Galesville Sandstones in St. Paul, Minnesota are approximately 1,090 and 480 feet squared per day. The storage coefficient is 0.000045. These values represent the average of four determinations of nonsteady flow to a well in an idealized infinite anisotropic aquifer. Analysis of the values of transmissivity and storage coefficient for hypothetical changes in location of two of the monitoring wells where depth-deviation surveys were not available indicates that computed transmissivities vary less than +/- 5% and storage coefficients vary less than +/- 6%. (Author's abstract)
W85-02684

AQUIFER STUDIES USING FLOW SIMULATIONS,
Binnie and Partners, London (England).
S. Puri.
Ground Water, Vol. 22, No. 5, p 538-543, September-October 1984. 8 Fig, 2 Tab, 6 Ref.

Descriptors: *Simulation, *Groundwater movement, *Lower Greensand, *England, Water level, Groundwater recession, Groundwater recharge, Drawdown, Hydrologic budget, Baseflow.

Flow simulations were used to supplement a hydrogeological study of the Lower Cretaceous, partly consolidated orthoquartzite known as the Lower Greensand. In southern England the Lower Greensand is an important source of water supply. The lack of aquifer monitoring prior to the 1970's gave rise to an uncertainty as to whether present-day water levels were declining. Simulation studies were carried out to refine the annual recharge estimate, to define the past effects of pumping and to obtain and indication of future trends. Catchment water balance indicates average annual recharge of 28 x 10 to the 6th cu m. The present overall abstraction from the aquifer is 71% of the annual recharge. The original 'natural' baseflow has reduced from 72% of annual recharge to the present 29%. The rate of water-level decline was high soon after the start of pumping and was over 0.3 m/yr for 55 years in the outcrop area. In the confined area, this rate occur for 70 yr. Following these periods the levels decline at a progressively lower rate, until a new steady state is reached. Pumping at distances as far as 30 km from the outcrop cause small but measurable drawdowns. (Moore-IVI)
W85-02685

FIELD TESTING THE HYPOTHESIS OF DARCIAN FLOW THROUGH A CARBONATE AQUIFER,
Geological Survey, Tampa, FL.
For primary bibliographic entry see Field 4B.
W85-02686

SIMULATION OF GROUND-WATER FLOW IN A MINED WATERSHED IN EASTERN OHIO,
Geological Survey, Columbus, OH.
For primary bibliographic entry see Field 4C.
W85-02687

RESULTS OF SEEPAGE METER AND MINI-PIEZOMETER STUDY, LAKE MEAD, NEVADA,
Montana Univ., Missoula. Dept. of Geology.
For primary bibliographic entry see Field 2H.
W85-02688

WEIGHTING OF OBSERVED HEADS FOR THE INVERSE PROBLEM,
Disposal Safety, Inc., Washington, DC.
B. Ross.
Ground Water, Vol. 22, No. 5, p 569-572, September-October, 1984. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Hydraulic head, *Estimation, Hydraulic gradient, Transmissivity, Groundwater recharge, Groundwater discharge, Hydrogeology.

In numerical methods for estimating transmissivities, recharges, discharges, and boundary fluxes from observed data, the hydrogeological parameters are estimated by finding the values which, when used to calculate heads, best match the observed heads. In using least-squares parameter estimation techniques to solve for hydrogeologic parameters, a weighting function may be used to reflect differing reliabilities of head measurements. In previous studies, the weighting function has been used in an ad hoc manner or not at all. The inverse square of the observed hydraulic gradient, adjusted to reflect the modeler's perception of geologic heterogeneity and data reliability, is typically an appropriate wieghting function. A slightly more complex formula may be used when measurement uncertainty is important. (Moore-IVI)
W85-02689

OPTIMAL SPACING OF INTERFERING WELLS: AN ANALYTIC SOLUTION,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 4B.
W85-02690

DETECTION OF AN IMPERMEABLE BOUNDARY IN AN ANISOTROPIC FORMATION: A CASE STUDY,
In-Situ, Inc., Laramie, WY.
S. C. Way, and C. R. McKee.
Ground Water, Vol. 22, No. 5, p 579-583, September-October, 1984. 5 Fig, 2 Tab, 2 Ref.

Descriptors: *Anisotropy, *Impermeable boundaries, *Image-well theory, Boundaries, Transmissivity, Groundwater movement, Mathematical equations.

Image-well theory is well known as a way to locate hydrologic boundaries in isotropic formations from pump test data, but it does not directly apply in anisotropic formations because the relationship between flow lines and equipotential lines is distorted due to directional transmissivity. A simple approach to locate an impermeable boundary in anisotropic formations is developed using the method of images. Information on directional transmissivity is essential in applying the theory, and knowledge of groundwater flow will, in many cases, help verify the findings. (Moore-IVI)
W85-02691

MODELING ORGANIC CONTAMINANT PARTITIONING IN GROUND-WATER SYSTEMS,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 5B.
W85-02692

MIGRATION OF CHLOROPHENOLIC COMPOUNDS AT THE CHEMICAL WASTE DISPOSAL SITE AT ALKALI LAKE, OREGON - 1. SITE DESCRIPTION AND GROUND-WATER FLOW,
Oregon Graduate Center, Beaverton.
For primary bibliographic entry see Field 5B.
W85-02693

NUMERICAL METHOD OF PUMPING T ANALYSIS USING MICROCOMPUTERS,
Birmingham Univ. (England). Dept. of Civil E neering.
For primary bibliographic entry see Field 4B
W85-02694

SIMPLE ANALYTICAL SOLUTIONS FOR T HP41CV PROGRAMMABLE CALCULATOR
Kleinfelder (J.H.) and Associates, Fresno, CA
For primary bibliographic entry see Field 4B
W85-02695

2G. Water In Soils

MACROPOROSITY TO CHARACTERIZE S TIAL VARIABILITY OF HYDRAULIC C DUCTIVITY AND EFFECTS OF LAND M AGEMENT,
Hawaii Univ., Honolulu.
L. R. Ahuja, J. W. Naney, R. E. Green, and D Nielsen.
Soil Science Society of America Journal, Vol No. 4, p 699-702, July-August, 1984. 7 Fig, 17

Descriptors: *Soil porosity, *Permeability co cient, *Land management, *Macroporosity, M sols, Oxisols, Tillage effects, Effective poros Porous media, Porosity.

To develop simplified methods of hydraulic c acterization of field soils and effects of mana ment, frequency distribution of macroporosity effective porosity) in a soil was investigated measure of its saturated hydraulic conducti distribution. The effective porosity (phi sub c) soil is related to its saturated hydraulic conduct ty (K sub s) by a generalized Kozeny-Carr equation. The exponent of this relationship assumed to vary within a narrow range (value or 5). The equation was then combined with s ing theory to derive the frequency distributio K sub s scaling factors from the phi sub c distri tion. These concepts were tested on experime data for two widely different soils, a mollisol an oxisol. The phi sub c is defined as total poro minus soil water content at -33 kPa pressure he The exponent of the ((K sub s) - (phi sub relationship was found to be nearly 4 for the s core data of both soils, while for a smaller set o situ field data for oxisol, which was withi narrow range of phi sub c, the value of the ex nent was smaller. There was a considerable sca in the relationships. However, with the expon set equal to 4 or 5 the distribution of K su scaling factors derived from phi sub c distribut closely matched the experimental K sub s deri distribution. The approach has a promise for lar scale applications. (Author's abstract)
W85-02317

STEADY INFILTRATION FROM SPHERIC CAVITIES,
Commonwealth Scientific and Industrial Resea Organization, Canberra (Australia). Div. of En ronmental Mechanics.
J. R. Philip.
Soil Science Society of America Journal, Vol. p 724-729, 1984. 6 Fig, 1 Tab, 9 Ref.

Descriptors: *Spherical cavities, *Infiltration, * pillarity, Soil water, Unsaturated flow, Subirri tion, Flow, Moisture potential.

The problem of quasilinearized steady infiltrat from spherical cavities, with the moisture poten fixed at the cavity surface, is solved exactly. So tions are presented numerically and graphically values of the dimensionless cavity radius R sub (the range 0 to 10. The dependence of R sub 0 total cavity flow, of the variation of infiltrat rate around the cavity surface, and of the distri tions of moisture content and potential, are exa ined. As R sub 0 increases, gravity increasin distorts the moisture distribution from the symm try produced by capillarity alone. This distorti although marked, is less than one-hundredth t for infiltration from circular cylindrical cavities vivid illustration of the stronger dominance

gravity over capillarity in two-dimensional systems than in three-dimensional ones. An earlier approximate solution of this problem proves accurate only for R sub 0 < or = 0.27. The cavity flow, evaluated by the present analysis, may be combined with the point source solution to give approximate results useful for the region deeper than 20 radii below the cavity. (Author's abstract)
W85-02318

EVALUATION OF SIMPLIFIED METHODS FOR DETERMINING UNSATURATED HYDRAULIC CONDUCTIVITY OF LAYERED SOILS,
Minnesota Univ., St. Paul. Dept. of Soil Science.
W. M. Schuh, J. W. Bauder, and S. C. Gupta.
Soil Science Society of America Journal, Vol. 48, p 730-736, 1984. 2 Fig, 1 Tab, 21 Ref.

Descriptors: *Permeability coefficient, *Layered soils, *Soil water, Conductivity, Permeability, Hydraulic head, Matric suction, Matric potential, Soil water potential.

The simplified field method of L.R. Ahuja et al. (Ahuja, L.R., R.E. Green, S.K. Chong, and D.R. Nielson. 1980. Water Resour. Res. Vol. 16, p 947-953) for determining hydraulic conductivity as a function of soil water suction, K(S), and the simplified field method of P.L. Libardi et al. (Libardi, P.L., K. Reichardt, D.R. Nielson, and J.W. Biggar. 1980. Soil Sci. Soc. Am. J. Vol. 44, p 3-7) for determining hydraulic conductivity as a function of soil water content, K(theta), were compared with the instantaneous profile method, to evaluate their suitability for estimating hydraulic conductivity of layered soil. The Ahuja method worked well on coarse and fine-textured soils and complex soil profiles with stratification. The Libardi method worked well on coarse and fine-textured, homogeneous materials and homogeneous parent materials underlying stratified soil materials. A calculated matching K value (K sub 0) was used with the Libardi method. Within layered soil materials slopes of the K(theta) curves, calculated with the Libardi method, were adequate; however, calculated K sub 0 values were often inadequate. Fit of calculated values with measured values of hydraulic conductivity could have been improved by using field-determined K sub 0 values. (Author's abstract)
W85-02319

HYDRAULIC CONDUCTIVITY AND WATER RETENTION OF CLAY SOILS CONTAINING COARSE FRAGMENTS,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering.
I. Ravina, and J. Magier.
Soil Science Society of America Journal, Vol. 48, p 736-740, 1984. 5 Fig, 2 Tab, 9 Ref.

Descriptors: *Permeability coefficient, *Water retention, *Clay soils, *Stoney soils, Gravel, Porosity, Soil compaction, Compaction, Soil water suction.

Field observations show that clay soils with medium to high coarse fragment contents are less compacted, have more favorable structure and provide better physical condition for tree growth than similar soils containing small amounts of coarse fragments. The effect of coarse fragments on soil compaction, hydraulic conductivity, and moisture retention at low suctions was investigated. Increasing coarse fragment content increased resistance to compaction and consequently preserved lower soil bulk density. Larger volumes of large pores were found after compaction of soil with increasing coarse fragment content. In compacted soils of increasing coarse fragment content, hydraulic conductivity was higher. Aerated porosity of soils between fragments increased with fragment content. It was concluded that coarse fragments contribute to improved physical conditions by acting as a 'skeleton' which resists soil compaction. (Author's abstract)
W85-02320

NONUNIFORM LEACHING FROM NONUNIFORM STEADY INFILTRATION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
J. R. Philip.
Soil Science Society of America Journal, Vol. 48, p 740-749, 1984. 11 Fig, 13 Ref.

Descriptors: *Leaching, *Infiltration, *Unsaturated flow, Moisture potential, Flow, Isochrones, Soil texture, Percolation.

The two-dimensional quasilinear steady flow equation is solved exactly for arbitrary periodic distribution of surface source strength nu sub 0 (x) (x, horizontal coordinate), both for flow to infinite depth and to a water table at finite depth. Solutions are given both for the Kirchhoff variab'e Theta and the stream function phi. They are explored in detail for nu sub 0 = (mean nu sub 0)(1 + eta cos(pi x/l)) (0 < eta < or = 1). For each solution emphasis is placed on determining the limits on nu sub 0 (x) which ensure that the moisture potential Psi < or = 0, so that the quasilinear formulation is applicable. This essential precaution has sometimes been disregarded. The presence of water table strongly influences Theta, but has relatively little effect on phi. This makes possible important mathematical simplifications. Remarkably, simple exact solutions are found for travel times. They reveal singularities in the travel-time functions overlooked in previous work using a finite difference method. For large times, the family of isochrones behaves like a traveling wave with the shape and velocity constant. Streamlines and isochrones are compared for a coarse soil (parameter alpha = 25/m) and a fine one (alpha = 0.25/m). Surface velocity differentials persist much more strongly for the coarse soil, which exhibits much greater horizontal variation of travel times. By one measure, nonuniformity of leaching is 7.8 times greater in the coarse soil than the fine one. A previous study of problems of this class concluded incorrectly that leaching is more uniform for saturated than for unsaturated flow. (Author's abstract)
W85-02321

LINEAR ANALYSIS OF THERMAL EFFECTS ON EVAPORATION FROM SOIL,
Princeton Univ., NJ. Dept. of Civil Engineering.
P. C. D. Milly.
Water Resources Research, Vol. 20, No. 8, p 1075-1085, August, 1984. 6 Fig, 2 Tab, 16 Ref.

Descriptors: *Evaporation rate, *Linear analysis, *Thermal effects, *Soil water, Moisture flux, Thermal liquid flux, Soil temperature.

Evaporation of water from a soil surface is a complex process that can be strongly tied to the distribution of temperature in the soil. One way of examining this coupling is through linearization and analytic solution of the partial differential equations and boundary conditions that govern the distributions of moisture and temperature. The solution for a step change in temperature and matric head at the surface of a soil that is initially isothermal and uniformly wetted suggests that evaporation can be calculated accurately by neglecting the dependence of moisture content on temperature, even when the associated 'thermal liquid flux' is the largest moisture flux immediately beneath the soil surface. The resulting error decreases with the hydrothermal diffusivity ratio, eta, which is the ratio of soil moisture diffusivity to soil thermal diffusivity, and increases with the thermal liquid force ratio, xi, which is proportional to the poorly understood temperature coefficient of matric head. In contrast, the solution for diurnally varying evaporation from a relatively dry soil shows that the relative error induced by neglecting vapor diffusion due to thermally induced vapor concentration gradients is approximately equal to the relative magnitude of the neglected flux itself. This error is roughly equal to sigma x (eta to the 1/2 power), where the thermal vapor force ratio, sigma, is the ratio of characteristic thermal to isothermal driving forces. Furthermore, when sigma x (eta to the 1/2 power) is large, the daytime switches from a time of maximum evaporation to a time of minimum. This behavior is not reproduced if the thermal vapor flux is ignored. (Authors abstract)
W85-02364

SIMULATION ANALYSIS OF THERMAL EFFECTS ON EVAPORATION FROM SOIL,
Princeton Univ., NJ. Dept. of Civil Engineering.
P. C. D. Milly.
Water Resources Research, Vol. 20, No. 8, p 1087-1098, August, 1984. 9 Fig, 6 Tab, 34 Ref, 1 Append. NSF grant ATM-781237 and ATM-8114723.

Descriptors: *Evaporation, *Thermal effects, *Simulation analysis, *Soil water, Soil temperature, Richard's equation, Water vapor, Vapor pressure, Vapor diffusion.

The Richards equation, which expresses the conservation of water in an isothermal soil, has a more general form in nonisothermal soil. In using the latter, it is necessary to know soil temperature, and modeling becomes considerably more complicated. A detailed numerical simulation model quantifies the thermal effects for two hypothetical soils under two climates. During characteristic 4-day climatic sequences in a season of soil heating, diffusion of vapor due to thermally induced vapor concentration gradients suppresses evaporation. The suppression is greatest (5-15% in this set of experiments) under arid conditions. Under these conditions, such thermal vapor diffusion also distorts the usual diurnal pattern of evaporation. Evaporation is generally more sensitive to isothermal than to thermal vapor diffusion. Variations in time and depth of the soil temperature cause corresponding variations in the water transport coefficients. These, in turn, result in biases (2-5%) and diurnal distortions of evaporation rates. Liquid flow attributable to the dependence of matric potential on temperature accounts for about 1% of evaporation in our experiments. In simulations of 1 month duration for each combination of soil and climate the joint neglect of all thermal effects mentioned above introduces an error of only about 1% in the average evaporation rate and does not distort its time distribution significantly. (Author's abstract)
W85-02365

TECHNIQUES FOR MAKING FINITE ELEMENTS COMPETITVE IN MODELING FLOW IN VARIABLY SATURATED POROUS MEDIA,
GeoTrans, Inc., Reston, VA.
P. S. Huyakorn, and S. D. Thomas.
Water Resources Research, Vol. 20, No. 8, p 1099-1115, August, 1984. 20 Fig, 5 Tab, 22 Ref, 5 Append.

Descriptors: *Finite element method, *Flow modeling, *Porous media, *Saturation, Saturated flow, Picard algorithm, Newton-Raphson algorithm, Galerkin finite element formulation, Algorithms, Capillary conductivity, Soil water.

A Galerkin finite element formulation is developed for the numerical simulation of water flow in variably saturated soil systems. Included in this formulation is a solution strategy based on Picard and Newton-Raphson algorithms. Both algorithms are especially to cope with severely nonlinear field problems. The two algorithms are formulated for both rectangular and triangular elements. The element matrices are evaluated in a simple and efficient manner using a technique referred to as the 'influence coefficient' technique. This technique avoids numerical integration and leads to a substantial saving of computational cost. Four examples are presented to demonstrate the effectiveness of the present finite element approach. These examples show that the nonlinear solution schemes are capable of accomodating cases involving large variations in the saturated hydraulic conductivity, as well as highly nonlinear soil moisture characteristics. A comparative study of the Picard and the Newton-Raphson algorithms is also provided. The study indicates that despite the higher cost per iteration of the Newton-Raphson scheme, it usually requires a substantially smaller number of iterations than the Picard scheme. In some instances where convergence difficulties are experienced with the latter scheme, it is desirable to use the Newton-Raphson scheme in order to obtain a cost-effective solution to the problem. (Author's abstract)
W85-02366

EQUIVALENCE OF TWO CONCEPTUAL MODELS FOR DESCRIBING ION EXCHANGE DURING TRANSPORT THROUGH AN AGGREGATED OXISOL,
California Univ., Davis. Dept. of Land, Air and Water Resources.
P. Nkedi-Kizza, J. W. Biggar, H. M. Selim, M. T. van Genuchten, and P. J. Wierenga.
Water Resources Research. Vol. 20, No. 8, p 1123-1130, August, 1984. 8 Fig, 4 Tab, 32 Ref.

Descriptors: *Ion exchange, *Oxisols, *Model studies, Isotope studies, Breakthrough curves, Calcium radioisotopes, Chlorine radioisotopes, Tritium, Soil columns, Soil water.

Breakthrough curves (BTCs) of the cation Ca-45(2+), an anion Cl-36(-), and labeled H2O were measured during miscible displacement through water-saturated soil columns packed with aggregates of an Oxisol. Two conceptual models were used to simulate the observed asymmetry and tailing in the BTCs caused by an apparent nonequilibrium situation in the porous medium. In both models the exchange process on one type of site was assumed to be instantaneous while the rate of isotopic exchange on another type of site was assumed to be either a diffusion-controlled process (model 1) or a first-order reversible kinetic process (model 2). Isotopic exchange in both models was described with a linear isotherm. It is shown that the two models are mathematically equivalent with respect to the derived BTCs. (Author's abstract)
W85-02368

ALGEBRAIC EQUATIONS FOR SOLUTE MOVEMENT DURING ADSORPTION,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
K. K. Watson, and M. J. Jones.
Water Resources Research, Vol. 20, No. 8, p 1131-1136, August, 1984. 3 Fig, 2 Tab, 15 Ref.

Descriptors: *Adsorption, *Mathematical equations, *Solute movement, *Solute transport, Porous media, Dispersion, Fick's law, Molecular diffusion, Mechanical dispersion, Diffusion, Boundary conditions.

Numerous contributions have appeared in the literature giving analytical solutions for the movement of nonreactive solute in unsaturated porous materials during adsorption and infiltration. Simple algebraic equations were developed that can be used with confidence for predicting solute disposition during absorption. Quasi-analytical solutions for constant concentration and constant flux boundary conditions using a velocity independent hydrodynamic dispersion coefficient were reduced to a simple yet accurate form. Solutions were also developed for systems where the mechanical dispersion forms the dominant component during dispersion. For systems lying outside the application of the fairly restriced quasi-analytical solutions, a computer-based numerical analysis is required so that calculated data on solute disposition may be obtained both for testing the limitations of the equations and for evaluating any necessary empirical parameters. Systems that lie between the extreme cases where both the molecular diffusion and mechanical dispersion have comparable significance were analyzed and values of an empirical parameter, which is a necessary term in the resulting equation, were determined from computer-based numerical studies. The magnitude of the parameter varies within a reasonably narrow range of values. Equations were also developed from the alternative governing differential equation for solute movement based on a Fickian model. (Collier-IVI)
W85-02369

INVESTIGATION OF THE PROPERTIES AND GENESIS OF WEST COAST WET LAND SOILS, SOUTH ISLAND, NEW ZEALAND; 5. PHYSICAL CHARACTERISTICS OF SOIL PROFILES AND SOIL WATER REGIMES,
New Zealand Soil Bureau, Lower Hutt.
R. J. Jackson.
New Zealand Journal of Science, Vol. 27, No. 2, p 155-174, 1984. 7 Fig, 3 Tab, 19 Ref.

Descriptors: *Soil properties, *Physical properties, *Wetlands, Drainage, Water level, Pore size, Pore water.

Physical characteristics of wet land soils at 8 type localities on the West Coast of South Island are described. Typically the physical characteristics show very large changes with depth within each profile, mainly associated with the thickness of the H horizons and the organic matter content and particle-size distribution of the mineral material. Dry bulk density, particle density, and total porosity of the non-stony horizons are dominated by the organic matter content, but the water-retention data show the influence of particle size and of soil structure. At sites under forest, unmodified organic horizons have low dry bulk density, very high large pore contents, and very high available water storage capacities. Most A horizons are humic silt loams with moderate dry bulk densities, large pore contents between 2 and 20% v/v, and available water contents of 30-50% v/v. Both H and Ah horizons show substantial shrinkage during determinations of water retention characteristics. In many profiles the amount of available water that is in the readily available category decreases with depth. Removal or severe modification of surface horizons, which may occur with land development, would result in greatly increased potential for drying of the underlying horizons during periods when weather conditions permit drying to occur. Many of these profiles of wet land soils have low contents of large pores in horizons at shallow depths. In such horizons quite large changes of the position of the water table occur without much change in the air-filled pore space, and drainage alone is unlikely to improve air movement. (Baker-IVI)
W85-02411

SIMULATION OF THE BEHAVIOUR OF NITROGEN IN SOILS (SIMULATION DE L'IMPACT DE PRODUITS REACTIFS DANS LES SOLS - CAS DE L'AZOTE),
Centre National de la Recherche Scientifique, Toulouse (France). Inst. de Mecanique des Fluides.
For primary bibliographic entry see Field 5B.
W85-02460

ORIGIN AND DISTRIBUTION OF CARBON DIOXIDE IN THE UNSATURATED ZONE OF THE SOUTHERN HIGH PLAINS OF TEXAS,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2K.
W85-02661

GEOSTATISTICAL APPROACH TO SOLUTE TRANSPORT IN HETEROGENEOUS FIELDS AND ITS APPLICATIONS TO SALINITY MANAGEMENT,
Agricultural Research Organization, Bet-Dagan (Israel). Div. of Soil Physics.
For primary bibliographic entry see Field 5B.
W85-02668

2H. Lakes

SINKING LOSSES OF PHYTOPLANKTON IN CLOSED LIMNETIC SYSTEMS,
Freshwater Biological Association, Ambleside (England).
C. S. Reynolds, and S. W. Wiseman.
Journal of Plankton Research, Vol. 4, No. 3, p 489-522, 1982. 21 Fig, 4 Tab, 37 Ref.

Descriptors: *Phytoplankton, *Sinking, *Blelham Tarn, *England, Sedimentation, Lakes, Algae, Diatoms, Temporal distribution, Vertical distribution, Productivity, Standing crop, Biomass.

Loss processes, resulting in the elimination of viable algae from the trophogenic zones of lake, exert important controls on the productivity of the phytoplankton, the standing crop, and, to some extent, its periodicity. Sedimentation losses are studied as a part of a study of the magnitude and variation of loss processes. Specific algal recoveries from sediment traps of two different designs and from mud surface deposits of large experimental enclosures (Lund Tubes) placed in Blel Tarn (England) were monitored during 1978 are analyzed in relation to the vertical and tem ral distribution of ten dominant phytoplank populations. Sedimentation accounts for diffe proportions of the total loss of biomass for di ent algae: between 28 and 100% of diatoms, 95% of Eudorina; <4% of populations of s algae (species of Ankyra, Chromulina, Cry manas). Rates of diatom loss are also derived f comparison of net rates of change (kn) and silica uptake-derived growth rate (k'); intrir sinking behavior may be specifically regulate relation to growth conditions. Temporal and cific differences in sinking behavior have two portant implications in phytoplankton ecolo The first is that different species respond differ ly to given conditions of physical stability. second point is that sinking losses can mak substantial impact upon the dynamics of phy plankton. (Moore-IVI)
W85-02215

EFFECTS OF LAKE ACIDIFICATION RATES OF ORGANIC MATTER DECOMPOTION IN SEDIMENTS,
Winnipeg Univ. (Manitoba). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W85-02218

PRIMARY PRODUCTION AND GRAZING FRESHWATER AND INTERTIDAL REACH OF A COASTAL STREAM, SOUTHEA ALASKA,
M. L. Murphy.
Limnology and Oceanography, Vol. 29, No. 4 805-815, July, 1984. 5 Fig, 4 Tab, 24 Ref.

Descriptors: *Porcupine Creek, *Alaska, *Prima productivity, *Grazing, *Intertidal areas, Periph ton, Invertebrates, Biomass, Shade, Isopods, A phipods.

During summer 1981, primary production of pe phyton and grazing by macroinvertebrates we measured in Porcupine Creek, a small stream Southeast Alaska. The intertidal reach was in meadow primarily of sedge (Carex sp.); the fres water reach was in a mature forest of weste hemlock (Tsuga heterophylla) and Sitka spru (Picea sitchensis). Daily net primary productio was 50% greater in the intertidal reach (mean 486 mg C/sq m) than in the freshwater rea (mean = 324 mg C/sq m). In the freshwater reac periphyton had high biomass (mean = 7.8 C/sq 95% C.I. = 4.9-10.7 g C/sq m) and low produ tion: biomass ratio (0.04), shade of the fore canopy limited primary production. In the inter dal reach, periphyton had low biomass (mean 2.0 g C/sq m, 95% C.I. = 1.3-2.7 g C/sq m) a high production: biomass ratio (0.24), and grazi macroinvertebrates limited primary production b reducing the biomass of periphyton. Mean dai net production in the intertidal reach could supp about 3.8 kcal/sq m/d and satisfy 200% of th daily energy requirement for maintenance and a tivity of the population of macroinvertebrates the reach, primarily the isopod Gnorimosphae oma oregonensis and amphipods Paramoera c lumbiana and Eogammarus confervicolus. A tochthonous primary production by periphyton probably the dominant source of energy in summe for secondary producers in the intertidal reach Porcupine Creek. (Author's abstract)
W85-02219

TRANSPORT OF CARBON, NITROGEN PHOSPHORUS, AND MAJOR SOLUTES I THE GAMBIA RIVER, WEST AFRICA,
California Univ., Santa Barbara. Dept. of Biolog cal Sciences.
L. F. W. Lesack, R. E. Hecky, and J. M. Melack. Limnology and Oceanography, Vol. 29, No. 4, 816-830, July, 1984. 8 Fig, 7 Tab, 46 Ref. NS grant DEB81-11398.

Descriptors: *Solute transport, *Carbon, *Nitro gen, *Phosphorus, *Gambia River, *West Africa Silicon dioxide, Carbonates, Organic carbon, Hys teresis, Particulates, Lithology, Relief.

Transport of solutes and particulate materials and their variation with discharge were studied for 1 year (July 1980-June 1981) in the Gambia River in the tropical savanna of West Africa. The water is dilute (flow-weighted mean total solutes, 40.6 mg/liter) solution of SiO2 and HCO3 (75% of total solutes by weight). Na(+), K(+), Cl(-), and total dissolved nitrogen showed no significant relation with discharge. Ca(2+), Mg(2+), HCO3(-), conductivity, and SO4(2-) decreased as discharge increased, while total dissolved phosphorus increased with discharge. After an initial increase SiO2 was independent of discharge. Dissolved organic carbon displayed counterclockwise hysteresis with rising and falling discharge. Particulate phosphorus and total particulate materials displayed clockwise hysteresis. Total transport amounted to 9.66 t/sq km/yr. The transport rates of both dissolved and particulate organic C are among the lowest ever reported. The low transport of total particulates and solutes is attributed to lack of relief and the lithology of the catchment. (Author's abstract)
W85-02220

TURBULENT MIXING IN THE HYPOLIMNION OF BALDEGGERSEE (SWITZERLAND) TRACED BY NATURAL RADON-222,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
D. M. Imboden, and Th. Joller.
Limnology and Oceanography, Vol. 29, No. 4, p 831-844, July, 1984. 9 Fig, 6 Tab, 25 Ref.

Descriptors: *Mixing, *Turbulence, *Hypolimnion, *Baldeggersee, *Switzerland, *Radon, Diffusion, Radioactive tracers, Mathematical models, Buoyancy, Water temperature.

Three analytical diffusion models are used to describe the distribution of a nonconservative tracer in the hypolimnion of a lake: The one-dimensional vertical (1-DV) model, developed for tracers in the deep sea, leads to a significant overestimation of vertical diffusivity Kz in lakes; the one-dimensional topographic vertical (1-DTV) model, applicable if horizontal mixing is fast compared to in situ decay, demonstrates that, except for the deepest layers, vertical tracer distributions are insensitive to Kz; the one-dimensional topographic horizontal (1-DTH) model, in which horizontal mixing is incomplete and vertical diffusion is disregarded, is the appropiate model for the interpretation of vertical excess Rn-222 profiles a few meters above the lake bottom. The radon flux F from the bottom is calculated from Rn-222 in the sediments and corrected for depth variation of porosity and radium activity. In Baldeggersee (Switzerland), F is 390 +/- 70 dpm/sq m/d. Radium activities in the sediments are 0.7 +/- 0.2 dpm/g dry mass, similar to those in other Swiss lakes and in coastal areas of the ocean but 20-50 times smaller than in the deep Pacific. Horizontal diffusivity in the hypolimnion decreases from June (5,000 sq m/d) to October (1,000 sq m/d); vertical diffusivity is between 1 and 10 sq m/d, roughly 10 times larger than values calculated from temperature in the upper hypolimnion. Vertical buoyancy flux is between 10-11 and 10-10 sq m/s cu, i.e. between values for the deep ocean and the small ELA lakes in Canada. The large Kz and the transient, often irregular shape of the randon profiles are the result of horizontal bottom currents previously measured by other methods. (Author's abstract)
W85-02221

CLASSIFICATION AND DYNAMIC SIMULATION OF THE VERTICAL DENSITY STRUCTURE OF LAKES,
Western Australia Univ., Nedlands. Dept. of Civil Engineering.
J. C. Patterson, P. F. Hamblin, and J. Imberger.
Limnology and Oceanography, Vol. 29, No. 4, p 845-861, July, 1984. 11 Fig, 2 Tab, 22 Ref.

Descriptors: *Density stratification, *Limnology, *Simulation, Lake basins, Wind, Mixing, Water circulation, Shear, Mathematical models, Thermal inversion, Water temperature, Salinity.

Field data from two lakes of widely differing geometry and size are analyzed in terms of four nondimensional numbers which allow the principal mixing processes in each lake to be identified. The numbers are based on basin geometry, density stratification, wind stress, and rates of inflow and outflow. The procedure highlights the differences in the dynamics of the two lakes and allows assessment of the validity of the assumption of one-dimensionality. The result is that both lakes were dominated by one-dimensional, but different processes. The dynamics of the epilimnion of the smaller lake were dominated by stirring from surface wind and cooling, whereas shear at the pycnocline was also significant in the larger lake. In neither case did the effects of the earth's rotation, inflow, or outflow generate significant horizontal gradients. A one-dimensional numerical model (DYRESM) was used to simulate the vertical temperature and salinity structures of both lakes over lengthy periods, with good results. The model is based on the parameterization of the important physical processes in a framework of horizontal layers of variable thickness and was applied in both lakes without alteration. The interpretative power of the model is demonstrated by examination of the formation and erosion of a thermal inversion in the larger lake. (Author's abstract)
W85-02222

MIXING AND THE DYNAMICS OF THE DEEP CHLOROPHYLL MAXIMUM IN LAKE TAHOE,
Scripps Institution of Oceanography, San Diego, CA.
M. R. Abbot, K. L. Denman, T. M. Powell, P. J. Richerson, and R. C. Richards.
Limnology and Oceanography, Vol. 29, No. 4, p 862-878, July, 1984. 14 Fig, 42 Ref.

Descriptors: *Lake Tahoe, *Deep chlorophyll maximum, *Mixing, *Water temperature, Productivity, Nutrients, Turbulence, Solar radiation, Seasonal variation.

Chlorophyll-temperature profiles were measured across Lake Tahoe about every 10 days from April through July 1980. Analysis of the 123 profiles and associated productivity and nutrient data identified three important processes in the formation and dynamics of the deep chlorophyll maximum (DCM): turbulent diffusion, nutrient supply rate, and light availability. Seasonal variation in these processes resulted in three regimes: a diffusion-dominated regime with a weak DCM, a variable-mixing regime with a pronounced, nutrient supply-dominated DCM, and a stable regime with a deep, moderate light availability-dominated DCM. The transition between the first two regimes occurred in about 10 days, the transition between the last two more gradually over about 3 weeks. The degree of spatial variability of the DCM was highest in the second regime and lowest in the third. These data indicate that the DCM in Lake Tahoe is constant in neither time nor space. (Author's abstract)
W85-02223

DIEL VARIATION OF NITROGEN FIXATION IN LAKE VALENCIA, VENEZUELA,
Colorado Univ. at Boulder. Dept. of Environmental, Population, and Organismic Biology.
S. N. Levine, and W. M. Lewis, Jr.
Limnology and Oceanography, Vol. 29, No. 4, p 887-893, July, 1984. 2 Fig, 1 Tab, 19 Ref. NSF Grants DEB 78-05324 and DEB 80-03883.

Descriptors: *Nitrogen fixation, *Lake Valencia, *Venezuela, *Diel variation, Cyanophyta, Eutrophic lakes, Heterocysts.

Using data from incubations in situ, light measurements, and heterocyst counts, two major causes of variation in nitrogen fixation were determined: change in abundance of nitrogen fixers at a given depth and change in heterocyst-specific nitrogen fixation. Lake Valencia is eutrophic and sustains large populations of b!ue green algae. During the months when Lake Valencia was circulating and during the early weeks of stagnation, when dissolved inorganic nitrogen was still relatively abundant, the nitrogen fixation rates during diel studies were rarely significantly different from zero. Studies while the nitrogen fixers were abundant and active showed fairly regular diel patterns. The rate of nitrogen fixation at 0.5 m was strongly dependent on the concentration of heterocystous blue-green algae, which changed with time of day. Four species of heterocystous blue-green algae were common to the lake during 1981: Anabaena volzii, A. spiroides, Cylindrospermopsis stagnale, and Anabaenopsis circularis. The volume-specific nitrogen fixation rates (nitrogen fixed/liter/hr) at 0.5 m were lowest at night, being < 6% of the maximum daytime rates. Heterocyst-specific nitrogen fixation did not follow the same diel trends as volume-specific nitrogen fixation. During most of the day, the heterocyst-specific nitrogen fixation rates were fairly uniform, between 31 and 37 nmol/hr in September. At night, heterocyst-specific nitrogen fixation was 3.0 nmol/hr in September. (Baker-IVI)
W85-02224

HUMIC SUBSTANCES IN AMAZONIA I: CHEMICAL CHARACTERIZATION OF HUMIC AND FULVIC ACIDS FROM TWO CENTRAL AMAZONIA LACUSTRINE SEDIMENTS (BLACK AND WHITE WATER SYSTEMS),
Universidade Federal de Sao Carlos (Brazil). Dept. de Quimica.
A. D. Santos, and A. A. P. Toledo.
Tropical Ecology, Vol. 24, No. 1, p 143-152, 1983. 5 Fig, 4 Tab, 14 Ref.

Descriptors: *Lake sediments, *Lake Caiaue, *Lake Jacaretinga, *Brazil, Bottom sediments, Humic acids, Fulvic acid, Amazonia, Chemical analysis, Litter.

The material extracted from the two lakes is probably formed by different humification processes. Lakes of the Rio Negro region seem to have substances form by humification from allochthonous material from the forest, where resistant materials such as lignin, tannins and phenols accumulated in the litter under aerobic conditions. A higher concentration of humic and fulvic acids was found in sediments from Caiaue Lake as compared to those from Jacaretinga Lake. The greater concentration of humic and fulvic acids from Caiaue Lake can be explained by the fact that this lake receives humic substances brought down by the Rio Negro, in addition to a substantial amount of material from the forest. Jacaretinga Lake, as well as other varzea lakes in the Careiro region, may have part of these substances removed by the Amazon River waters during flooding seasons. Material extracted from Jacaretinga Lake sediment had a higher nitrogen content than Caiaue Lake, but a lower carbon content. The humic and fulvic acids were characterized by a high predominance of carboxylic acidity in both lakes. The chromaticity coefficient of humic acid for the material from Caiaue was higher than the one from Jacaretinga, suggesting a predominance of aliphatic structure in the humic acid from Caiaue and in the fulvic acid from Jacaretinga. (Baker-IVI)
W85-02234

BIOLOGICAL COMMUNITIES OF THREE SUBTROPICAL FLORIDA LAKES OF DIFFERENT TROPHIC CHARACTER,
University of South Florida, Tampa. Dept. of Biology.
J. L. Elmore, B. C. Cowell, and D. S. Vodopich.
Archiv fur Hydrobiologie, Vol. 100, No. 4, p 455-478, July, 1984. 6 Fig, 5 Tab, 48 Ref.

Descriptors: *Benthos, *Lakes, *Trophic level, *Florida, Phytoplankton, Zooplankton, Macrobenthos, Meiobenthos, Protozoa, Eutrophication.

Phytoplankton, zooplankton, macrobenthos, meiobenthos, and protozoans were sampled during 1979-1980 in three subtropical lakes of differing trophic state in central Florida. The phytoplankton of Lake Beauclair (hypereutrophic) was dominated by Cyanophyta (52%) and Chlorophyta (38%). In Corner Lake (mesotrophic) the dominant divisions were the same as in Lake Beauclair, but Chloro-

phyta (59%) was more abundant than Cyanophyta (35%). Bay Lake (oligotrophic) was dominated by Chlorophyta (54%) and Cryptophyta (31%). Rotifers (63%) were the most important zooplankters in Lake Beauclair, with crustaceans comprising 37% of the numerical density. Corner Lake had almost equal proportions of rotifers (52%) and crustaceans (49%), whereas crustaceans (64%) were more abundant than rotifers (36%) in Bay Lake. Phytoplankton and zooplankton increased, whereas macrobenthos decreased with increasing lake trophic state. Meiobenthos densities decreased from Bay Lake to Corner Lake and then increased somewhat in Lake Beauclair. If nematodes are excluded, meiobenthos abundance shows a strong inverse correlation with trophic state. Protozoan densities exhibited little difference between Bay Lake and Corner Lake, but Lake Beauclair had a much greater abundance than the other lakes. Nutrient levels were probably most important in causing increases in densities of phytoplankton, zooplankton, and protozoans with increasing trophic state. Decreasing densities of benthos with increasing trophic states were likely caused by differences in levels of dissolved oxygen near the sediment water interface. (Baker-IVI)
W85-02240

ELEMENTAL RESIDENCE TIMES IN ACTON LAKE, OHIO,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
D. E. Canfield, W. J. Green, T. J. Gardner, and T. Ferdelman.
Archiv fur Hydrobiologie, Vol. 100, No. 4, p 501-519, July, 1984. 8 Fig, 3 Tab, 28 Ref.

Descriptors: *Lakes, *Chemical properties, *Acton Lake, *Ohio, Seasonal variation, Physical properties, Biological properties, Sodium, Chloride, Calcium, Manganese, Magnesium, Iron, Water quality.

Elemental residence times in the lake were controlled by several specific, physical, chemical and biological processes. Residence time trends for Ca were seasonal when compared to conservative behavior, with biologically induced calcite precipitation the main removal mechanism. Residence times for Fe and Mn were long, with bottom sediment resuspension and anoxic regeneration the most important contributors. Terrestrial organic decomposition and sediment resuspension were probably responsible for the long residence times observed for K. Mg, Na, and Cl are conservative in Acton Lake. Results from this study may be extended to predict residence time behavior in other systems since the same processes controlling elemental residence times in Acton Lake may also affect residence times in other lakes. Residence times for iron and manganese may be in general long in shallow, eutrophic lakes where the ratio IAP/Ksp exceeds one. Sodium and chloride should behave conservatively in most lakes. In lakes where bottom sediment resuspension is important in affecting lake chemistry, residence times for many toxic trace metals may be long, possibly affecting water quality. (Baker-IVI)
W85-02241

LEAF LITTER PROCESSING RATES IN FOUR TEXAS STREAMS,
Southwest Texas State Univ., San Marcos, Aquatic Station.
R. A. Short, S. L. Smith, D. W. Guthrie, and J. A. Stanford.
Journal of Freshwater Ecology, Vol. 2, No. 5, p 469-473, August, 1984. 2 Tab, 10 Ref.

Descriptors: *Litter, *Streams, *Texas, Organic matter, Decomposition, Water temperature, Invertebrates.

Rates of leaf liter processing were investigated in four Texas streams during fall-winter. Assuming an exponential decay model, processing coefficients of some leaf species were among the highest yet reported. Processing coefficients for the various leaf species ranged from 0.0040 for sycamore in the Blanco River to 0.0619 for hackberry in Honey Creek. Values for percent loss/day ranged from 0.54 to 6.00. When compensated for the higher water temperatures found in these streams compared to more northern streams, processing rates were equivalent or even slightly lower. It is hypothesized that (on a per degree day basis) this slower processing rate may result from the depauperate shredder fauna in such Texas streams. Ecosystem level studies of invertebrate community structure and associated mechanisms of energy transfer via processing of particulate organic matter are needed to clarify the apparently different strategies present in the more unpredictable environment of many Texas streams. (Baker-IVI)
W85-02247

USE OF NEPHELOMETRIC TURBIDITY TO CALCULATE CARLSON'S TROPHIC STATE INDEX IN KEYSTONE LAKE OKLAHOMA,
Corps of Engineers, Vicksburg, MS.
R. G. Hunter, and J. Wilhm.
Journal of Freshwater Ecology, Vol. 2, No. 5, p 475-485, August, 1984. 5 Fig, 3 Tab, 20 Ref.

Descriptors: *Turbidity, *Lakes, *Keystone Lake, *Oklahoma, Chlorophyll, Phosphorus, Water quality, Nephelometric Turbidity, Mathematical equations, Trophic level.

Relationships among measurements of turbidity and chlorophyll and phosphorus were examined at six stations in Keystone Lake, Oklahoma from March to October of 1981. Maximum chlorophyll a, total phosphorus, and turbidity occurred in the upper reaches of the two main arms. Total phosphorus of all samples ranged from less than 3 to 66 mg/cu m and averaged 14 mg/cu m. Chlorophyll a of all samples ranged from 3 to 65 mg/cu meter averaging 23 mg/cu m. Secchi disc transparency ranged from 0.3 to 5 m and varied significantly by both station and date. Chlorophyll a concentration could not be predicted adequately from Secchi disc readings due to interference by non-chlorophyll turbidity. Secchi disc depth represented 30 to 50% of the true photic zone and these two parameters were well correlated. Photic zone depth ranged from 0.8 to 4.8 m, varied significantly with both station and date and was poorly correlated with phosphorus and chlorophyll a. Nephelometric turbidity was strongly correlated with all parameters except chlorophyll a. Carlson's trophic state index was of limited usefulness due to the weak relationship among parameters such as chlorophyll a and Secchi disc depth. Calculation of this index based on nephelometric turbidity strengthened the relationship. The addition of nephelometric turbidity of Carlson's index was accomplished by setting a 0 value of the index equal to 200 NTU. When mean values were plotted by station or date, a good correlation existed between Secchi disc transparency and photic zone measurements made with the submarine photometer. (Baker-IVI)
W85-02248

SESTON MICROBIAL ACTIVITY IN A RIVER-RESERVOIR SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
P. F. Kondratieff, and G. M. Simmons, Jr.
Journal of Freshwater Ecology, Vol. 2, No. 5, p 487, August, 1984. 4 Fig, 72 Ref.

Descriptors: *Seston, *Reservoirs, *Rivers, *Water quality, *Microbiological studies, Hypolimnion, Aquatic drift, Dam effects, Reservoirs, Detritus, Chlorophyll a, Sedimentation.

Organic seston was studied in a 3rd-4th order impounded river in southwestern Virginia. The hypolimnetic release reservoir had an area of 67 ha and was located in a 4860 ha watershed, 90% of which was forested. The study was to determine reservoir effects on seston quality by measuring microbial activity and chlorophyll a on river and reservoir seston. The reservoir interrupted the lotic seston pathway in the Dan River. In general, the longer detritus is recycled within a system the more refractory it becomes to microbial and animal metabolism. The reservoir eliminated much of the riverine particulate seston from suspension and thereby increased the possibility that reservoir generated seston could be of overall higher quality. Within the impoundment, autochthonous production and microbial ETS activity were significan higher than at upstream riverine sites and at a immediately below the dam. The reservoir ses was therefore of considerably higher quality t either imports or exports. Five km below the poundment, chlorophyll a concentrations w consistently low while ETS activity increased s nificantly from that at the station immediat below the dam. Through mechanisms such as se mentation of imported seston, substantial in-res voir autotrophic production, and high downstre microbial activity, impoundments on rivers m contribute to maximizing lotic ecosystem effici cies. (Baker-IVI)
W85-02249

TRANSFORMATION AND DECOMPOSITIO OF PHOTOSYNTHETIC PRODUCTS OF LA PHYTOPLANKTON,
Tokyo Metropolitan Univ. (Japan). Dept. of Bi ogy.
Y. Watanabe.
Japanese Journal of Limnology, Vol. 45, No. 2, 116-125, April, 1984. 5 Fig, 2 Tab, 26 Ref.

Descriptors: *Lakes, *Limnology, *Phytoplan ton, *Decomposition, *Photosynthesis, Orga matter, Bacteria, Particulate matter.

The transformation and decomposition proces of newly assimilated photosynthetic products lake phytoplankton were followed. The amount refractory and labile particulate organic matter a dissolved organic matter derived from both t cellular and extracellular organic matter was det mined using a C-14 tracer method under controll laboratory conditions. Cellular organic matter w consumed by phytoplankton respiration in t early stages of incubation and decreased to 19% the initial amount for 30 days at 25 C. A sh occurred in the chemical constitution of the p dominant cellular organic matter: hot ethanol sol ble and hot water soluble components became h water insoluble. After decomposition for 85 day 14.7% and 1.5% of the cellular products we transformed to particulate and dissolved organ matter, respectively. The extracellular produc which were 9.3% of the total photosynthetic pro ucts, were easily metabolized and decomposed b lake bacteria. After 133 days, 19.4% and 7.5% the initial extracellular products were changed particulate and dissolved organic matter, respe tively. During the course of the decomposition, marked difference was noted in the gel filtrati profile of the dissolved organic matter derive from the extracellular products. (Baker-IVI)
W85-02254

ANNUAL PRODUCTION BY GAMMARU PSEUDOLIMNAEUS AMONG SUBSTRAT TYPES IN VALLEY CREEK, MINNESOTA,
Minnesota Univ., St. Paul. Dept. of Entomology Fisheries, and Wildlife.
T. F. Waters.
American Midland Naturalist, Vol. 112, No. 1, 95-102, July, 1984. 2 Tab, 40 Ref.

Descriptors: *Valley Creek, *Minnesota, *Gam marus, *Substrates, *Aquatic productivity, Pro ductivity, Invertebrates, Amphipods, Benthos, Sil ing, Sand, Gravel, Cobble.

In high alkalinity, spring-fed streams, species o Gammarus frequently constitute the predominan biomass component of the invertebrate standin stock and are a main element of a stream system' production and energy flow. Annual productio by Gammarus pseudolimnaeus Bousfield in Valle Creek, Minnesota, was computed, using the size frequency method, separately by substrate type fo the 5-year period, 1968-1972. Four substrate type were identified: sand, sand-gravel, gravel, an cobble. Annual production was higher in fine particle substrates than in coarse-particle sub strates. The 5-year means were: sand, 21.4; sand gravel, 21.8; gravel, 15.0; and cobble, 11.0 g/sq m (dry weight). The ratio of annual production t annual mean standing stock (P/B) ranged mostl from 5.5-6.5, with 6.0 being the 5-year mean of al substrates combined. Densities and standing stock were also higher in fine-particle substrates an

ere also affected more by the siltation in fine-article substrates. The siltation that occurred in ie middle years of the study apparently filled uch of the interstitial space with clay reducing ie usable space in the fine-particle substrates real-vely more than in coarse substrates. Production as lowest in all substrates in 1971, the year most verely affected by the siltation. (Collier-IVI)
/85-02279

EASONAL SPATIAL AND TEMPORAL PHY-OPLANKTON CHANGES IN A SHALLOW UTROPHIC LAKE,
lberta Univ., Edmonton. Dept. of Botany.
. G. Jenkerson, and M. Hickman.
lova Hedwigia, Vol. 39, No. 1-2, p 1-33, 1984. 16 ig, 2 Tab, 68 Ref. Natural Sciences and Engineer-ig Research Council of Canada grant A6384.

escriptors: *Hastings Lake, *Alberta, *Phyto-lankton, *Eutrophic lakes, *Seasonal distribution, Physicochemical properties, Algae, Cyanophyta, iatoms, Chrysophyta, Chlorophyta, Nitrate, Spe-es diversity, Water temperature, Light intensity.

hytoplankton fluctuations in Hastings Lake, Al-erta, Canada, were investigated in relation to hysicochemical parameters. The lake is edaphical-eutrophic, characterized by clinograde oxygen istributions. The phytoplankton was dominated y cyanophycean algae during the summers (e.g., nabaena circinalis, A. flos-aqua, Aphanizomenon os-aquae, Microcystis aeruginosa, Oscillatoria ibbrevis, Merismopedia tenuissima and Coelos-haerium naegelianum). Two cyanophytes were lso winter dominants (e.g., Gomphosphaeria la-ustris v. compacta and Lyngbya lagerheimii) long with Chlamydomonas spp., Gonium sociale nd Rhodomonas minuta. Stephanodiscus hantzs-hii was the only dominant diatom. In general hlorophytes showed spring and autumn activity, hen temperature and light changed rapidly, and ominated during winters also. A tolerance for inter low temperature and light was shown in egative correlations with those factors. Popula-ons maintained a modicum of growth under low emperature and light were dominants, out-com-eting the blue-greens as winter nitrate levels were igh. Almost all chlorophycean dominants showed ositive correlation with nitrate. Spring and mmer species responded to moderated tempera-re and light conditions with population peaks nd community dominance again outcompeting lue-greens as nitrate levels were not at summer ows. Diversity was low in winter and summer and igh in spring and autumn. (Collier-IVI)
V85-02282

VATER CHEMISTRY AND PHOSPHATASE CTIVITY OF THE BLUE-GREEN ALGA RI-ULARIA IN UPPER TEESDALE STREAMS,
Durham Univ. (England). Dept. of Botany.
). Livingstone, and B. A. Whitton.
ournal of Ecology, Vol. 72, No. 2, p 405-421, uly, 1984. 7 Fig, 7 Tab, 33 Ref.

Descriptors: *Upper Teesdale, *England, *Phos-hatase activity, *Cyanophyta, *Rivularia, *Chem-al properties, Algae, Phosphate, Phosphorus, Hy-rogen ion concentration.

Rivularia colonies are abundant and sometimes ominant in many streams in Upper Teesdale, orthern England. In three stream systems chosen or intensive survey, the alga was restricted to sites ombining drainage from both peat and limestone. Water chemical variables were measured monthly ver a year (March 1981-February 1982). Most hanges at the main Rivularia sites were probably ue to varying combinations of drainage from peat, imestone and ores rich in zinc, lead or barium. Mean concentration of filterable phosphate (as P) rom three main sites was 87 micro g/L. Less than % of this phosphate was reactive; the remainder hydrolyzed by persulfate digestion method) was pparently organic. Most of the phosphorus passed lown the streams in March-May, with 'filterable rganic' phosphate (as P) reaching 1.0 mg/L in wo streams in May. In contrast, both organic and eactive phosphate were near or below detection imits (3 micro g/L, 1 micro g/L respectively) for the other months (June-February). Rivularia colonies were shown by two independent methods to have marked alkaline phosphatase activity. The response of the phosphatase to pH was the same for populations from all three streams. Stream water contained active phosphatase. Because the morphology of Rivularia trichomes indicates that the alga is growing under phosphate-limited conditions, it is suggested that one important reason for its success in these streams is its ability to hydrolyze organic phosphates. (Author's abstract)
W85-02283

HYPOLIMNETIC PHOSPHORUS RETRIEVAL BY DIEL VERTICAL MIGRATIONS OF LAKE PHYTOPLANKTON,
Helsinki Univ., Lammi (Finland). Lammi Biological Station.
K. Salonen, R. I. Jones, and L. Arvola.
Freshwater Biology, Vol. 14, No. 4, p 431-438, August, 1984. 5 Fig, 26 Ref.

Descriptors: *Lake Nemeton, *Finland, *Phytoplankton, *Phosphorus, *Migration, *Hypolimnion, Bog lakes, Chemical stratification, Stratification, Euphotic zone, Epilimnion, Nitrogen, Thermocline.

In the boreal forest zone, small sheltered bog lakes can develop intense and very stable stratification patterns with extremely sharp vertical gradients of chemical conditions. In such lakes the euphotic zone closely coincides with the epilimnion. Experiments to assess the possibility that migrating phytoplankton could gain access to hypolimnetic phosphorus and then transport it to the euphotic zone were carried out during summer, 1982, in Lake Nemeton, a small dystrophic lake in the Evo district of southern Finland. Movement of P-33 from hypolimnion to epilimnion was investigated using small-diameter experimental tubes enclosing thermally stratified water columns. The vertical distribution of inorganic phosphorus in the lake showed a sharp increase across the thermocline so that enhanced concentrations were available to phytoplankton just below the thermocline. Inorganic nitrogen concentrations did not show a marked relation to thermal stratification. One abundant motile alga (Cryptomonas marssonii) showed striking and regular vertical migrations in the lake, moving below the thermocline at night and returning to the surface waters in early morning. These migrations took cells across a 10 degree C temperature gradient. Non-motile phytoplankton showed constant vertical distributions. In the experimental tubes an upward movement of phosphorus took place from hypolimnion to epilimnion which was only attributable to transport by phytoplankton cells undertaking active vertical migrations. (Collier-IVI)
W85-02286

ROLE OF TALL AND MEDIUM SPARTINA ALTERNIFLORA ZONES IN THE PROCESSING OF NUTRIENTS IN TIDAL WATER,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
T. G. Wolaver, and J. Zieman.
Estuarine, Coastal and Shelf Science, Vol. 19, No. 1, p 1-13, July, 1984. 4 Fig, 3 Tab, 37 Ref.

Descriptors: *Spartina, *Nutrients, *Nutrient exchange, *Carters Creek, *Virginia, *Tidal Rivers, Cycling nutrients, Nitrogen, Phosphorus, Nutrient removal, Ammonium, Nitrates, Phosphates, Nitrite, Marshes, Tidal marshes, Wetlands, Seasonal variation.

A nitrogen and phosphorus nutrient exchange study was conducted on a vegetated mesohaline marsh in the Carters Creek area, Virginia. The low marsh, dominated by tall Spartina alterniflora removed NH4(+), NO3(-), PO4(3-), dissolved organic nitrogen (DON), dissolved organic phosphorus (DOP), particulate nitrogen (PN), and particulate phosphorus from the tidal water as it traversed this zone on an annual basis, while all the nitrogen and phosphorus species were removed from the tidal water inundating the high marsh (medium S. alterniflora). Nitrite was the only nutrient which was released into the tidal water on an annual basis, this occurring in the low marsh during the fall. The low marsh functioned differently from the high marsh in that (1) most of the nitrogen and phosphorus was removed from the tidal water as it resides on the low marsh (areal basin), and (2) seasonal changes in flux direction for NH4(+), DON, DOP, and PN were observed. The nutrients removed from the tidal water can potentially supply all of the nitrogen and phosphorus required for plant production in the low marsh and between 30 and 105 percent of the nitrogen and 60-70 percent of the phosphorus needed by the high marsh. (Author's abstract)
W85-02287

DEOXYGENATION AND REMINERALIZATION ABOVE THE SEDIMENT-WATER INTERFACE; AN IN SITU EXPERIMENTAL STUDY,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries Research.
N. C. Bulleid.
Estuarine, Coastal and Shelf Science, Vol. 19. No. 1, p 15-25, July, 1984. 7 Fig, 2 Tab, 32 Ref.

Descriptors: *Sediment-water interface, *Mineralization, *Deoxygenation, *Estuarine environment, *Detritus, Ammonium, Phosphates, Oxygen, Anoxic conditions, Cycling nutrients, Nitrogen, Nutrient flux.

An in situ chamber of volume 388 l and bottom area 0.64 sq m was used to determine the flux of oxygen and inorganic nutrients across an estuarine sediment-water interface over a 65-day period. Over the first 7 days, oxygen uptake was 378 mg/sq m/day and the rates of ammonium and phosphate release were 2.22 and 0.34 mg at./sq m/day, respectively. The water became anoxic in 14 days. The rates of flux in a similar chamber containing only detritus recently settled from the water column were 371 mg/sq m/day (oxygen), 1.66 mg at./sq m/day (ammonium) and 0.12 mg at./sq m/day (phosphate), demonstrating that detritus contributes substantially to exchange across the sediment-water interface. The evolution of the two chambers was similar over the latter part of the experimental period. A third chamber containing only water exhibited very minor changes. The role of detritus in nutrient recycling at the sediment-water interface is discussed in relation to the productivity of shallow water bodies such as the estuary in which the experiment was conducted, which itself undergoes periodic deoxygenation during prolonged stratification. The measured flux of nitrogen across the interface was found to represent approximately 31% of the mean daily phytoplankton requirement. (Author's abstract)
W85-02288

GAS CHROMATOGRAPHIC METHOD FOR THE DETERMINATION OF ELEMENTAL SULPHUR IN SEDIMENTS,
Waterworks of Hajdu-Bihar County, Debrecen (Hungary).
For primary bibliographic entry see Field 5A.
W85-02305

ASSESSMENT OF THE TROPHIC STATE OF A WATER BODY,
Commission of the European Communities, Ispra (Italy). Dept. of Physical and Natural Sciences.
O. Ravera.
Annales de Limnologie, Vol. 19, No. 3, p 229-234, 1983. 16 Ref.

Descriptors: *Trophic level, *Public opinion, *Lake classification, *Lake stages, Lake Monate, Italy, Phosphorus, Chlorophyll, Eutrophication, Transparency, Nutrients, Solar radiation, Turbidity, Macrophytes, Zooplankton.

The trophic level of a lake may be judged scientifically as well as by public perception. Agreement is not always perfect between limnologists and the public as to what the optimum value of some parameters, such as transparency, should be. A classification of lakes according to their trophic level may be based on well defined limits between

successive levels on a numerical trophic scale. Natural classifications have been developed based on the probability that a given lake will, with a certain mean concentration of phosphorus and chlorophyll, belong to a given trophic category. A model adopted as a guideline to predict the trophic level of lakes studied in the framework of the OECD's 'Eutrophication Programme' (1971-1979) is based on mass-balance concepts. The trophic state of lakes should be assessed according to the relationships between phosphorus load, phosphorus concentration, and chlorophyll concentration that were developed by the OECD program. These relationships facilitate the prediction of what must be done to reduce the phosphorus load and improve the lakes conditions. Deviations from these relationships may be caused by nutrient release from sediments, short hydrological retention time, high mineral turbidity, excessive development of macrophytes, non available forms of phosphorus, or high predation pressure by zooplankton. To compare the trophic degree of lakes lying at different latitudes, the pattern of solar radiation and temperature should be considered, in addition to nutrient loading. Results from a study carried out from 1969 to 1980 on the small alpine lake Monate (Northern Italy) show the difficulties involved in assessing the trophic degree of a lake and identifying the causes of its evolution. (Collier-IVI)
W85-02328

CHEMICAL CONTENT OF SNOW AND EFFECT OF MELTING ON CASCADE MOUNTAIN LAKES,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W85-02329

MINIMAL MODEL OF EUTROPHICATION IN FRESHWATER ECOSYSTEMS,
Akademiya Nauk SSSR, Moscow.
A. A. Voinov, and Y. M. Svirezhev.
Ecological Modelling, Vol. 23, No. 4, p 277-292, July, 1984. 6 Fig, 15 Ref.

Descriptors: *Eutrophication, *Model studies, *Tophic level, Phytoplankton, Detritus, Nutrients, Dissolved oxygen, Reservoirs.

A very simple model of eutrophication is presented. It includes several quite aggregated parameters and can be studied by analytical methods. Nevertheless, its dynamic behavior reflects well real reservoir evolution as observed under the impact of increasing biogenic pollution. Such models, simple in construction but sensitive to the main trends of an ecosystem, are termed 'minimal'. The state variables in the model are the concentrations of: (1) phytoplankton; (2) biogenic elements (nutrients); (3) detritus; and (4) dissolved oxygen. Transformations among the substances are described by a system of four ordinary differential equations. Steady-state dynamics are studied (the so-called quasi-stationary process). The qualitative analysis undertaken shows that the total amount of substances in a reservoir (phytoplankton + detritus + nutrients) is a very important ecosystem control parameter. In fact, it is this parameter that determines the rate and the degree of eutrophication. It also turns out that the relations between some observed characteristics of the ecosystem may define beforehand the future behavior of the reservoir. (Author's abstract)
W85-02339

SALT LAKES AND THEIR ORIGINS IN XINJIANG, CHINA (IN CHINESE),
Qinghai Inst. of Salt Lake, Xining (China).
X. Zheng.
Oceanologia et Limnologia Sinica, Vol. 15, No. 2, p 168-178, 1984. 8 Fig, 5 Tab, 8 Ref.

Descriptors: *Saline lakes, *Xinjiang, *China, Brine, Minerals, Geology, Paleogeography, Chemical composition.

This paper, based on field data and experimental results, is intended to analyze and summarize the distribution, chemical composition of brines, groups of salt minerals, types and salt forming characteristics of the Xinjiang salt lakes. Evolution of the salt lakes and salt-forming regularities as seen from analysis of paleogeography environment, geological tectonic and substance origins and so forth are also reported. This paper will serve as a reference for further investigation of the Xinjiang salt lakes, as well as for comprehensive utilization of their resources. (Author's abstract)
W85-02383

THRESHOLD ODOUR CONCENTRATIONS OF ODOROUS ALGAL METABOLITES OCCURRING IN LAKE WATER,
Helsinki Univ. (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5F.
W85-02389

STRUCTURE AND DYNAMICS OF ZOOPLANKTON COMMUNITIES, ALLIGATOR RIVERS REGION, N.T., AUSTRALIA,
Esso Australia Ltd., Sydney.
R. D. Tait, R. J. Shiel, and W. Koste.
Hydrobiologia, Vol. 113, p. 1-13, June, 1984. 9 Fig, 2 Tab, 23 Ref.

Descriptors: *Environmental effects, *Mine wastes, *Population dynamics, *Oxbow lakes, *Plankton, *Australia, Seasonal variation, Uranium, Alligator River, Magela Creek, Rotifers, Crustacea, Billabongs.

A two year study was made of the species composition dynamics of plankton and littoral microfauna of billabongs (ox-bows) on the Magela Creek in an area associated with the impact of mining and milling of uranium. This study was extended with a summary of seasonal fluctuations in water quality in the study area, a checklist of all taxa recorded in the zooplankton and examples of spatial and seasonal variation in the community composition. Magela Creek is an ephemeral tributary of the East Alligator River. The region receives 97% of its annual rainfall from October to May, during which the floodplain may be submerged to a depth of 2-3 meters. Between May and December the plain dries out progressively, concentrating aquatic life in the remaining billabongs. Extremely diverse plankton assemblages occur late in the wet season, with up to 80 taxa of rotifers and microcrustacea in some billabongs while there is a decrease in diversity but increase in population density as the dry season progresses. Natural fluctuations in water quality may be extreme, and limiting to plankters common elsewhere in the tropics. The plankton is composed largely of littoral or epiphytic taxa, with endemic species in all groups. (Baker-IVI)
W85-02405

ZOOPLANKTON ASSOCIATIONS IN THE SWAMPS OF SOUTHERN SUDAN,
Westfield Coll., London (England). Dept. of Zoology.
J. Green.
Hydrobiologia, Vol. 113, p 93-98, June, 1984. 1 Fig, 11 Tab, 7 Ref.

Descriptors: *Zooplankton, *Swamps, *Sudan, *Lake Ambadi, Nile, Channels, Crustacea, Floodplains, Population density, Lakes.

Samples were collected from 24 sites in the swamps of southern Sudan. Samples taken in the main Nile channel yielded a poor zooplankton, deficient in species and heavily laden with organic debris. A richer zooplankton population was found in the side arms and floodplain lakes. Frequently these samples contained 15-20 species of rotifers and 10 or more species of Crustacea. With heavy vegetation on the foodplain lakes, the number of species increases. For the Crustacea the index of diversity normally varied between 0.6 and 2.4, but in a side arm of the Bahr el Zeraf it reached 6.1 and in Lake Ambadi on the Bahr el Ghazal it reached 8.4. Rotifer diversity was somewhat higher, normally ranging between 2 and 4.5, but reaching 23 in Lake Ambadi. The most diverse population of zooplankton was found at Lake Ambadi; however, the density of zooplankton in this lake was small due to a nutrient defic combined with low pH. (Baker-IVI)
W85-02406

ATTEMPT AT ECOLOGICAL PROGNOSI THE PLANKTON IN THE MAN-MADE L PARANA MEDIO (CHAPETON TRANS ARGENTINA,
Akademiya Nauk SSSR, Moscow. Inst. of E tionary Morphology and Animal Ecology.
N. N. Smirnov.
Hydrobiologia, Vol. 113, p 159-163, June, 19 Fig, 2 Tab, 13 Ref.

Descriptors: *Plankton, *Lakes, *Lake P Medio, *Argentina, Environmental effects, A Vegetation, Population dynamics.

The projected man-made lake along 300 km c Middle Parana in the Republic of Argentina radically affect a large and unique biospheric plex. This man-made lake will be a very large long ditch, having a maximum width of more 40 km and steep left and right shores. The per age of Copepoda and Cladocera is expecte increase and temperatures above the level of a 20 C at the water surface also contribute to reproduction of the latter. At the available lev nutrients, namely about 1 mg nitrate/liter, g algae will flourish. The development of des will be favored by a pH shift below 7. The a dant development of algae will also benefit by increased water transparency and slow v movements. The zooplankton will mainly d mine the existence of fishes and of the other p ing animals of this level in the Parana Medio r made lake. Extensive growths of periphyton or great surface of uniquely long dams will ha species of demersal plankton and crawling spe of Chydoridae and Macrothricidae. The latter will thus develop in abundance at about 500,00 m of concrete slopes overgrown by attached al The zooplankton of the vegetation will be conf to small area of macrophytes. (Baker-IVI)
W85-02407

TROPICAL LAKES - FUNCTIONAL ECOLO AND FUTURE DEVELOPMENT: THE NE FOR A PROCESS-ORIENTED APPROACH,
Oslo Univ. (Norway). Zoological Inst.
J. P. Nilssen.
Hydrobiologia, Vol. 113, p. 231-242, June, 198 Fig, 3 Tab, 61 Ref.

Descriptors: *Tropical regions, *Lakes, *P *Plankton, Population dynamics, Eutrophicat Fungus, Bacteria, Seasonal variation, History.

Tropical lakes may be divided into several ma classes including shallow, lowland lakes; deep, tiary lakes; high altitudinal lakes; rainforests la and man-made lakes at all latitudes and altitu Grazing, competition, predation, abiotic adaptat and other ecological processes are similar in t perate and tropical lakes. The structure of the ar of adaptative radiation and the dispersal ability the species are important for the present distri tion of taxa. Fish play a key role in the trop since many species both consume zooplankton a compete with them for algal and pelagic sesto food. Diurnal patterns in habitat selection of may also influence nutrient re-distribution in tropics as in many temperate lakes. Eutrophicati clear-cutting of the rain forest, unwise introducti of new species not adapted to prevailing con tions, overfishing, extensive use of biocids, a probably acidic rain in areas with poorly buffer waters are problems which threaten tropical lak Co-evolution of fish and algae should be investig ed further as it may in part explain the gene scarcity and simplicity of the zooplankton comm nity. Limnocorral experiments should also be us for further assessing processes in tropical lak (Baker-IVI)
W85-02408

INFLUENCE OF PREDATION BY FISH AN WATER TURBIDITY IN A DAPHNIA GES NERI POPULATION IN AN AMAZONIA FLOODPLAIN LAKE, BRAZIL,

useu Paraense Emilo Goeldi, Para (Brazil). Dept. Zoologia.
. L. Carvalho.
ydrobiologia, Vol. 113, p 243-247, June, 1984. 2 g, 14 Ref.

escriptors: *Zooplankton, *Population dynamics, urbidity, *Water level, *Lakes, Lago Grande, o Solimoes, Brazil, Daphnia, Floodplains.

ne population behavior of Daphnia gessneri erbst, 1967 in a floodplain lake of the lower Rio limoes was investigated between April 1979 and arch 1980. Emphasis was placed on predation by e fish called tambaqui (Colossoma macropomum, naracidae), water level fluctuation and water nsparency in Lago Grande. Zooplankton densi- samples were collected at two sites near mid- ke, where water depth and Secchi disc transpar- cy were measured. Qualitative samples of zoo- nkton and fish collections were taken at several es in the adjacent floodplain areas. A disappear- ce of D. gessneri during the low water period as noted and may be caused by intense predation fish and low water transparency due to bottom diments that are mixed throughout the water lumn by wind action. When the water level ose anew and transparency improved, D. gess- ri appeared again in the stomach contents of C. acropomum. (Baker-IVI)
85-02409

IPACT OF ZOOPLANKTON STATUS ON HE MANAGEMENT OF LAKE KINNERET SRAEL),
nneret Limnological Lab., Tiberias (Israel).
. Gophen.
ydrobiologia, Vol. 113, p 249-258, June, 1984. 1 g, 3 Tab, 63 Ref.

escriptors: *Lakes, *Zooplankton, *Management, ake Kinneret, *Israel, Population dynamics, easonal variation.

ne summer ecosystem of Lake Kinneret is char- terized as a steady state type in which the impact the zooplankton-chain is of great importance. crease of predation pressure on zooplankton by h can disequilibriate the balanced trophic rela- ns existing between a nannoplankton production d zooplankton grazing capacity. Such a situation n lead to organic accumulation as nannoplankton oms, resulting in water quality deterioration. ecommendations include the reduction external trient load and regulation of fish populations by hery policy and fish introduction. Fish regula- n will call for intensive increase of S. galilaeus pulations. This fish has a unique value in the arket, can graze Peridinium efficiently and is a tural component of the ecosystem. Eliminating e introduction of S. aureus, a zooplankton feeder d suppressor of Sarotherodon galilaeus is en- uraged plus eliminating the stocking of silver rp, an exotic fish with low commercial value, hich feeds on zooplankton in summer and can be ltured more successfully in fish ponds. A reduc- n is sought in the bleaks population in the increasing fishing pressure aimed at decreasing edation pressure on zooplankton. (Baker-IVI)
85-02410

EVERSE WEATHERING IN THE CLOSED-ASIN LAKES OF THE ETHIOPIAN RIFT,
assachusetts Inst. of Tech., Cambridge. Dept. of arth and Planetary Sciences.
or primary bibliographic entry see Field 2K.
85-02468

OLONIZATION AND RECOVERY OF LOTIC PILITHIC COMMUNITIES: A METABOLIC PPROACH,
linois Univ. at Urbana-Champaign. Dept. of Civil ngineering.
. L. Osborne.
ydrobiologia, Vol. 99, No. 1, p 29-36, February, 83. 3 Fig, 1 Tab, 23 Ref.

escriptors: *Primary productivity, *Respiration, Benthos, *Sheep River, *Alberta, Metabolism, treams, Bacteria, Invertebrates, Periphyton, Sub- rates, Lotic environment.

Community respiration and net primary productivity measurements from precleaned and disturbed substrates of various sizes were collected to examine the colonization and recovery rates of lotic epilithic communities in situ. The study was conducted in an unperturbed reach of the Sheep River, Alberta. The lowest community respiration and primary production rates were recorded immediately following the artificial perturbation suggesting that both the autotrophic and heterotrophic system components were adversely affected. The natural responses of benthic communities to spring spates appears to be similar to the metabolic responses invoked by the artificial perturbation employed. The recovery of the autotrophic community was slower than the heterotrophic. Under similar envionmental conditions and availability of a colonizing pool, a 13-21 day recovery period would be required to attain a metabolic level similar to that which existed prior to the perturbation. The heterotrophic community component recolonizes sooner than the autotrophic component. The energy flow through epilithic communities appear to attain a stable level during the summer, and the duration of the metabolic equilibrium is dependent on constancy of the physical environment. (Baker-IVI)
W85-02476

PREDICTION OF SECCHI DISC DEPTHS IN FLORIDA LAKES: IMPACT OF ALGAL BIOMASS AND ORGANIC COLOR,
Florida Univ., Gainesville. Center for Aquatic Weeds.
D. E. Canfield, Jr., and L. M. Hodgson.
Hydrobiologia, Vol. 99, No. 1, p 51-60, February, 1983. 2 Fig, 6 Tab, 17 Ref.

Descriptors: *Secchi disks, *Model studies, *Florida, *Lakes, Chlorophyll, Color, Turbidity, Algal growth, Eutrophication, Transparency.

A model for the prediction of Secchi disc depths in Florida lakes was developed and tested using data from 205 lakes. Between August 1979 and September 1980, the lakes were sampled three times to determine chlorophyll a concentration, color concentration, and Secchi disc depths. A strong hyperbolic relationship was noted between lake transparencies as measured by use of the Secchi disc and algal biomass as measured by chlorophyll a concentrations. For the sampled lakes, 38% have chlorophyll a values above 10 mg/cu m and 55% have organic color values above 30 mg/cu m. As a result, 66% have Secchi disc depths below 2 m. To assist Florida lake managers, a quantitative empirical model which could be used to predict Secchi disc depths given various chlorophyll and/or color concentrations was developed to determine which variables should be used in the final model and whether the relationships between lake transparency, chlorophyll a and color concentrations were linear or nonlinear. It is believed the model will be applicable to lakes outside of Florida as chlorophyll and color concentrations should affect lake transparency similarly. The model will not work in lakes that have significant concentrations of inorganic sediments. To significantly reduce the remaining error term, a term for nonalgal turbidity, and most likely a term for inorganic suspended sediments needs to be incorporated into the model. (Baker-IVI)
W85-02477

LIMNOLOGICAL STUDIES ON THE PRETORIA SALT PAN, A HYPERSALINE MAAR LAKE,
National Inst. for Water Research, Pretoria (South Africa).
P. J. Ashton, and F. R. Schoeman.
Hydrobiologia, Vol. 99, No. 1, p 61-73, February, 1983. 8 Fig, 2 Tab, 46 Ref.

Descriptors: *Limnology, *Pretoria Salt Pan, *South Africa, *Maar lakes, Chemical properties, Drainage basins, Saline lakes, Stratification, Hydrologic budget.

The Pretoria Salt Pan is shallow, having a maximum depth of 2.85 m, and alkaline with surface water pH varying from 9.6 to 10.9. Pronounced mesothermy (38.2 C in spring) occurs at a depth between 0.55 and 0.7 meters. The water budget of the lake is governed by evaporation, precipitation and the inflow of spring water. The artesian spring located at the end of the promontory was the only source of inflowing water, other than direct rainfall and surface runoff. Secchi disc transparencies ranged from 7 to 19 cm. A total ionic concentration gradient increased from 59,500 mg/l near the surface to 298,000 mg/l at 2.75 meters, stabilizing the thermally inverted water column. The major cation was sodium and nearly equal proportions of chloride plus carbonate and bicarbonate accounted for over 98% of the anions. Higher concentrations of most elements occurred shortly after heavy rainfall in the surrounding area and lowest values were recorded towards the end of winter when inflows were lowest. The lake was meromictic with a steep chemocline, persistent thermally inverted temperature profile and complete anoxia at depths greater than 50 cm. The diel pattern of dissolved oxgyen distribution involving a nocturnal deoxygenation and diurnal reoxygenation was unusual. (Baker-IVI)
W85-02478

DETECTION WITH THE AID OF A BIOASSAY (SELENASTRUM CAPRICORNUTUM) OF THE EFFECTS OF A MINE WASTE ON THE AQUATIC ENVIRONMENT: TOXICITY OR ENRICHMENT OF ESSENTIAL SUBSTANCES (DETECTION A L'IDE D'UN BIO-ESSAI (SELENASTRUM CAPRICORNUTUM) DES REPERCUSSIONS D'UN REJET MINIER SUR L'ENVIRONNEMENT AQUATIQUE: TOXICITE OU ENRICHISSEMENT EN SUBSTANCE ESSENTIELLE),
Department of the Environment, Hull (Quebec).
C. Blaise, and P. Couture.
Hydrobiologia, Vol. 114, No.1, p 39-50, July, 1984. 2 Fig, 7 Tab, 29 Ref.

Descriptors: *Mine wastes, *Water pollution effects, *Nutrients, *Quebec, Bioassays, Algal growth, Turbidity, Suspended solids, Nitrogen, Phosphorus, Heavy metals, Dissolved solids.

Physical and chemical studies and algal bioasays were conducted to assess the effects on waterways receiving the treated effluent wastes of an iron ore mining operation located in north-eastern Quebec, Canada. Initial data interpretation indicates that the area directly below the outfall of the mining effluent (Hesse Lake and Webb Creek) is the most perturbed and that this condition diminishes for stations located further downstream. For Hesse Lake, in particular, high values of conductivity, turbidity, suspended solids, nitrate + nitrite nitrogen, phosphorus and algal growth potential were reported. Nitrate + nitrite nitrogen levels observed in the aux Pekans River system are the result of high levels present in Hesse Lake and Webb Creek. A more elaborate analysis, based on an evaluation of algal phosphorus uptake obtained with bioassays, indicates that apparent toxicity noticed in a few samples is probably due to the unavailability of essential elements other than phosphorus or nitrogen. This toxicity is accounted for by trace metal unavailability due to complex formation by organic matter. Cautious interpretation of results is recommended when using algal bioassyas in order to distinguish between possible interacting effects of growth-limiting essential elements and the presence of toxic substances. (Baker-IVI)
W85-02480

TEMPORAL AND SPATIAL DISTRIBUTION OF ROTIFERA IN A CHILEAN RESERVOIR: A POSSIBLE EFFECT OF IMPOUNDMENT HYDRODYNAMICS,
Chile Univ., Santiago. Dept. de Biologia.
D. Soto, I. Vila, and B. Villalobos.
Hydrobiologia, Vol. 114, No. 1, See also W85-02480, W85-02472, p 67-74, July, 1984. 6 Fig, 2 Ta, 27 Ref. Grants SCRP 551-381 and MAB 5 UNESCO.

Descriptors: *Rotifers, *Chile, *Rapel Reservoir, *Temporal distribution, *Spatial distribution, *Reservoirs, Population dynamics, Seasonal variation, Dam effects.

Rotifers were sampled at monthly intervals for a year a four monitoring stations in Rapel Reservoir. This reservoir lies in central Chile and was formed when a hydroelectric dam was built on the river in 1960. It is a monomictic and temperate lake which displays a dendritic shape and covers an area of about 137.5 sq km, with a distance of 40 km from major influent rivers to the dam. Maximal discharge to the lake occurs in the summer following snow melt in the Andes. Flow in the Tinguiririca River depends more on rainfall reaching the maximum in the winter. Thus the reservoir has two main periods of water inflow. Fifteen species of rotifers were identifed, but only Keratella cochlearis was consistently found at each station. It was also in most cases the most abundant totalling more than 50% of the rotifer population. Sampling stations nearest the dam showed greatest rotifer densities in spring and autumn; those nearest the in flowing rivers had highest abundance in summer. The impoundment water dynamics and the relative locations within the lake are suggested as determinants for different rotifer assemblages and probably for most other planktonic organisms. (Baker-IVI)
W85-02481

LONG-TERM CHANGES OF THE SUBMERGED MACROPHYTES IN EUTROPHIC LAKE MIKOLAJSKIE (NORTH POLAND),
Warsaw Univ. (Poland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.
W85-02483

HYDROBIOLOGICAL RESEARCH ON TWO SMALL BRACKISH LAKES IN PORTONOVO; I: LAKE PROFONDO (RICERCHE IDROBIOLOGICHE SU DUE LAGHETTI DI PORTONOVO; PARTE I: LAGO PROFONDO),
Perugia Univ. (Italy). Ist. di Idrobiologia e Pescicultura.
For primary bibliographic entry see Field 5C.
W85-02499

HYDROBIOLOGICAL RESEARCH ON TWO SMALL BRACKISH LAKES IN PORTONOVO; II: LAKE GRANDE (RICERCHE IDROBIOLOGICHE SU DUE LAGHETTI DI PORTONOVO; PARTE II: LAGO GRANDE),
Perugia Univ. (Italy). Ist. di Idrobiologia e Pescicultura.
For primary bibliographic entry see Field 5C.
W85-02500

TOTAL PHOSPHORUS LOAD TO LAKE MONATE (NORTHERN ITALY, VARESE) (STIMA DEL CARICO DI FOSFORO TOTALE AL LAGO DI MONATE (PROVINCIA DI VARESE, ITALIA SETTENTRIONALE)),
Commission of the European Communities, Ispra (Italy).
For primary bibliographic entry see Field 5B.
W85-02501

HISTORICAL AND CURRENT LIMNOLOGICAL RESEARCH IN THE SMALL RIVER LINDE, THE NETHERLANDS,
Department of Public Works, Leeuwarden (Netherlands).
T. H. L. Claassen.
Hydrobiological Bulletin, Vol. 18, No. 1, p 23-34, June, 1984. 4 Fig, 4 Tab, 27 Ref.

Descriptors: *Limnology, *River Linde, *Netherlands, Streams, Chemical properties, Physicochemical properties, Seasonal variation, Chloride, Iron, Phosphorus, Nitrogen.

Existing and newly collected limnological data of the Linde, a stream in the southeastern part of Friesland, are detailed. An overview of the available water quality data is presented along with historical data. The resemblance is striking between older water quality data and recent ones. A period of 20 years with regard to chemical data and about 10 years with regard to biological data is considered. There is a periodicity of various water quality parameters during the period of a year. The discharge of superfluous water in winter coincides with low chloride and high iron, phosphorus and nitrogen concentrations of the water. The spatial diversity between parts of the stream is described. Three main reaches could be distinguished, the upper, middle and lower course, each with their own physicochemical and biological characteristics. When setting ecological water quality standards this division should be taken into account. Not only the stream biocoenoses themselves must be regarded, but also the surrounding peat areas and the downstream shallow lakes. These water are, among others, dependant on the water quality of the Linde. (Baker-IVI)
W85-02503

RESISTANCE TO MIXING IN NEW ZEALAND LAKES,
Department of Scientific and Industrial Research, Taupo (New Zealand). Taupo Research Lab.
A. B. Viner.
New Zealand Journal of Marine and Freshwater Research, Vol. 18, No. 1, p 73-82, 1984. 7 Fig, 1 Tab, 17 Ref.

Descriptors: *Lakes, *Stratification, *Mixing, *New Zealand, Stability, Morphology, Wind, Algae, Light, Thermal stratification, Phytoplankton.

Illustrations are offered of the way in which stability calculations can help towards reducing limnological problems. A graph and equation are given which relate New Zealand lakes through their stabilities. Stability is defined as the amount of energy required to mix a thermally stratified column of water to isothermy. Lake stability calculations quantify the resistance a column of water has to vertical mixing. Date from a selection of New Zealand lakes have been used to show a predictive relationship between the seasonal maximum stability and mean depth. Because of their proportionality, seasonal maximum stability can be substituted for the total annual stability for the purposes of lake comparisons, although total stability would be a better ecological parameter if enough data were available. Stability calculations in the euphotic zones of lakes enable useful comparisons to be made regarding growth conditions for different types of phytoplankton, in particular buoyant cyanophytes, and especially in relation to light penetration. An example is given where the degree of thermal stratification (stability) could be related to wind stress energy. (Baker-IVI)
W85-02507

EPIPELIC ALGAE IN MARGINAL PARTS OF THE PRZECZYCE RESERVOIR AND OF NEIGHBOURING SECTORS OF THE RIVER CZARNA PRZEMSZA (UPPER SILESIA); 1. ALGAE IN CONSTANTLY SUBMERGED ZONE,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
D. Sieminiak.
Acta Hydrobiologica, Vol. 25/26, No. 1, p 51-66, 1983/1984. 1 Fig, 2 Tab, 10 Ref.

Descriptors: *Algal growth, *Reservoirs, *Przeczyce Reservoir, *River Czarna Przemsza, *Upper Silesia, *Poland, Population dynamics, Water quality.

In the years 1977 and 1978 investigations were carried out on the bottom living algae in the reservoir and in the river just above and below it. The algal communities studied may be said to be fairly varied, since altogether (apart from diatoms) about 180 taxa were identified. Although only certain of the species occurred in large numbers both in the river and in the reservoir, they were accompanied, particularly in the reservoir, generally in very small quantities, by a variety of algal species from various systematic groups, principally Cyanophyta, Chlorococcales, Mesotaeniales, Desmidiales, Euglenales, and Xanthophyceae, which are typical of the littoral of still water reservoirs. Such bottom-living algal communities are characterisic of unpolluted waters. The presence of the red alga Batrachospermum moniliforme in the Czarna Przemsza river below the reservoir is noted which indicates that the water outflowing from t
voir is relatively pure. (Baker-IVI)
W85-02522

**THROUGHFLOW INVESTIGATIONS IN
DERER FINSTERTALER SEE' (TYRO
URANIN DYE. (DURCHFLUSSUNT
CHUNGEN AM VORDEREN FINSTER
SEE (KUEHTAI, OSTERREICH) MIT U
FAEBVERSUCHES),**
For primary bibliographic entry see Field 2
W85-02524

**BIOMASS AND PHOSPHORUS-CONTE
THE MACROPHYTES OF THE NE-B
THE LUNZER UNTERSEE (AUSTRIA)
LATION TO NUTRIENT-RICH INFLOW
TO THE SEDIMENT (BIOMASSE UND
PHORGEHALT DER MAKROPHYTE
DER NO-BUCHT DES LUNZER UNTE
(AUSTRIA) IN ABHANGIGKEIT VON
STOFFREICHEN ZUFLUSSEN UND
SEDIMENT),**
Oekologische Station Waldviertel, Schrem
tria).
G. Schlott, and G. Malicky.
Archiv fur Hydrobiologie, Vol. 101, No.
265-277, August, 1984. 2 Fig, 13 Tab,

Descriptors: *Macrophytes, *Phosphorus,
*Nitrogen, *Lunzer Untersee, *Austria,
plants, Nutrients, Lake sediments, Biomass.

Macrophytes were studied in a part of the
Untersee with respect to their biomass and
phorus content. Both the biomass and the ph
rus content of macrophytes showed big diffe
depending on the nutrient supply. Inlets wit
nutrient transport and also places of diffuse
increase the biomass and the phosphorus-c
of the plants. For comparison it is necess
investigate plants from unpolluted sites of th
water body. In the Mayrbucht the different
ent supply of different areas is associated
different values in the sediment. The differe
phosphorus are essentially higher than th
nitrogen. The comparison of the N/P-ratio
macrophytes with the sediment-phosphoru
show the limiting role of the phosphorus. (
IVI)
W85-02527

**STRATIFICATION OF THE KOENIGSSE
VARIA, GERMANY) (DIE SCHICHTUNGS
HALTNISSE DES KOENIGSSEES),**
Munich Univ. (Germany, F.R.). Zoologische
O. Siebeck, and R. Muller.
Archiv fur Hydrobiologie, Vol. 101, No.
289-301, August, 1984. 9 Fig, 2 Tab, 6 Ref.

Descriptors: *Lakes, *Water circulation, *
igssee Lake, *Germany, Circulation, Seasonal
ation, Eutrophication.

Due to its morphometrical and meteorolo
properties, water circulation in the Koenigs
poor. Circulation, while possible from Dece
to March, will not occur it the lake become
covered. Even so, it will mix only in a layer
about 20 m from the surface. Vertical wate
change becomes very limited between 20 an
m. At depths greater than 140 m, vertical
exchange is very poor, causing the lake to e
tendencies toward monimolimnion. This mero
is of biogenic origin. In the lake a monimolim
would occur in a very early stage of eutrop
tion, if measures are not taken to prevent se
inflows caused by growing tourism. (Baker-
W85-02528

**DEVELOPMENT OF OXYGEN CONDITI
IN LAKE ZURICH FROM 1936 TO
(ENTWICKLUNG DER SAUERSTOFFV
HALTNISSE IM ZURICH-OBERSEE UND
ZURICH-UNTERSEE VON 1936 BIS 1982),**
Zurich Univ., Kilchberg (Swizerland). Hydro
logical-Limnological Station.
E. A. Thomas, and C. G. Orn.
Archive fur Hydrobiologie, Vol. 101, No. 1/
327-342, August, 1984. 5 Fig, 2 Tab, 12 Ref.

escriptors: *Dissolved oxygen, *Lake basins, ake Zurich, *Switzerland, Hypolimnion, Phosates, Water pollution effects, Water pollution ntrol.

wo separate basins are found in Lake Zurich. The pper Lake Zurich has a maximum depth of 48 m d the Lower Lake has a depth of 136 m. Oxygen ofiles were obtained monthly from both basins d evaluated. Based on the course of the annual rpolimnetic oxygen minimum, the 47 yr covered the data file may be divided into three intervals. he annual minimum between 20 m depth and the ttom of the lake decreased at Altendorf from 69 mg/l to 2.14 mg/l. In the Lower Lake the nual minimum in 100-136 m depths initially orsened from 2.24 mg/l to 1.19 mg/l, but then rongly improved to 3.54 mg/l. Hypolimnetic ygen conditions in the Lower Lake have recoved, whereas the annual oxygen minima in the pper Lake still underlie a deteriorating trend. he conspicuous improvement observed since 67 in the Lower Lake is primarily due to the rposeful steps taken to eliminate sewage phosates. Within the drainage area of the Upper ake however, sewage treatment measures are still adequate. (Baker-IVI)
'85-02529

IMNOLOGY AND PLANKTON PERIODICIY OF JOS PLATEAU WATER RESERVOIR, IGERIA, WEST AFRICA,
s Univ. (Nigeria). Dept. of Botany.
A. Khan, and C. Ejike.
ydrobiologia, Vol. 114, No. 3, p 189-199, July, 84. 6 Fig, 2 Tab, 35 Ref.

escriptors: *Limnology, *Plankton, *Reservoirs, amingo Dam, *Nigeria, Dissolved oxygen, ater temperature, Diel variation, Water chemisy.

imnological data are presented concerning the ankton and water chemistry of Lamingo Dam, cated within the Jos biotite granite area of the ateau State (Nigeria). The water body falls into eadle's category I of African lakes. The conducvity is less than 40 microS/cm. The low specific nductance indicates a low ionic content. Total kalinity was due primarily to bicarbonate ions nd it varied from 0.23 to 0.44 meg/l. Variations in ssolved oxygen were noticeable with higher alues recorded for cold dry periods. The surface ater temperature varied from 16 to 24 C, low mperatures generally prevailing during Decemer and early February. Plankton were characterzed by a moderate standing crop of phytoplankn, and zooplankton were, generally, very limited species and abundance. A diel cycle was characrized by nocturnal upward migration of the zooankton, and the reverse behavior in the phytoankton. (Baker-IVI)
'85-02546

SPECTS OF THE ECOLOGY OF THE FISHES F HOLYROOD POND: A COASTAL LAKE ITH OCCASIONAL ACCESS TO THE SEA OCATED IN ST. MARY'S BAY, NEWFOUNDAND,
lemorial Univ. of Newfoundland, St. John's.
. F. O'Connell, C. W. Andrews, J. P. O'Brien, nd E. G. Dawe.
nternationale Revue der Gesamten Hydrobiolo-ie, Vol. 69, No. 3, p 333-360, 1984. 15 Fig, 9 Tab, 2 Ref.

escriptors: *Ponds, *Fish, *Holyrood Pond, Newfoundland, *St. Mary's Bay, Seasonal varitions, Temperature, Brackish water, Oxygen, Fish opulations, Physical properties, Chemical properes.

hysical and chemical conditions and fish were tudied during spring and summer in 1974 and 1975 Holyrood Pond, Avalon Peninsula, Newfoundnd. Holyrood Pond is a body of salt water which landlocked for the greater part of the year. In rder to alleviate flooding of waterfront property nd highway erosion problems the barrier, comosed of beach material that isolates the pond from t. Mary's Bay set in place by southwest winds and wave action, is opened in spring and early summer by bulldozer. When the barrier is closed, individual salinity and temperature profiles resemble those described for meromictic lakes. During the open barrier phase, the pond comes under tidal influence and behaves like a fjord. A total of 30 species of fish was encountered in the pond throughout the investigation. The trout sample consisted of a mixture of the anadromous and nonanadromous forms. Maximum length and age of cod are much lower than reported for the offshore populations. The same applies to white hake. Winter flounder growth on the other hand is very good compared with other areas. (Baker-IVI)
W85-02563

INTERACTIONS BETWEEN PHYTOPLANKTON, ZOOPLANKTON, AND FISH IN THE NUTRIENT RICH SHALLOW LAKE HJARBAEK FJORD, DENMARK,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
K. Olrik, S. Lundoer, and K. Rasmussen.
Internationale Revue der Gesamten Hydrobiologie, Vol. 69, No. 3, p 389-405, 1984. 6 Fig, 5 Tab, 27 Ref.

Descriptors: *Nutrients, *Phytoplankton, *Zooplankton, *Fish, *Hjarbaek Fjord, *Denmark, Ammonia, Nitrogen, Seasonal variation, Algal growth, Population dynamics, Acidity, Daphnia, Copepods.

The seasonal periodicity of phytoplankton, zooplankton, fish and water chemistry, and the interrelationship between these variables, were examined in the nutrient rich, dammed up, shallow and slightly brackish lake Hjarbaek Fjord in North Jutland, Denmark. During the summer the balance between the various levels of the pelagic food chain in the lake was completely disturbed. Extensive growth of small fast-growing bluegreen algae and chlorococcal green algae caused by high nutrient levels induced a rise in pH to 10.5 in July. This extreme pH-rise drove the fish into the rivers and caused the death of those that did not escape. The slow-moving Daphnia hyalina, which was heavily predated upon by fish, multiplied explosively after the fish had disappeared, and almost completely grazed away the phytoplankton biomass consisting mainly of chlorococcal green algae and small bluegreen algae. The pH then became stabilized at 8.0, but ammonia concentrations rose to noxious levels for fish and the oxygen concentration dropped to below 6 mg/l, a level which is noxious to highly sensitive fish. A smaller maximum of large phytoplankton species occurred during the Daphnia maximum and gave rise to a maximum of the copepod Cyclops strenuus, which can actively grasp and divide larger phytoplankton species. Fish returned to the lake in October, when pH levels and concentration of ammonia, phosphorus and oxygen, had normalized. (Baker-IVI)
W85-02564

ORGANIC CARBON IN A EUTROPHIC FISHPOND,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
P. Blazka, and L. Prochazkova.
Internationale Revue der Gesamten Hydrobiologie, Vol. 69, No. 3, p 429-441, 1984. 7 Fig, 5 Tab, 44 Ref.

Descriptors: *Scenedesmus, *Organic carbon, *Eutrophic lakes, *Velky Farsky, *Czechoslovakia, Chlorophyta, Chlorophyll, Spectrophotometry, Algae, Chromatography, Cation exchange.

The concentration of dissolved organic carbon (DOC) in a eutrophic fishpond (Velky Farsky - located near the village of Belice, Czechoslovakia) was significantly correlated with chlorophyll a concentration and increased during the growing season. Samples of pond water and Scenedesmus abundans culture media were treated with a cation exchanger in Na cycle and chromatographed on Sephadex G 25 and G 10. The culture media was of similar ionic composition to the pond water. UV and VIS spectra of the peak fractions showed no absorbance maxima between 210 and 300 nm. In the pond about half of the organic carbon is in fractions with an apparent molecular weight (AMW) of 500-1000, while in the algal medium (after cultivation) most of organic carbon has an AMW of about 120. The spectral data, DOC analyses, and elution volume of the peak fractions suggest that substituted aromatics and aliphatic compounds with conjugated chromophoric groups play a minor role as constituents of DOC in pond water (Collier-IVI)
W85-02566

POTENTIAL MOBILITY OF PHOSPHORUS IN DIFFERENT TYPES OF LAKE SEDIMENT,
Uppsala Univ. (Sweden). Limnologiska Institutionen.
B. Bostrom.
Internationale Revue der Gesamten Hydrobiologie, Vol. 69, No. 4, p 457-474, 1984.

Descriptors: *Phosphorus, *Sweden, *Lakes, *Lake sediment, Physicochemical analysis, Chemical analysis, Hydrogen ion concentration, Trophic level, Aluminum, Iron, Nutrients.

Internal loading of phosphorus from sediments often leads to maintenance of high trophic levels in lakes after drastic reductions of nutrient inputs. An approach for determining the prerequisites for internal phosphorus loading from different sediments is to analyze the fractional distribution of the sedimentary phosphorus and to then determine the proportion that is potentially mobile within the naturally occurring range of variation for the most important environmental factors. The fractional composition and potential mobility of sediment phosphorus was investigated in nine Swedish lakes with different characteristics. Differences between sediments regarding P release patterns in laboratory experiments with varying pH and redox conditions could largely be explained by differences in the fractional composition of the sedimentary P. Sediments from sewage-loaded lakes contained considerably more loosely adsorbed P than unpolluted lakes. P release was redox-sensitive and strongly favored by high pH values in sediments with a high content of aluminium and iron-bound P. Other sediments released primarily organic and loosely adsorbed P, and in such cases less P was released and redox and pH conditions had less effect. For most sediments, the release rates measured in the laboratory were similar to those determined from mass balance calculations for the lakes. (Collier-IVI)
W85-02567

INTERACTIONS BETWEEN LIGHT SITUATION, DEPTH OF MIXING AND PHYTOPLANKTON GROWTH DURING THE SPRING PERIOD OF FULL CIRCULATION,
Technische Univ., Dresden (German D.R.).
H. Horn, and L. Paul.
Internationale Revue der Gesamten Hydrobiologie, Vol. 69, No. 4, p 507-519, 1984. 3 Fig, 4 Tab, 28 Ref.

Descriptors: *Lake Saidenbach, *Germany (Democratic Republic), *Mixing, *Phytoplankton, *Water circulation, Photosynthesis, Seasonal variation, Lakes, Biomass, Productivity, Solar radiation.

In mesotrophic Lake Saidenbach (German Democratic Republic), with maximum depth of 45 m and a mean depth of 15.35 m, vigorous growth of the phytoplankton does not start until after the onset of the spring complete circulation, and the end of the circulation period very often coincides with the beginning of the decline of the mass development (usually Asterionella formosa). The poor light situation and the fact that vertical phytoplankton profile shows significant differences between the plankton concentrations at different depths indicate that the spring complete circulation does not represent a complete recirculation, and thus mixing, of the water down to the bottom but involves only episodic and local partial recirculations interspersed with periods of relatively slight turbulence. The actual mixing depth during this period of complete circulation is therefore obviously less than the mean depth of the water concerned, which is commonly assumed to be equal. This permits the algae in the upper layers to grow.

Respiratory losses of the phytoplankton at greater depths probably remain slight due to their adaptation to low light intensities in winter. Using values reported in the literature for the minimum daily radiation permitting development of the phytoplankton, a maximum possible mean mixing depth of 12 m was calculated for the lake during the spring complete circulation; this is about 78% of the mean depth. (Collier-IVI)
W85-02568

INTERNAL SEICHE AND WAVES IN LAKE CHUZENJI (JAPAN),
National Inst. for Environmental Studies, Tsukuba (Japan).
T. Hirata, and T. Muraoka.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No.1, p 91-96, July, 1984. 7 Fig, 1 Tab, 6 Ref.

Descriptors: *Lake Chuzenji, *Japan, *Lakes, *Waves, *Seiches, Limnology, Thermocline, Mixing, Stratification, Wind, Hydrostatic pressure.

Lake Chuzenji is located in the Nikko National Park, about 100 km north from Tokyo. The lake is about 6.54 km in length and 1.85 km in width, with a mean depth of 94.7 m. When the wind blew over the lake for a reasonably long time, the surface mixing layer deepened eventually toward the leeward area. The wind action was effective only to break the isotherms near the surface and had little impact on the thermocline. The model of the hydrostatic pressure proposed can provide a reasonable estimation for the increase of the surface mixing layer over the thermocline. When the wind forcing was completely excluded, the oscillation of the thermocline was noted in periods of 12 hours and in other shorter periods of time. The 12 hour periods were generated by the uninodal internal seiche, and the latter was determined to be the typical Brunt-Vaisala wave of which wavelength is the same magnitude of the thermocline thickness. (Baker-IVI)
W85-02605

MID-SUMMER MIXING DEPTHS OF LAKES OF DIFFERENT LATITUDES,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
K. Patalas.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 97-102, July, 1984. 5 Fig, 19 Ref.

Descriptors: *Fetch, *Lakes, *Mixing, *Latitudinal studies, *Mixing, Canada, Cyclin, nutrients, Limnology, Elevation, Water temperature, Climate, Topography.

The possibility that mixing depth might be predicted from simple morphometric measurement in a wide variety of lakes was examined. The epilimnion depths in 23 lakes in the Yukon and Yellowknife areas generally displayed a similar trend with fetch, although the range of mixing depths was wider than in lakes south of 59 degrees N. The wider range of epilimnion depths in these northern lakes could be explained by their wider range of elevations. Several Canadian lakes situated in lower latitudes between 42 degrees and 51 degrees N have been plotted against the regression line. Nineteen lakes in Quebec, Ontario and Manitoba, with fetches shorter than 15 km, closely followed the trend described for Polish and Central Canadian lakes. Seventeen of these fell within the 0.95 confidence limits. Their mid-summer temperatures were usually within the 20-23 C range. Greater deviation was found for some lakes of Nova Scotia and New Brunswick for the 54-59 degree N regression. The similar mixing depths of lakes in such remote latitudes, from 35 to 65 degrees N, indicates that the size of a lake as expressed by its fetch is the most significant factor defining the extent of mixing. Factors such as latitude dependent temperature, continental or oceanic climates and the surrounding topography can modify the mixing depth from 10 to 30% from values predicted by the 54-59 degree N regression. (Baker-IVI)
W85-02606

AUTUMNAL AND VERNAL CIRCULATION OF SMALL FOREST LAKES IN SOUTHERN FINLAND,
Helsinki Univ., Lammi (Finland). Lammi Biological Station.
K. Salonen, L. Arvola, and M. Rask.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 103-107, July, 1984. 7 Fig, 1 Tab, 6 Ref.

Descriptors: *Forest watersheds, *Finland, *Meromictic lakes, *Water circulation, Seasonal variation, Lakes, Salinity, Thermal stratification, Color, Anoxic zone.

A systematic survey was made of 71 lakes to get an idea of the occurrence of meromixis among small lakes in Southern Finland. Most of the study lakes were forest lakes in the Evo lake district. Their size varied between 0.001 to 0.28 sq km and the color of water varied between 7 and 290 mg Pt/liter. The survey found meromixis, and in particular, spring meromixis, to be rather common among small forest lakes in Southern Finland. Apparently in the whole northern coniferous forest zone meromictic lakes are much more common than is generally believed. The lakes of this study differ from most other meromictic lakes in that they had no marked salinity gradient. In such cases temperature gradient was also significant in maintaining stratification. Therefore, the humic color of water, with its tendency to reduce mixing, is probably important for the occurrence of meromixis in small lakes. Equally important might also be the regularly found anoxic zone of small humic lakes, which may increase leaching of electrolytes into the hypolimnion. (Baker-IVI)
W85-02607

MEASUREMENT OF VERTICAL MOVEMENT OF LAKE WATER,
Rissho Univ., Tokyo (Japan). Dept. of Geography.
T. Arai.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 108-111, July, 1984. 3 Fig, 3 Ref.

Descriptors: *Water circulation, *Vertical flow, *Measuring instruments, *Lake Shibire, *Japan, Stratification, Temperature effects, Diurnal variation, Seasonal variation, Ultrasonic current meter, Heat flux.

The ultrasonic current meter (USCM) was designed to detect the vertical flow and calculate the vertical heat flux. While it can detect only the vertical flow (W), it is equipped with a temperature sensor. Thus the automatic calculation of vertical heat flux by eddy correlation method is possible by this USCM. Investigations were conducted in Lake Shibire, a small mountain lake in Central Japan with a typical closed form that lacks in- and out-flowing rivers. The maximum velocity was about 2 mm/sec in both summer and fall nights and within a range of 1 mm/sec normally. The vertical motion was mainly controlled by thermal stratification in the surface layer and air-water temperature difference. It is necessary to extend the investigation to wide and deep lakes which store a large amount of heat in the water column in summer and release it during fall overturn period, generating strong vertical flow. (Baker-IVI)
W85-02608

TEMPERATURE AND TRANSPORT PATTERNS IN LAKE TAHOE: SATELLITE IMAGERY, FIELD DATA AND A DYNAMIC MODEL,
California Univ., Davis. Div. of Environmental Studies.
T. Strub, T. M. Powell, and M. R. Abbott.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 112-18, July, 1984. 4 Fig, 11 Ref.

Descriptors: *Water circulation, *Lake Tahoe, *Temperature effects, Model studies, Satellite technology, Wind, Primary productivity, Water temperature, Gyre.

With the use of satellite images, in situ temperature sections, measured winds and a numerical wind driven model the mean spring and summer
temperature structure was determined a
Tahoe. Typical afternoon south west winds
upwelling on the west and in the south, a
accumulation of warm water on the east
water from the west moves to the northeast
least during some periods warm water fro
east returns to the west in a large clockwis
which occupies the northern half of the ope
The current pattern in the south is less cle
may be more variable due to winds that
from northerly to southerly during the da
have also been found to be more variable fro
to day. Areas of warm water identify loc
where water is blown against the shore;
indicate that the shoreline inflows in the no
will not be dispersed as rapidly as inflows
west side. Previous synoptic studies have
high levels of primary productivity in the
east and southeast corner and it is suggeste
inflowing water may be trapped against the
there by the wind-driven currents. (Bake
W85-02609

PARTICULATE MATTER DISTRIBU AND HEATING PATTERNS IN A SM POND,
Clemson Univ., SC. Dept. of Biological Sci
S. P. Schreiner.
Verhandlung Internationale Vereinigung Lim
gie, Vol. 22, No. 1, p 119-124, July, 1984. 2 F
Ref.

Descriptors: *Particulate matter, *Phytoplar
*Ponds, *Thermal stratification, Eutrophic
Seasonal variation, Turbidity, Light penetr

Biotic and abiotic particulate layers asso
with seasonal phytoplankton succession and
mal stratification significantly affect surface
internal heating patterns. These effects were
ied in a small eutrophic 1.5 ha farm pond w
mean depth of 1.9 m. A submersible beam tra
tance meter was used in conjunction with i
measurements of standard physicochemical p
eters to locate and study the development of
toplankton and other types of layers. Mea
ments were made morning and afternoon
weekly during the stratified period in 1982. R
indicate a rapid successional sequence of p
plankton layers in April through June with s
quent development of a metalimnetic layer pe
ing from June until fall overturn in early Oct
Temperature measurements revealed intense
ing in the near surface waters during perio
high surface turbidity and less intense heating
greater depth when surface turbidity was l
Greater rates of heating occurred near subsu
layers than in the overlying water, when su
turbidity was low enough to permit light pen
tion to the deeper layer. (Baker-IVI)
W85-02610

MODELING THE SEASONAL THERMAL VELOPMENT OF LAKE NANTUA (FRANCE) (MODELISATION DE L'EVO TION THERMIQUE SAISONNIERE DU DE NANTUA (AIN, FRANCE)),
Institut National de la Recherche Agronom
Jouy-en-Josas (France). Lab. de Biometrie.
F. Chahuneau.
Verhandlung Internationale Vereinigung Limn
gie, Vol. 22, p 125-131, July, 1984. 2 Fig, 6

Descriptors: *Lake Nantua, *France, *Seas
variation, *Thermal stratification, *Model stu
Lakes, Phosphorus, Dissolved oxygen, Mather
cal models, Simulation, Weather.

After the reduction in the contribution of sul
to Lake Nantua, the concentrations of phosph
to the lake was greatly reduced, but the hypo
nion remains anoxic from July to November,
primary production is elevated (>100 g C/sq
yr) and the phytoplankton population is still d
nated by the cyanophyte Oscillatoria rubescens
order to analyze the factors which are involve
the function of the lake, a mathematical model
developed for the seasonal cycle of phosph
and oxygen. The fundamental components of
model are a group of equations which permit

ulation of the seasonal thermal development of lake and the variation in intensity of the proc- of vertical transport in response the meterologi- fluctuations. The model was calibrated based data for 1972, and produced satisfactory results en used for 1973. This constitutes a validation he model. (Moore-IVI)
5-02611

ORT MEROMICTIC EPISODE IN THE AD SEA: 1979-1982,
izmann Inst. of Science, Rehovoth (Israel).
Stiller, J. R. Gat, N. Bauman, and S. Shasha.
rhandlung Internationale Vereinigung Limnolo- Vol. 22, No. 1, p 132-135, July, 1984. 1 Fig, 7

scriptors: *Meromictic lakes, *Monimolimnion, ead Sea, *Salinity, *Temperature, Density, Sea- al variation, Saline lakes, Suspended solids, ite.

e Dead Sea is a 325 m deep terminal, hypersa- lake in the Jordan Rift Valley. It is a classical mple of a meromictic lake. The water column s periodically sampled at the central, deepest t of the lake. Prior to 1979, the monimolimnion s probably isolated for more than 250 yr. Its nity was practically constant and anoxic condi- s had prevailed. Due to the reduced Jordan er discharge to the Dead Sea, an overturn of water column took place in February, 1979. ring the turnover, oxygen had invaded the re water column down to the lake bottom. By end of 1979 salinity and temperature in the p waters were higher by 0.6 g/kg and 1.2 C ectively than in February of that year. The et of meromictic stratification in the winter of 9/80 resulted in renewed isolation of the deep ers. From December 1979 to November 1982 monimolimnion was vertically homogeneous its potential temperature and salinity remained tically unchanged. Immediately after the turn- r there was a large increase in the concentra- of suspended matter throughout the water mn, from 1.5 to 4.5 mg/liter. At turnover in cember 1982, the surface brines had a high nity and a relatively low temperature and thus able conditions for authigenic formation of te had been reached. Halite flocs were ob- ed floating on the lake surface on calm days halite crystals were collected in sediment traps 0 m depth, 23 and 178 g/sq m/day in Decem- 1982 and January 1983, respectively. (Baker-
)
5-02612

ME CONSIDERATIONS ON ADEQUATE NSTRUCTION OF BOX MODEL AND ITS PLICATION,
ional Inst. for Environmental Studies, Tsukuba an).
primary bibliographic entry see Field 5B.
5-02613

ARACTERIZATION OF PARTICULATE D COLLOIDAL PHOSPHORUS FORMS IN TER BY CONTINUOUS FLOW DENSITY ADIENT CENTRIFUGATION,
sala Univ. (Sweden). Limnologiska Institu- en.
Persson.
handlung Internationale Vereinigung Limnolo- Vol. 22, No. 1, p 149-154, July, 1984. 2 Fig, 2 , 11 Ref.

criptors: *Cycling nutrients, *Phosphorus, ke Ramsjon, *Lake Siggeforasjon, *River an, Particulate matter, Colloids, Continuous , Density currents, Algae.

separation and characterization of particulate colloidal phosphorus achieved by continuous density gradient centrifugation of lake and r waters in silica gel gradients were demon- ted for a hypereutrophic lake (Lake Ramsjon), oligotrophic lake (Lake Siggeforasjon) and a land river (River Lidan). The search for suita- density gradient media and technical approach- or separation of particulate phosphorus forms in natural waters is also presented. Microscopic examination showed blue-green and chrysophycean algae to be dominant in L. Ramsjon and L. Siggeforasjon, respectively. For the river, only a minute amount of material could be observed. The algae had densities < 1.13, whereas the organic material of the heavier fractions was undefined and termed detrital/colloidal. The phosphorus content of the fractions was 0.002-0.60% of dry weight. No signficant correlation between organic content and phosphorus content of the fractions could be found. Algal phosphorus may significantly contribute to the phosphorus content of fractions of high organic content only if they contain much more phosphorus than the detritus/colloids. The centrifugal approach presented did offer a direct accumulation and separation of particulate and colloidal material solely by buoyant density. This type of separation did not successfully distinguish between functional particulate phosphorus components like algae and organic colloids in the lakes. (Baker-IVI)
W85-02614

PHOSPHORUS RESIDENCE TIME IN RELATION TO TROPHIC CONDITIONS IN LAKES,
Canada Centre for Inland Waters, Burlington (Ontario).
L. L. Janus, and R. A. Vollenweider.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 179-184, July, 1984. 2 Fig, 3 Tab, 3 Ref.

Descriptors: *Phosphorus, *Lake sediments, *Cycling nutrients, *Trophic level, Eutrophication, Lakes, Residence time, Oligotrophic lakes, Lake management.

The dependency of phosphorus residence time on such variables as lake concentration, inflow concentration, water residence time, mean lake depth and chlorophyll content was examined. The approach used for this analysis was a statistical dissection of cross-sectional relationships. Consideration was given to differences of these relationships between trophic categories. The relative residence time of phosphorus was found to be clearly related to the trophic conditions a lake. The processes which regulate the relative residence time and their magnitudes of influence differ with trophic category. Although the relative residence time is dependent on loading in oligotrophic lakes, it becomes less dependent on loading with increasing eutrophication. The movement of phosphorus through a lake and the trophic condition observed appears to be highly dependent on sediment uptake capacity for phosphorus in lakes of different trophic characteristics. Conversely, sediment properties will strongly influence the trophic response to a given load. For practical lake management, the implication following from this is that the resilience of lakes will depend on their previous history. Basically, oligotrophic lakes will respond slowly to increasing load, but rapidly to decreasing load as long as the perturbation is short in time; lakes with a long previous eutrophication history have lost resilience, and therefore will respond much more slowly to comparable load reductions. (Baker-IVI)
W85-02616

EFFECTS OF TURBULENCE ON PHOSPHORUS SUPPLY IN A SHALLOW BAY OF LAKE MEMPHREMAGOG,
McGill Univ., Montreal (Quebec). Dept. of Biology.
R. H. Peters, and A. Cattaneo.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 185-189, July, 1984. 1 Fig, 1 Tab, 21 Ref.

Descriptors: *Turbulence, *Wind, *Phosphates, *Lake Memphremagog, *Quebec, *Vermont, Bays, Phosphorus, Cycling nutrients, Seasonal variation, Lake sediments, Waves.

The effects of wind generated turbulence on orthophosphate uptake and on the concentrations of total and soluble phosphorus were examined in one bay of Lake Memphremagog (Quebec, Vermont). Although the study period included only one time of very heavy waves, surface chop was sufficient to double or treble total P concentration at the inshore station on three occasions. A smaller increase was also noted on two other occasions. These increases were very localized phenomena. The increases were also ephemeral and, when sampling was sufficient, declined to normal values within 2 days. Mean values of total P concentration on wavy and calm days also show the effects of water turbulence at inshore stations. These variations in total P had no effect on soluble P concentration. Neither the examination of mean values nor sign tests showed any trend among the three stations samples on either windy or calm days. The rate constants at all sites showed considerable fluctuation from sampling to sampling superimposed on a significant seasonal increase. Since turbulence had little effect on soluble P or on phosphate turnover at any site or time in this study, it seems unlikely that sediment resuspension serves as a mechanism of internal P loading. Possible effects of larger waves cannot be ruled out from this study. (Baker-IVI)
W85-02617

IMPORTANCE OF INTERNAL PHOSPHORUS LOAD TO THE EUTROPHICATION OF LAKES WITH ANOXIC HYPOLIMNIA,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W85-02618

PHOSPHORUS RELEASE PATTERNS FROM SEDIMENTS OF A MEROMICTIC MESOTROPHIC LAKE (PIBURGER SEE, AUSTRIA),
Innsbruck Univ. (Austria). Dept. of Limnology.
For primary bibliographic entry see Field 5C.
W85-02619

PHOSPHORUS BUDGETS OF INDOOR RESERVOIR MODELS VARYING IN SEDIMENT COMPOSITION AND WATER INLET SITE,
Ehime Univ., Matsuyama (Japan). Dept. of Environment Conservation.
H. Kagawa, and Z. Kawabata.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 229-232, July, 1984. 4 Fig, 3 Ref.

Descriptors: *Water quality control, *Reservoirs, *Eutrophication, *Phosphorus, Model studies, Nutrients, Lake sediments, Inlet depth.

The combined effects of water inlet depth and sediment composition on the phosphorus budget were studied in order to find a way to retard the eutrophication of reservoirs. Indoor reservoir models were constructed using polyethylene tanks. The water temperature was almost the same at any depth of the two deep inflow tanks and changed seasonally along with the room temperature. In shallow inflow tanks, athough the water temperature was equal to that of the deep inflow tanks, lower temperature prevailed beneath the thermocline during cooling periods. Under these conditions total phosphorus budgets differed from tank to tank. The TP budgets of the tanks during the initial 40 days, before the emergence of filamentous algae and during the entire 496 days of operation are pictured. The cumulative amounts of TP outflow differed from tank to tank, although those of TP inflow were intentionally similar in all tanks and increased steadily during its 16 months of operation. (Baker-IVI)
W85-02620

TRANSFERS BETWEEN FORMS OF SEDIMENTARY PHOSPHORUS INDUCED BY NITRATE TREATMENT,
Uppsala Univ. (Sweden). Limnologiska Institutionen.
K. Pettersson.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 233-238, July, 1984. 1 Fig, 3 Tab, 14 Ref.

Descriptors: *Phosphorus, *Lake sediments, *Nitrates, *Lake Finjasjon, *Lake Vallentunasjon, *Sweden, *Lake Balaton, *Hungary, Bottom sediments, Mineralization.

In lake metabolism the role of the sediments is of major importance since the very significant phosphorus pool there can, if partly released to the lake water, delay lake recovery after a drastic reduction of the external nutrient loading. Sediments from accumulating bottom areas in Lake Finjasfon, Lake Vallentunasjon (Sweden) and Lake Balaton (Hungary) were treated with nitrate to evaluate the significance of mineralization for the transfers between forms of sedimentary P. Fractional composition of sedimentary P was determined before and after incubation with nitrate at 10 and 20 C. NaOH-extracted organic P decreased 47%, 33% and 43% corresponding to 16.2%, 12.8%, and 5.6% of the total P content in the sediments of Lake Finjasjon, Lake Vallentunasjon and Lake Balaton, respectively, after incubation at 20 C for 16 days. The liberated P was to a large part incorporated in bacterial biomass (41% to 66%). Concerning the Lake Finjasjon sediment about 50% of the decrease in NaOH-extracted organic P was transferred to iron- and aluminum-bound P. In Lake Vallentunasjon sediment both loosely bound P and calcium-bound P increased with about 2% of total P at 20 C. Loosely sorbed P increased with 2% of total P also in the sediment of Lake Balaton. (Baker-IVI)
W85-02621

CALCULATION OF PHOSPHORUS AND NITROGEN LOADINGS TO NATURAL AND ARTIFICIAL LAKES,
Iowa State Univ., Ames. Dept. of Animal Ecology.
R. W. Bachmann.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 239-243, July, 1984. 2 Fig, 5 Ref.

Descriptors: *Lakes, *Nutrients, *Phosphorus, *Nitrogen, Model studies, Limnology, Depth, Hydraulic flushing rate.

Several techniques have been used to estimate nutrient loadings to lakes. The possibility of using the lake itself as an integrator of P and N inputs has been examined. P and N loadings to lakes are estimated by rearranging the Vollenweider equation to predict loadings from lake measurements of total P and total N, mean depth, and hydraulic flushing rate. Whether this was a useful technique and what errors are associated with the predicted values are determined. The data for P in lakes was taken from the published literature and includes measurements on lakes from the United States, Canada and northern Europe. The technique appeared to do a good job in making order of magnitude estimates of nutrient loading. This makes the method of practical use in many situations such as seasonal surveys of many lakes over a broad geographic area, since actual loading rates can vary by several orders of magnitude from lake to lake. The method is not suitable for determining differences between very similar lakes or for detecting relatively small changes over time in a single lake. (Baker-IVI)
W85-02622

NITROGEN LOADING: INFLUENCE ON DISSOLVED INORGANIC CARBON IN NATURAL WATERS,
Hidrobioloski Zavod, Ochrida (Yugoslavia).
For primary bibliographic entry see Field 5C.
W85-02623

MODELING CHEMICAL WATER QUALITY IN RESERVOIRS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5C.
W85-02624

SUMMARY OF US OECD EUTROPHICATION STUDY. RESULTS AND THEIR APPLICATION TO WATER QUALITY MANAGEMENT,
Texas Tech Univ., Lubbock. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W85-02625

AERATION OF ANOXIC HYPOLIMNETIC WATER: EFFECTS ON INTERNAL NUTRIENT AND PHOSPHORUS CONCENTRATIONS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
For primary bibliographic entry see Field 5G.
W85-02626

SEASONAL CHANGES IN TOTAL PHOSPHORUS AND THE ROLE OF INTERNAL LOADING IN WESTERN CANADIAN LAKES,
Alberta Univ., Edmonton. Dept. of Zoology.
E. E. Prepas, and J. Vickery.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 303-308, July, 1984. 1 Fig, 1 Tab, 15 Ref.

Descriptors: *Phosphorus, *Seasonal variation, *Lake sediments, *Alberta, *Internal loading, Vertical distribution, Mixing, Nutrients.

During 1980 and 1981 data on seasonal variations in the vertical distribution of total phosphorus (TP) were collected on 15 lakes in central Alberta. These data are used to evaluate whether internal sources of TP were responsible for the temporal variation observed in these lakes. The study lakes are located in the boreal mixed-wood and lower transition biomes in central Alberta. Based on various patterns of the data the lakes were divided into shallow and deep lakes. Internal loading was indeed responsible for the temporal changes observed in the TP levels in these lakes. The sediments appear to be a major P source. TP concentrations increased in the hypolimnion when dissolved oxygen levels were low, beginning at the sediment-water interface. Surface water TP levels increased when phosphorus-rich water from the hypolimnion was mixed with relatively dilute water from the epilimnion. In deep lakes, TP levels increased systematically in the hypolimnion, when the euphotic zone did not extend in the phosphorus-rich hypolimnetic water. Although TP levels have increased in the hypolimnia of other lakes when the dissolved oxygen levels were low, these increases have not been very systematic. In this study a systematic increase was detectable. In the shallow lakes, TP levels fluctuated dramatically throughout the water column during the study period. To determine the contribution of sediment-released P to the TP dynamics in shallow lakes samples would have to be collected daily rather than weekly as was the case in this study. (Baker-IVI)
W85-02630

EMPIRICAL MODELS FOR PREDICTION OF ALGAL BLOOMS AND COLLAPSES, WINTER OXYGEN DEPLETION AND A FREEZE-OUT EFFECT IN LAKES: SUMMARY AND VERIFICATION,
Canada Centre for Inland Waters, Burlington (Ontario).
J. Barica.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 309-319, July, 1984. 9 Fig, 3 Tab, 22 Ref.

Descriptors: *Lakes, *Eutrophication, *Algae, *Model studies, Seasonal variation, Fishkills, Winterkill, Summerkill, Dissolved oxygen, Prairies, Ice cover, Freeze-out.

Three empirical predictive models, developed for eutrophic shallow prairie lakes during 1973-1979, were summarized and tested on other lakes to assess their validity. A summerkill risk prediction model, based on maximum mid-winter ammonia-nitrogen and maximum summer chlorophyll a relationship, was used to estimate the likelihood of an algal bloom collapse and consequent fish kill from oxygen depletion in 42 new lakes, with prediction accuracy of 88%. A winterkill prediction nomogram, relating oxygen depletion rates, mean depth of the lake, and length of ice cover, was found to be valid also for large lakes and hypolimnetic oxygen depletion in shallow stratified lakes. A freeze-out model describing behavior of inorganic substances in shallow lakes under ice cover was confirmed for winter increases of hardness and gas saturation. The extra data sets used in testing, proved general validity of all three models and their applicability to fisheries and water management even though their true calibration was not sufficient, analyzed. (Baker-IVI)
W85-02631

SEDIMENT GEOCHEMISTRY IN A EUTROPHIC LAKE COLONIZED BY THE SUBMERSED MACROPHYTE MYRIOPHYLLUM SPICATUM,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
R. Carignan.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 355-370, July, 1984. 7 Fig, 1 Tab, 10 Ref.

Descriptors: *Buckhorn Lake, *Ontario, *Eutrophic lakes, *Macrophytes, *Lake sediments, Geochemistry, Iron, Chemical reactions, Porosity, Density, Interstitial water, Myriophyllum, Hydrogen sulfide.

Buckhorn Lake is a shallow heavily cottage eutrophic lake of Southeastern Ontario which is a good example of the extremely variable nature of macrophyte communities. An attempt was made to characterize the sediment geochemistry of different sites sustaining variable biomasses in order to identify possible macrophyte-sediment interactions that could explain the dynamic and variable nature of the macrophyte communities of this lake. Sediments sustaining a high macrophyte density are characterized by elevated total phosphorus and pore water nutrient concentration relative to deeper pelagic sediments. This suggests that at high densities, macrophytes cause an increase in organic matter and nutrient loading to the sediments. Sediments sustaining low or declining biomasses were characterized by the authogenic formation of a carbonate apatite, very low pore water iron and phosphate, low redox potential, and relatively high levels of hydrogen sulfide and ammonia. In lab experiments, the growth of Myriophyllum was slightly stimulated by iron addition to sediments. The natural level of hydrogen sulfide observed in these sediments did not inhibit growth. In the lake, the presence of high densities of macrophytes appears to trigger a series of secondary geochemical reactions unfavorable to the growth and explaining the site-specific decline of Myriophyllum. (Baker-IVI)
W85-02633

EFFECTS OF PHOSPHORUS FERTILIZATION ON PHYTOPLANKTON BIOMASS AND PHOSPHORUS RETENTION IN SUBARCTIC QUEBEC LAKES,
McGill Univ., Montreal (Quebec). Dept. of Biology.
V. H. Smith, F. H. Rigler, O. Choulik, M. Diamond, and S. Griesbach.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 376-382, July, 1984. 3 Fig, 1 Tab, 22 Ref.

Descriptors: *Lakes, *Phosphorus, *Phytoplankton, *Quebec, *Subarctic zone, Nutrients, Eutrophication, Algal growth, Biomass, Models.

A long term study of lakes from 1977-1983 in the Canadian subarctic near Schefferville, Quebec suggests that existing empirical water quality models can be used successfully in the North. The general response of phytoplankton to nutrients appears similar in both subarctic and temperate zone lakes. Ice-free season chlorophyll concentrations are predicted reasonably well by the Dillon and Rigler model (Limnol. Oceanogr. 19:767-773, 1974) but can be predicted with even greater precision by the multivariate model of Smith (Limnol. Oceanogr. 27:1101-1112, 1982). The Schefferville results thus underscore the importance of nitrogen as a regulator of phytoplankton productivity in lakes. Preliminary results also suggest that phosphorus retention in subarctic lakes can best be predicted with the Ostrofsky model (J. Fish. Res. Bd Can. 35:1532-1536, 1978), and suggest further that retention may be higher in subarctic than in temperate zone lakes. This hypothesis should be

rther using data from subarctic lakes from other gions of the world. (Baker-IVI)
'85-02635

FFECTS OF AN IN SITU ARTIFICIAL ACIDI-ICATION ON THE LACUSTRINE PHYTO-LANKTON AND ZOOPLANKTON (EFFETS 'UNE ACIDIFICATION ARTIFICIELLE IN ITU SUR LE PHYTOPLANCTON ET LE ZOO-LANCTON LACUSTRE),
cole Polytechnique, Montreal (Quebec). Section ı Genie de l'Environnement.
or primary bibliographic entry see Field 5C.
'85-02636

LANKTON OF AN ACID-STRESSED LAKE EJIMKUJIK NATIONAL PARK, NOVA COTIA, CANADA); PART 1, DESIGN AND ATER CHEMISTRY RESULTS OF AN EN-LOSURE EXPERIMENT,
alhousie Univ., Halifax (Nova Scotia). Dept. of ology.
M. Colins, and P. A. Lane.
erhandlung Internationale Vereinigung Limnolo-e, Vol. 22, No. 1, p 395-400, July, 1984. 4 Fig, 1 ıb, 7 Ref. Environment Canada grant OSC82-113.

escriptors: *Plankton, *Acidification, *Kejimku- National Park, *Nova Scotia, *Beaverskin ake, Food chains, Lime, Nutrients, Nitrogen, osphorus, Chlorophyll, Water pollution effects.

e stress of acid deposition affects more than a ecies list or set of distribution patterns for plank-n populations; whole food webs may be inextri-bly altered. The food web of the pelagic zone of lake was examined using a multiple enclosure stem. Plankton communities were monitored for eir responses to acidification, liming, and nutrient ading in Beaverskin Lake, pH 5.5. The pH was anipulated and subsequent physical and chemical ects were examined. Similar nutrient trends re observed in the controls, limed and acidified closures. The nutrient enriched enclosures clear-showed increases in N, P, and chlorophyll a lues. Some type of auxiliary buffering was acting lower pH and this could be a result of either a ysical or biological enclosure effect. A trend of iformity at the nutrient level does not necessari-imply that the other trophic levels indirectly ated to the perturbation will be as consistent. aker-IVI)
85-02637

ROWTH RESPONSES OF RIVER AND LAKE HYTOPLANKTON POPULATIONS IN LAKE ICHIGAN WATER,
ichigan Univ., Ann Arbor. Great Lakes Re-arch Div.
L. Schelske, C. O. Davis, and L. E. Feldt.
erhandlung Internationale Vereinigung Limnolo-, Vol. 22, No. 1, p 445-451, July, 1984. 4 Fig, 2 b. 10 Ref.

escriptors: *Lakes, *Phytoplankton, *Lake chigan, *Grand River, Nutrients, Chlorophyll, gal growth, Eutrophication, Diatoms, Standing op.

e effects of P and river water on deep-living ytoplankton populations and the fate of seeded er populations in lake water were examined. tered and unfiltered river water and P were ded to samples of lake water taken at the depth the subsurface chlorophyll maximum at a station noved from the influence of tributaries. Addi-ns of river water were 0, 1, 2, 5, and 10% and of osphorus were 0, 1, 2, 5, and 10 micro g P/liter. emical conditions and phytoplankton in the and River and the offshore lake were very ferent. Conditions at the lake stations varied rtically with a phytoplankton maximum at 32 m. is subsurface assemblage was dominated by dia-ns whereas the mixed layer assemblage con-ned smaller proportions and much smaller popu-ions of diatoms. Greatest community responses, measured by increases in chlorophyll a were tained in the unfiltered river water treatments th doublings in concentrations for the 2, 5, and 10% treatments. Standing crops increased with treatment because of the phytoplankton added with unfiltered water. Greater increases in chlorophyll a were obtained with P treatments than with filtered river water treatments. Nutrient utilization rates were greatest in unfiltered river water treatments and least with filtered river water. The results show that some allochthonous river populations can grow under the light and temperature conditions that might be found at the depth of the subsurface chlorophyll maximum. (Baker-IVI)
W85-02638

LONG-TERM PHYTOPLANKTON CHANGES IN LAKE MICHIGAN: CULTURAL EUTROPHICATION OR BIOTIC SHIFTS,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
A. S. Brooks, G. J. Warren, M. E. Boraas, D. B. Scale, and D. N. Edgington.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 452-459, July, 1984. 1 Fig, 1 Tab, 43 Ref. EPA grant R005655-01.

Descriptors: *Phytoplankton, *Sodium, *Lake Michigan, *Great Lakes, *Eutrophication, Lakes, Cyanophyta, Zooplankton, Phosphorus, Water pollution effects.

The effects of elevated sodium ion concentration, alone and combined with elevated phosphoconcentration were studied on the community dynamics of Lake Michigan phytoplankton using laboratory continuous culture techniques which simulate field conditions as closely as possible. The hypothesis that elevated sodium concentration would promote the competitive abilities of one or more cyanophyte species such that the phytoplankton community would become dominated by cyanophytes was investigated. Experimental evidence suggests that the abundance of large filamentous cyanophytes depends on the abundance of large zooplankton. It appears that whereas changing chemical conditions in Lake Michigan may exert some influence on phytoplankton abundance and community structure, overriding biotic factors must also be considered before drawing conclusions which may significantly influence regulatory strategies and management policies. (Baker-IVI)
W85-02639

PHYTOPLANKTON STANDING STOCK, SIZE DISTRIBUTION, SPECIES COMPOSITION AND PRODUCTIVITY ALONG A TROPHIC GRADIENT IN GREEN BAY, LAKE MICHIGAN,
Lawrence Univ., Appleton, WI. Dept. of Biology.
S. Richman, P. E. Sager, G. Banta, T. R. Harvey, and B. T. Destasio.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 460-469, July, 1984. 9 Fig, 2 Tab, 24 Ref. Sea Grant NA800AA-D-00086.

Descriptors: *Phytoplankton, *Green Bay, *Lake Michigan, Trophic level, Great Lakes, Primary productivity, Nutrients, Sinks, Standing stock, Distribution.

During the summer of 1982 the phytoplankton community was examined along the longitudinal axis of Green Bay at 12 stations which were then combined into five regions from south to north. The trophic gradient is easily discernible from the data tables. The response of the phytoplankton community to these gradients was determined in terms of shifts in species composition, particle size distribution of standing stock and productivity. The most obvious trend in the microscope enumeration is the decrease in phytoplankton concentrations from south to north in the bay. A second trend, but a more subtle one, is seen in the concentration increase which came about slowly over the summer. All the data indicate that the phytoplankton assemblage was shifting from smaller to larger forms during this time. These qualitative changes in the phytoplankton composition provide further support of the trophic gradient in Green Bay. The values obtained for phytoplankton density, phytoplankton biovolume, chlorophyll a and primary productivity are closely related to each other as shown by highly significant correlation coefficients. These findings emphasize the importance of the bay as a nutrient sink, especially in reducing the enrichment effects of the Fox River for Lake Michigan. (Baker-IV)
W85-02640

BENTHIC AND EPIBENTHIC (MICROCRUSTACEANS, MACROBENTHOS) COMMUNITY STRUCTURE IN THE VICINITY OF A POWER PLANT, SOUTHEASTERN LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 5C.
W85-02641

BIOLOGY, ECOLOGY AND CHEMISTRY OF A FLOC-LIKE SEDIMENT IN LAKE ERIE,
State Univ. of New York at Buffalo. Dept. of Biological Sciences.
J. F. Storr, J. R. Fox, P. J. Hadden-Carter, and C. J. Cazeau.
Verhandlung Internationale Verinigung Limnologie, Vol. 22, No. 1, p 504-509, July, 1984. 4 Fig, 11 Ref.

Descriptors: *Lake sediments, *Lake Erie, *Plankton, *Floc, Great Lakes, Sediments, Algae, Chemical composition, Aquatic animals, Organic matter, Cholesterol, Tubifex.

A floc-like veneer of organic-rich material was found as a loose quasi-floating layer up to 25 cm thick overlying sediments in the deeper (6 to 10 m), quiet portions of eastern Lake Erie. Steps were taken to determine the rate of plankton rainout, the amount of build-up on the bottom, the distribution of the floc, and the chemical composition of the floc in comparison to unconsolidated sediments. Fifteen bottom sampling stations were established along a 17 km transect from Point Abino on the Canadian side to Sturgeon Point on the American side of Lake Erie. The maximum rate of plankton rainout occurred in one two-week period in July. Highest rates occurred near the shore. Floc was generally found below the 10 m depth, up to 18-25 cm thick at depths over 16.5 cm. Where accumulation occurred, oxygen values fell from about 5 ppm in upper waters to less than 3 ppm in the bottom 2 to 3 m. Algae were found only at near-shore stations. Tubifex worms were predominant at stations where floc was thickest. Cholesterol was identified as the major component of the unsaponifiable fraction of sediment. Twelve peaks, representing specific compounds, were held in common by plankton, floc and sediment samples. Percent dry weight of ether and water soluble extracts peaked dramatically just under the sediment surface. The amount of ethanol extractable resins was greatest at the surface, declining gradually to a particular sampling site where it fell off dramatically. (Baker-IVI)
W85-02642

MT. ST. HELENS ASH IN LAKES IN THE LOWER GRAND COULEE, WASHINGTON STATE,
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W85-02643

CRATER LAKE STUDY: DETECTION OF POSSIBLE OPTICAL DETERIORATION OF A RARE, UNUSUALLY DEEP CALDERA LAKE IN OREGON, U.S.A.,
Army Engineer District, Portland, OR.
D. W. Larson.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 513-517, July, 1984. 2 Tab, 25 Ref.

Descriptors: *Crater Lake, *Oregon, *Optical properties, Opacity, Plankton, Limnology, Transparency, Nutrients, Diatoms, Caldera lakes.

The uniqueness and vulnerability of the Crater Lake environment was examined and the limnological data, gathered since 1967, was summarized. Crater Lake is located along the summit of the Oregon Cascade Range, about 105 km north of the

Oregon-California border, and about 195 km inland from the Pacific Ocean. Secchi disk readings for 1937 and 1969 averaged 38.3 and 36.6 m, respectively while the average value for 1978 was 29.3 m. The cause of this trend toward decreased transparency is uncertain. There may have been an increase in suspended particulate matter. Some evidence suggests that the lake has become more productive biologically perhaps as a result of increased algal nutrients present in the water. The phytoplankton community consists of more than 150 species, although fewer than 10 of these are dominant. Roughly 90% are diatoms, 15 of which belong to the genus Nitzschia. The vertical distribution of phytoplankton is characterized by three maxima: at the surface, 0-20 m; at middepth, 80-120 m; and near the bottom of the profile, 180-200 m. The regular presence of large numbers of diatoms at the 0-20 m stratum is in sharp contrast with findings reported by earlier investigators. (Baker-IVi)
W85-02644

NUTRIENT REDUCTION BY BIOMANIPULATION: AN UNEXPECTED PHENOMENON AND ITS POSSIBLE CAUSE,
Minnesota Univ., Minneapolis. Limnological Research Center.
For primary bibliographic entry see Field 5G.
W85-02645

LAKE ACIDIFICATION AND THE BIOLOGY OF ADIRONDACK LAKES: I. ROTIFER COMMUNITIES,
New York State Museum, Albany. Science Service Div.
For primary bibliographic entry see Field 5C.
W85-02646

RECENT PH HISTORY OF BIG MOOSE LAKE (ADIRONDACK MOUNTAINS, NEW YORK, U.S.A.) INFERRED FROM SEDIMENT DIATOM ASSEMBLAGES,
Indiana Univ. at Bloomington. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W85-02647

FORMS AND DISTRIBUTION OF CARBON IN SEDIMENTS OF CASTLE LAKE, CALIFORNIA, U.S.A.,
Michigan State Univ., Hickory Corners. W.K. Kellogg Biological Station.
R. G. Carlton.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 578-582, July, 1984.

Descriptors: *Lake sediments, *Carbon, *Castle Lake, *California, Oligotrophic lakes, Organic matter, Nutrients, Productivity, Particulates, Light availability.

The function of sediment in the nutrient dynamics of oligotrophic Castle Lake, California was investigated. The data which characterized the carbon constituents of Castle Lake are presented and the significance of organic content in sediments is discussed with emphasis on the factors which control the quality and quantity of carbon in sediments. Several factors directly affect the quantity and quality of organic matter in these sediments. A primary consideration is the source of particulate materials. Allochthonous sources have not been quantified. Autochthonous sources include particle production in the water column and in situ production by the sediment microbial community. The high organic content of surficial sediments of the littoral stations was probably a result of high production rates by algae and microheterotrophs. Productivity rates at deeper sites are unknown, but areas with lower light and temperature should have lower algal production. Therefore, sedimented seston becomes more important at depths with lower epipelic production. The fundamental characteristic which distinguishes sediment of Castle Lake from that of most other lakes is the high concentration of organic matter, particularly in sediment of the littoral zone. Relationships between sediment particulate organic matter and lake trophic state must be interpreted with regard to the availability of light at the sediment water interface and the degree of oxygen saturation and depth of the water column. (Baker-IVI)
W85-02648

HETEROTROPHIC BACTERIAL COMMUNITY IN OLIGOTROPHIC LAKE TAHOE,
Tokyo Metropolitan Univ. (Japan). Dept. of Biology.
Y. Watanabe, and C. R. Goldman.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 584-590, July, 1984. 4 Fig, 1 Tab, 16 Ref. Japan Ministry of Education Grant C-5754032, NSF grant BSR80-19918, California State Water Resources Control Bd. grant 1-009-160-0.

Descriptors: *Oligotrophic lakes, *Bacteria, *Lake Tahoe, Eutrophication, Nutrients, Phosphorus, Nitrogen, Carbon, Water pollution effects, Solar radiation, Ecological distribution.

Horizontal and vertical distribution of heterotrophic bacteria in highly oligotrophic Lake Tahoe are clarified. Here the eutrophication process brought about by human activity proceeds slowly but relentlessly. Very low densities of planktonic bacteria were recorded in viable counts of samples taken from the epilimnion of the lake center and at a station off the west shore. In contrast, much higher counts were found in areas subject to human impact such as a yacht harbor and shallow channels in a residential zone at the south shore. Total counts of bacterial samples were rather high. The ratio of the viable to total counts was higher in the more eutrophic water. Periphytic bacterial density on the lake bottom rocks in the littoral zone was rather high and stable almost irrespective of the depth and the abundance of periphtyic organic matter. Many bacterial cells were attached to the epilithic algae and detrital particles on the rocks. There was a tendency for most of the bacteria in unpolluted lake water to be chromogenic, forming yellow to deep red-colored colonies on the culture plate. Those in the sample from the polluted area were not chromogenic. No correlation was noted between the bacterial density and the water temperature or primary productivity. Decrease of bacterial density was found in both viable and total counts in the upper photic zone above the Secchi depth of the water column. The negative effect of sunlight on bacterial growth was demonstrated. Both planktonic and periphytic bacteria in Tahoe are limited by a shortage of N and P as well as by organic C. (Baker-IVI)
W85-02649

PRIMARY PRODUCTIVITY AND PRECIPITATION AT CASTLE LAKE AND LAKE TAHOE DURING TWENTY-FOUR YEARS, 1959-1982,
California Univ., Davis. Div. of Environmental Studies.
C. R. Goldman, and E. de Amazaga.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 591-599, July, 1984. 5 Fig, 30 Ref. NSF grant DEB-8019918.

Descriptors: *Primary productivity, *Precipitation, *Lake Tahoe, *Castle Lake, *California, Nutrients, Seasonal variation, Flushing, Nutrients, Algae.

Castle Lake is a subalpine lake located in northern California at an altitude of 1706 m where it lies in a protected cirque basin. The lake is covered with ice and snow for 5 to 6 months of the year and receives almost no rain during the summer. Lake Tahoe does not freeze in winter and about a third of the water column receives sufficient light for photosynthesis. Primary productivity in Castle Lake over the period of 24 years averaged 64 g C/sq m/yr. From June through September, 69% of the primary productivity occurred. The highest carbon fixation took place during July and August. The lake shows an alternative pattern of high and low years of primary productivity. In Castle Lake, annual primary productivity shows no significant trend with time. Primary productivity in Lake Tahoe has increased from 39 g C/sq m/yr in 1959 to a high of 96 g C/sq m/yr in 1980. Lakes such as Castle Lake which are subject to accelerated flushing during years of heavy rain and snowpack have both nutrients and algae flushed out b
flow-through. In Lake Tahoe the relatio
precipitation and primary productivity (P
examined but no direct relation was found
water year precipitation and PPr. By u
percentage change in primary productiv
tween successive years in comparison to p
tion during the corresponding water year
cellent positive regression results if two an
years are excluded. (Baker-IVI)
W85-02650

**LITTORAL PHYTOPLANKTON PRODU
TY AND BIOMASS AS INDICATORS O
FERENTIAL NUTRIENT LOADING O
TAHOE,**
California Univ., Davis. Inst. of Ecology.
For primary bibliographic entry see Field
W85-02651

**VARIABILITY IN PHOSPHORUS CO
TRATIONS IN NORTH TEMPERATE
A CASE STUDY OF ANTHROPOGENIC
ING,**
Salford Univ. (England). Dept. of Civil E
ing.
For primary bibliographic entry see Field
W85-02652

**EFFECTS OF ROTENONE TREATME
THE BENTHIC FAUNA OF A SMALL
PHIC LAKE,**
Trondheim Univ. (Norway).
For primary bibliographic entry see Field
W85-02653

**RESULTS OF SEEPAGE METER AND
PIEZOMETER STUDY, LAKE
NEVADA,**
Montana Univ., Missoula. Dept. of Geolog
W. W. Woessner, and K. E. Sullivan.
Ground Water, Vol. 22, No. 5, p 561-568,
ber-October, 1984. 9 Fig, 18 Ref.

Descriptors: *Seepage meters, *Piezometer
face-groundwater interactions, *Lake
*Nevada, Groundwater recharge, Re
Groundwater discharge, Bank recharge,
sulfate.

The seepage meter and the mini-piezomet
utilized in an attempt to evaluate groun
reservoir interactions over a 12-month p
Echo Bay in Lake Mead. In conjuction wi
techniques three standard piezometers, re
seismic data, and water chemistry data w
lized to interpret seepage device results. D
four-month period, from December 1979 t
1980, an 8 ft (2.5 m) rise in reservoir st
reservoir contributed water to Echo Wa
storage at rates of up to 0.29 gpd/sq ft (1
m). Ground-water discharge occurred for
mainder of the project, during a stage decli
April 1980 to May 1980, a rise in June 19
leveling off and slight decline for the rema
the year, July 1980 to December 1980. Th
mum seepage meter ground-water discha
of 3.0 gpd/sq ft (122 lpd/sq m) was reco
December 1980. Seepage meter water ch
data for June were similar to Lake Mea
chemistry and were interpreted to be pre
recharged Lake Mead water. September
chemistry data showed two possible com
of ground-water discharge, a high SpC
sulfate Echo Wash ground water and a low
Lake Mead recharged bank storage water.
ber ground-water chemistry data show
charge to be a high SpC calcium sulfate
similar to Echo Wash ground-water quality
was apparently unaffected by Lake Mead
Mini-piezometer data were collected at ea
age meter site. However, these data usually
provide correlative results with seepage me
probably because of suspended sediment
piezometer water column and plugging of
forated tip. Seepage meters were successfu
lized to characterize reservoir ground-wate
action in Echo Bay. (Author's abstract)
W85-02688

2I. Water In Plants

ZONATION OF MOSSES AND LICHENS ALONG THE SALMON RIVER IN IDAHO,
Montana Univ., Missoula. Dept. of Botany.
For primary bibliographic entry see Field 2E.
W85-02330

CONCEPT OF DROUGHT ADAPTATION (LA NOTATION D'ADAPTATION A LA SECHERESSE),
Centre National de la Recherche Scientifique, Gif-sur-Yvette (France). Lab. du Phytotron.
C. Vartanian, and G. Lemee.
Bulletin de la Societe Botanique de France, Actualites Botaniques, Vol. 131, No. 1, p 7-15, 1984. 1 Fig, 33 Ref.

Descriptors: *Drought resistance, *Adaptation, Plant morphology, Plant physiology, Plant tissues, Vegetation, Water stress.

The concept of drought adaptation is discussed in terms of dynamic reaction, or strain, as a response to an environmental water stress. As a result of structural and functional modifications induced, different strategies may contribute to drought resistance. The major types of drought adaptation are: drought avoidance, which supposes that the plant is able to erect barriers between its living matter and the environment, enabling the maintenance of a steady state water potential (homoiohydry); and drought tolerance (poikilohydry) which implies maintaining its water potential equilibrium with the environment. Avoidance of the dehydration strain, a characteristic of higher plants, is attained through numerous ways which are largely morphological and anatomical in nature; dehydration tolerance, a more primitive adaptation typical of lower terrestrial organisms, depends on specific, intrinsic properties of the protoplasm. Whether total drought resistance results mostly in survival or productivity will depend on the equilibrium between adaptive strategies. (Author's abstract)
W85-02331

VARIABILITY IN ADAPTIVE MECHANISMS AND WATER DEFICITS IN ANNUAL AND PERENNIAL CROP PLANTS,
Cordoba Univ. (Spain).
J. Fereres.
Bulletin de la Societe Botanique de France, Actualites Botaniques, Vol. 131, No. 1, p 17-32, 1984. 11 Fig, 1 Tab, 64 Ref.

Descriptors: *Adaptation, *Crop plants, *Water deficits, Productivity, Water stress, Dehydration, Leaves, Water potentials.

Terrestrial plants have evolved numerous mechanisms which enable them not only to survive, but to achieve substantial productivity levels under drought. Most adaptive mechanisms appear to be directed at either avoiding or tolerating plant water deficits. The sensitivity of leaf area expansion to mild water stress is emphasized, suggesting that it has adaptive significance by acting as a partitioning mechanism which favors root growth and hence improves the shoot water status. Alterations in developmental pathways often aid the plant in avoiding dehydration by adjusting its life cycle to the available water supply. Mechanisms of dehydration tolerance include the control of transpiration and the maintenance of turgor through osmotic adjustment. Examples of adaptive mechanisms and their possible role in yield responses under water stress are presented for sorghum, cotton and sunflower as annuals and orange, almond and olive trees as perennials. There is substantial variability in the degree of expression of several adaptive mechanisms and this has important implications for the improvement of crop production under water stress. (Author's abstract)
W85-02332

SOME DATA AND REFLECTIONS ON THE DROUGHT RESISTANCE MECHANISMS OF MAIZE AND SUNFLOWERS (QUELQUES DONNEES ET REFLEXIONS SUR LES MECANISMES DE RESISTANCE A LA SECHERESSE A PARTIR DES EXEMPLES DU MAIS ET DU TOURNESOL),
Institut National de la Recherche Agronomique, Clermont-Ferrand (France). Station d'Agronomie.
J. Morizet, P. Cruiziat, and D. Togola.
Bulletin de la Societe Botanique de France, Actualites Botaniques, Vol. 131, No. 1, p 33-43, 1984. 5 Fig, 1 Tab, 15 Ref.

Descriptors: *Drought resistance, *Maize, *Sunflowers, Productivity, Hydroponics, Water uptake, Plant physiology.

In this paper, the term drought resistance is used from its agronomic sense, i.e. the ability for a crop to produce a yield under 'dry conditions' not much inferior to yield under 'wet conditions'. Aspects of the water relations and growth were compared between two drought tolerant and non tolerant varieties of maize and between sunflower and maize. Concerning the varieties of maize, our results show that during the post drought period, the increase in net assimilation of the drought tolerant varieties is much higher. Concerning maize and sunflower, comparisons were made on transpiration and photosynthesis during a short period of drought (a few hours) induced by lowering of the root temperature in hydroponic culture of the two species. The results show a great analogy with those observed under field conditions for the whole cycle of vegetation; that is, a better drought tolerance in sunflower than in maize. Great distance still exists between the theoretical work suggesting schemes of drought resistance and knowledge of the actual physiological mechanism involved. (Author's abstract)
W85-02333

AGRONOMIC ASPECTS OF DROUGHT RESISTANCE OF THE SUNFLOWER (HELIANTHUS ANNUUS L.) (ASPECTS AGRONOMIQUES DE LA RESISTANCE A LA SECHERESSE CHEZ LE TOURNESOL (HELIANTHUS ANNUUS L.)),
A. Merrien, and R. Blanchet.
Bulletin de la Societe Botanique de France, Actualites Botaniques, Vol. 131, No. 1, p 45-50, 1984. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Drought resistance, *Sunflower, *Water use efficiency, *Plant physiology, France, Plant tissues, Water stress, Dehydration, Leaves, Photosynthesis.

If high yields are to be possible for most cultivated crops, the control of water consumption, the first limiting factor under the climate of south-west France, will be more and more important. Part of this water consumption control will perhaps be obtained by breeding new varieties adapted to drought. To increase information about whole-plant behavior, and to conduct some preliminary tests particulary useful for breeders, studies on the consequences of water stress on plant physiology and production are important. An example of the resistance process is leaf area adjustment to water availability in sunflowers and the consequences on photosynthesis; another example explains why an increase in water use efficiency is noticed for sunflowers under dry conditions. Based on these examples, the sunflower presents some drought resistant characteristics. (Author's abstract)
W85-02334

APPLICATION OF FUNDAMENTAL STUDIES ON THE IMPROVEMENT OF DROUGHT RESISTANCE OF PLANTS (APPLICATIONS DES ETUDES FONDAMENTALES A L'AMELIORATION DE PLANTES RESISTANTES A LA SECHERESSE),
Paris-7 Univ. (France). Lab d'Ecologie Generale et Appliquee.
J. Vieira Da Silva.
Bulletin de la Societe Botanique de France, Actualites Botaniques, Vol. 131, No. 1, p 51-57, 1984. 6 Tab, 16 Ref.

Descriptors: *Drought resistance, *Brazil, *Cotton, *Plant physiology, Plant breeding Crop production, Dehydration, Genetics, Stomata, Phosphorus.

In semiarid conditions of Northeast Brazil, with an irregular but somewhat long rainfall period, fundamental ecophysiological research demonstrated that drought resistance in cotton depends: a) on a fast growth of root system, b) on a root system size enabling the plant to exploit a more important water reserve, c) on a large starch amount in the root providing for periods with stomata closure and d) on a great cellular resistance to dehydration which maintains the integrity of cellular internal compartmentation. Conditions b) and c) depend also on a late flowering enabling the translocation of photosynthates to roots. Indeterminate flowering and fruiting is necessary to profit from late rains. Selection criteria, for the screening of a great number of plants, were modified from fundamental research results. Those criteria are: a) speed of root growth of seedlings (experience shows that this character is linked with final size of root systems), b) amount of starch in roots, c) leaching of inorganic phosphorus after a drought or heat treatment which means disruption of chloroplast membranes and activation of acid phosphatase. These characteristics seem to be polygenic in heredity, as it occurs in most complex physiological phenomena; the breeding system adapted was recurrent selection which conserves population variability. Selection for root growth in the seedling stage showed a gain in the root system size with heritability of 37% and a genetic gain of 65%. After one recurrent cycle for starch content in roots, the heritability was 22.4% and genetic gain 12.1%. Heritability of inorganic phosphorus leaching after an osmotic treatment of leaf fragments is of 38.1% with a genetic gain of 12.5% for the 2nd cycle and of 11.9% for the 3rd cycle. These results show that selection procedures can be adapted from previous physiological research and that a close link between the ecophysiologist and the breeder, is necessary. (Author's abstract)
W85-02335

ROLE OF THE PHOTOPERIOD ON DROUGHT ADAPTATION OF COTTON (ROLE DE LA PHOTOPERIODE DANS L'ADAPTATION A LA SECHERESSE DES COTONNIERS),
Centre National de la Recherche Scientifique, Gif-sur-Yvette (France). Lab. du Phytotron.
C. Hubac, M. Ouedraogo, D. Guerrier, and J. Ferran.
Bulletin de la Societe Botanique de France, Actualites Botaniques, Vol. 131, No. 1, p 79-88, 1984. 3 Fig, 4 Tab, 28 Ref.

Descriptors: *Cotton, *Drought resistance, *Photoperiod, Plant physiology, Plant tissues, Leaves, Stomata, Water potential, Transpiration, Water use efficiency, Photoperiodism, Potassium.

Cotton resistance to drought stress was increased with exposure to short photoperiods. This process was phytochrome dependent, as shown by the effect of red light (R) and far red light (FR). Especially 30 min. of FR at the beginning of the dark period increased strongly the resistance. This increase was measured by the evolution of water, osmotic and turgor potentials during stress; there is water economy with short photoperiod. A strategy for water economy is the degree of stomatal aperture; with far red treatment, stomatal aperture was reduced, transpiration and water adsorption by roots decreased. These effects could be linked to modifications of inner solute concentration, especially potassium ions, and to modifications of lipid composition. The hypothesis of membrane permeability modification is discussed. (Author's abstract)
W85-02336

ACTION OF DROUGHT ON POLAR LIPIDS IN THE LEAVES OF COTTON (GOSSYPIUM HIRSUTUM L.) (ACTION DE LA SECHERESSE SUR LES LIPIDES POLAIRES DES FEUILLES DE COTONNIER (GOSSYPIUM HIRSUTUM L.),
Paris-7 Univ. (France). Lab d'Ecologie Generale et Appliquee.
A. T. Pham Thi.

Bulletin de la Societe Botanique de France, Actualites Botaniques, Vol. 131, No. 1, p 89-97, 1984. 2 Fig, 5 Tab, 22 Ref.

Descriptors: *Cotton, *Drought, *Lipids, *Leaves, Galactolipids, Phospholipids, Plant physiology.

Cotton plants (Gossypium hirsutum L. cv. Reba, drought-sensitive and Moco-sinho, drought-resistant) were submitted to water stress by withholding irrigation. Polar lipid content of leaves decreased, the galactolipids being more affected than the phospholipids. The percentage of linolenic acid (18 : 3) decreased, mostly in the galactolipid fraction. The drought resistant variety showed less pronounced variations than the sensitive one. Differences between the two varieties appeared after hardening treatment which consisted of 3 cycles of slight water stress followed by rehydration. In Mocosinho, the content of monogalactosyl-diacylglycerol increased significantly, and an augmentation of phosphatidyl choline was also observed. In Reba, on the contrary, both galactolipid and phospholipid content decreased. (Author's abstract)
W85-02337

CHANGES IN THE CONTENT OF POLYAMINES AND THEIR PRECURSORS DURING THE MORPHOGENETIC ADAPTATION IN RAPE, BRASSICA NAPUS L. VAR. OLEIFERA M. A LA SECHERESSE (VARIATIONS DES TENEURS EN POLYAMINES ET LEUR PRECURSEURS AU COUR DE L'ADAPTATION MORPHOGENETIQUE DU COLZA, BRASSICA NAPUS L. VAR. OLEIFERA M. A LA SECHERESSE),
Centre National de la Recherche Scientifique, Gif-sur-Yvette (France). Lab. du Phytotron.
A. Geay, N. Vartanian, and O. Queiroz.
Bulletin de la Societe Botanique de France, Actualites Botaniques, Vol. 131, No. 1, p 99-111, 1984. 10 Fig, 1 Tab, 29 Ref.

Descriptors: *Drought, *Rape, *Polyamines, *Adaptation, *Drought resistance, Drought effects, Roots, Plant physiology, Plant tissues, Putrescine, Spermidine, Spermine, Arginine, Ornithine, Irrigation, Dehydration.

Changes in polyamines (putrescine, spermidine, spermine) and precursors (arginine, ornithine) were followed during the adaptive morphogenetic response to drought in rape species (Brassica napus L. var. oleifera Metz). Plants were grown during the vegetative stage, under different conditions: watering, progressive soil drying inducing short roots initiation, and rehydration. The analyses were performed separately in aerial parts, whole subterranean organs and in the excised short roots. Whereas no metabolic changes were noticed in the plants regularly watered, some modifications occurred in the plants subjected to progessively increasing water deficit, which could be correlated with the morphological and physiological changes observed at the whole plant level: increased in the precursor (arginine and ornithine) content which appeared concomitantly with the decline in putrescine content at a threshold value of water potential. On rehydration, the increase in precursor content and the decline in putrescine were stopped, suggesting that enzymatic activities of arginine decarboxylase and ornithine decarboxylase, inhibited during the drought period, could resume rapidly. In the short drought-induced roots, the polyamine and precursor content remained constant and at a higher level than in root system of watered plants, during the whole period of drought. The short roots appear as a system undergoing high metabolic activity, capable of withstanding severe drought conditions and thus representing the adaptive potential of the plant. (Author's abstract)
W85-02338

DIURNAL COURSE OF PLANT WATER POTENTIAL, STOMATAL CONDUCTANCE AND TRANSPIRATION IN A PAPYRUS (CYPERUS PAPYRUS L.) CANOPY,
Trinity Coll., Dublin (Ireland). Dept. of Botany.
M. B. Jones, and F. M. Muthuri.
Oecologia, Vol. 63, No. 2, p 252-255, August, 1984. 3 Fig, 15 Ref.

Descriptors: *Papyrus, *Lake Naivasha, *Kenya, *Plant water potential, *Stomatal conductance, *Transpiration, Plant physiology, Water potentials, Wetlands, Swamps, Vapor pressure, Iron.

The diurnal course of water potential, stomatal conductance and transpiration was measured on mature umbels (the major evaporating surface) of papyrus (Cyperus papyrus L.) growing in a fringing swamp on Lake Naivasha, Kenya. Umbel water potential declined only slightly during the morning but fell rapidly after midday to a minimum value of -1.5 M Pa in early afternoon. The two main structures forming the umbels - the bracteoles and rays - showed similar patterns of change of stomatal conductance throughout the day. The values of conductance indicate major stomatal opening during the morning, partial midday closure and some recovery of opening during the afternoon. It appears that the increase in water vapor pressure deficit of the air is the major cause of the midday closure of the stomata and that plant water potential has little effect. The reason why transpiration is reduced at high vapor pressure deficits when water is freely available to the roots is not clear. However, it is speculated that the restricted water movement into the plant from the anaerobic root environment has the effect of reducing the uptake of toxic ferrous iron. The daily total of canopy transpiration is estimated to be 12.5 mm, twice the value previously reported for papyrus but similar to daily values determined for other wetland communities. (Author's abstract)
W85-02341

INTRASPECIFIC COMPETITIVE EFFECTS ON WATER RELATIONS, GROWTH AND REPRODUCTION IN ENCELIA FARINOSA,
Utah Univ., Salt Lake City. Dept. of Biology.
J. R. Ehleringer.
Oecologia, Vol. 63, No. 2, p 153-158, August, 1984. 6 Fig, 3 Tab, 22 Ref. NSF grant 83-13136.

Descriptors: *Incienso, *Competition, *Plant populations, *Plant growth, *Plant reproduction, *Desert plants, *Sonoran desert, Plants, Plant tissues, Leaves, Water requirements, Population density, Deserts, Leaf water potential.

An experiment was conducted to assess the importance of intraspecific competition on water relations, growth and repoductive output in Encelia farinosa, a common deciduous-leaved shrub of the Sonoran Desert. Nearest neighbor analyses in monospecific stands indicated that plants exhibited a clumped distribution. Plant size and nearest neighbor distance were positively correlated, inferring intraspecific competition. Removal experiments monitored for two years indicated that plants now without neighbors had higher leaf water potentials, higher leaf conductances, and a greater leaf area than control plants. As a consequence, growth rates and reproductive output were significantly higher in plants without neighbors. These data strongly support the notion that warm desert plants with a contagious spatial distribution compete for water. (Author's abstract)
W85-02342

PERIPHYTIC OXYGEN PRODUCTION IN OUTDOOR EXPERIMENTAL CHANNELS,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
P. G. Meier, and D. W. Dilks.
Water Research, Vol. 18. No. 9, p 1137-1142, 1984. 5 Fig, 4 Tab, 13 Ref.

Descriptors: *Primary productivity, *Oxygen, *Streams, *Chlorophyll a, Periphyton, Aquatic plants, Light intensity, Water currents, Velocity.

Oxygen production was quantified as a function of chlorophyll a in outdoor experimental channels. Variables investigated included a range of light intensities and four current velocities incorporated through the use of a factorial design. Physical reaeration rates for correcting overall oxygen increases were also determined. Stream velocity was found to be statistically insignificant in affecting oxygen production, but was a factor in periphyton accrual and species composition. Gross oxygen production exceeded respiration by a fa three (Baker IVI)
W85-02432

COMMON RELATIONSHIP BETWEE CIPITATION AND GRASSLAND PEA MASS FOR EAST AND SOUTHERN A
California Univ., Berkeley. Dept. of Zoolo
For primary bibliographic entry see Field 2
W85-02544

EPILITHIC AND EPIPELIC DIATOMS SANDUSKY RIVER, WITH EMPHAS SPECIES DIVERSITY AND WATER TION,
Bowling Green State Univ., OH. Dept. of
cal Sciences.
For primary bibliographic entry see Field 2
W85-02545

PRIMARY PRODUCTION IN RATTLE SPRINGS, A COLD DESERT S STREAM,
Battelle Pacific Northwest Labs., Richlan
Environmental Sciences Dept.
For primary bibliographic entry see Field 2
W85-02547

EFFECTS OF CANOPY COMPONEN THROUGHFALL CHEMISTRY: AN E MENTAL ANALYSIS,
Dartmouth Coll., Hanover, NH. Dept. of
cal Sciences.
For primary bibliographic entry see Field 2
W85-02560

RESPONSES OF STOMATA AND LEA EXCHANGE TO VAPOUR PRESSURE CITS AND SOIL WATER CONTENT, CIES COMPARISONS AT HIGH SOIL CONTENTS,
Commonwealth Scientific and Industrial R
Organization, Wembley (Australia).
For primary bibliographic entry see Fi
W85-02561

SEASONAL PHYSICAL, CHEMICAL ALGAL CHANGES IN FIVE RIVERS ING THROUGH THE OIL SANDS REGI ALBERTA, CANADA,
Alberta Univ., Edmonton. Dept. of Botany.
For primary bibliographic entry see Field 2
W85-02562

MICROELECTRODE STUDIES OF INT TIAL WATER CHEMISTRY AND PHOT THETIC ACTIVITY IN A HOT SPRIN CROBIAL MAT,
Montana State Univ., Bozeman. Dept. of M
ology.
For primary bibliographic entry see Field 2
W85-02593

2J. Erosion and Sedimentation

FIFTY YEARS OF SEDIMENTATION,
California Inst. of Tech., Pasadena.
V. A. Vanoni.
Journal of Hydraulic Engineering, Vol. 110 p 1022-1057, August, 1984. 13 Fig, 1 Tab, 1

Descriptors: *Sedimentation, *History, Se transport, Entrainment, Erosion, Review load, Suspended sediments, Scour.

The development of sedimentation is trace the 1930s through the 1970s with key contri being cited. The term sedimentation inclu processes of erosion, entrainment, transpo deposition, and compaction of sediment. M the research in the early decades of this dealt with the development of relations fo port of bed load by streams. The developm the mechanics of turbulent flow which occu

early decades of this century were brought to
ır on the problem of sediment suspension in the
: 1930s. First experiments on local scour were
de in 1940 in a study of the scour of sand by
rically oriented jets. Basic studies of bed forms
bed form predictors are cited. A primary ob-
itive in sedimentation is to develop relations
ich will give sediment discharge in terms of
draulic parameters and bed sediment character-
cs. In the 1940s workers concentrated on devel-
ng expressions for discharge of bed load in
ich the hydraulic variable is the shear stress.
ore recently, workers have concentrated on de-
oping what are called total sediment discharge
ations, some of which apply the theory of sus-
sion or concepts related to it. Additional work
the following areas is also cited: hydraulic rela-
ns, effect of water temperature, hydraulic geom-
y, and stream forms. (Baker-IVI)
35-02263

GRADATION AND DEGRADATION OF AL-
VIAL-CHANNEL BEDS,
F. Jaramillo, and S. C. Jain.
rnal of Hydraulic Engineering, Vol. 110, No. 8,
1072-1085, August, 1984. 9 Fig, 14 Ref. NSF
nt CEE80-23003.

scriptors: *Model studies, *Alluvial rivers, *Ag-
dation, Channels, Sedimentation, Accretion,
diment transport, Rivers.

st rivers are subject to some kind of control or
turbance that gives rise to nonequilibrium flow
ditions. A nonlinear parabolic model for none-
librium processes in alluvial rivers is presented.
alytical expressions for the characteristic pa-
neters of relevant aggradation and degradation
cesses are derived. The model can be consid-
d an accurate tool for predicting one-dimension-
nonequilibrium processes in alluvial channels
to a sudden variation in sediment-transport
e at the upstream end of the stream. It is applica-
to both aggradation and degradation processes
which the relative variation in sediment dis-
rge ranged between -1 and 1. The agreement
ween the nonlinear analytical solution and the
ilable experimental data is good. (Baker-IVI)
35-02265

DAL PHASE CONTROL OF SEDIMENT DIS-
ARGE FROM THE YANGTZE RIVER,
ods Hole Oceanographic Institution, MA.
D. Milliman, Y. Hsueh, D.-X. Hu, D. J.
shinski, and H.-T. Shen.
uarine, Coastal and Shelf Science, Vol. 19, No.
p 119-128, July, 1984. 5 Fig, 3 Tab, 12 Ref.
fice of Naval Research contract N00014-81-C-
99.

scriptors: *Yangtze River, *China, *Sediment
charge, *Tidal effects, *East China Sea, Estua-
e environment, Spring tides, Neap tides.

the Yangtze River estuary in eastern China,
al phase plays a major role in controlling sedi-
nt discharge. During 1980 and 1981 the flux of
ter and dissolved/suspended solids from the
er into the East China Sea was studied as part of
roader study of the sediment dynamics in the
ion. Direct measurements indicate that during
ing tide in mid-November 1981 approximately 3
es the sediment passed down the main channel
the river as during the next neap tide, 3 days
er. The estuary presumably acts as a conduit for
erine sediment during spring tide but as a sink
ring neap tide. The ratio of spring to neap
nsport is somewhat less than for other estuaries
t have been studied; this results from a smaller
ference in spring-neap tidal ranges (volumes)
ative to estuarine depth (volume), rather than
er discharge or absolute tidal range. Tidal phase
ntrol of sediment discharge can occur in microti-
estuaries if the difference between spring and
ap tidal range is sufficiently great compared to
an estuarine depth. (Collier-IVI)
35-02292

LATING RAINFALL EROSIVITY FACTORS
SOIL LOSS IN KENYA,
Office of International Cooperation and Development (USDA), Washington, DC.
L. G. Ulsaker, and C. A. Onstad.
Soil Science Society of America Journal, Vol. 48, p 891-896, 1984. 1 Fig, 3 Tab, 46 Ref.

Descriptors: *Soil erosion, *Rainfall, *Kenya, *Soil management, Water loss, Alfisol, Erosion, Erodibility, Climate, Rainfall intensity.

Runoff plots were established on a representative soil site in Kenya in 1980 to evaluate soil and water losses as influenced by climate, soil, and management practices. Fifteen erosivity factors were regressed to ascertain best fit on the soil loss from 3 fallowed plots for each of 35 storms between March 1982 and April 1983. Two of the best rainfall erosivity factors with their respective coefficients of determination are: total kinetic energy times maximum 30-min intensity (EI sub 30), r squared = 0.69, and rainfall amount times the maximum 30-min intensity (AI 30), r squared = 0.72. A regression equation was developed relating EI 30 to rainfall amount, A. The coefficient of determination was 0.902. Soil erodibility for this Alfisol was found to be 0.0314 tonne hectare hour per hectare megajoule millimeter or 0.24 in customary English units. Erodibility factor values ranged from 0.07 for storms producing soil losses less than 1 t/ha to 0.55 for storms producing soil losses greater than 10 t/ha. (Author's abstract)
W85-02322

SOIL AND WATER LOSSES AS AFFECTED BY TILLAGE AND MANURE APPLICATION,
Wisconsin Univ.-Madison. Dept. of Soil Science.
D. H. Mueller, R. C. Wendt, and T. C. Daniel.
Soil Science Society of America Journal, Vol. 48, p 896-900, 1984. 1 Fig, 4 Tab, 26 Ref. EPA grant G001359-01.

Descriptors: *Tillage, *Water loss, *Soil erosion, *Manure, Rainfall, Runoff, Best management practices, Crop residue.

Little data are available on conservation tillage under field conditions characteristic of a dairy operation. Thus, simulated rainfall was used to compare soil and water losses among conventional, chisel, and no-till systems for corn both with and without surface-applied manure prior to tillage. Rainfall was applied at several times during the growing season of 1978 and 1979. A portion of the previous year's crops residue was removed in 1978 and all the residue was left in 1979. A tillage x date interaction was observed for runoff losses in both years of the experiment. Significantly lower runoff occurred for the conventional and chisel systems relative to the no-till system immediately after planting. At later sampling periods, runoff significantly increased for the conventional system and runoff losses approached that from no-till. In contrast, lower runoff losses occurred for the chisel system relative to the other tillage systems. This was most apparent in 1979 when more residue was partially incorporated or left on the soil surface. Surface spread manure decreased runoff for all tillage treatments at the September 1978 sampling period and at both sampling periods in 1979. The results indicated the greatest response with the chisel system. In 1978 and 1979, a tillage x manure interaction was observed for the soil loss. In 1978, little difference in soil loss was observed among unmanured tillage treatments. However, the application of manure reduced soil losses for chisel and no-till systems relative to the conventional system. In 1979, soil losses were lower from unmanured chisel and unmanured no-till treatments than from the unmanured conventional treatment. Soil losses were significantly lower from the manured chisel treatment than all other treatments. (Author's abstract)
W85-02323

SEWERMAN AND THE SCIENTIST; A PARABLE FOR THE ACADEMIC FOLLOWING A COURSE OF DECONTAMINATION (L'EGOUTIER ET LE SAVANT; CONTE MORAL POUR UNIVERSITAIRE EN CURE D'ASSAINISSEMENT),
Institut National Polytechnique, Toulouse (France).
For primary bibliographic entry see Field 5D.
W85-02351

NITROGEN AND PHOSPHORUS IN THE SEDIMENTS OF A TIDAL, FRESHWATER MARSH IN MASSACHUSETTS,
Marine Biological Lab., Woods Hole, MA. Ecosystems Center.
W. B. Bowden.
Estuaries, Vol. 7, No. 2, p 108-118, June, 1984. 6 Fig, 2 Tab, 25 Ref.

Descriptors: *Nitrogen, *Marsh, *Sediments, *Phosphorus, *Massachusetts, Ammonium, Mineralization, Transpiration, Diffusion, Advection, Interstitial water.

Cores for sediment and pore water analyses were taken from a small tidal, freshwater marsh at the head of the North River, between Hanover and Pembroke, Massachusetts. The marsh sediments lie on glacial till, 20 km upstream from the mouth of the North River. The sediments were waterlogged and highly organic. Organic nitrogen content did not change dramatically with depth. Sediments contain from 1.59 to 1.93% N on a dry weight basis. Ammonium concentrations decreased with depth but were always greater than nitrate concentrations. The depth distribution of ammonium is probably maintained by a dynamic balance between net microbial mineralization of litter, plant uptake, transpiration, diffusion, and porewater advection. Total organic phosphorus decreased steadily down to 20 cm. The TON:TOP ratio increased linearly from 14:1 at the surface to 32:1 at 20 cm and was then nearly constant to 70 cm. Phosphorus may be recycled less efficiently than nitrogen. Over time, proportionately more nitrogen than phosphorus may be incorporated into recalcitrant compounds. Phosphorus may also be more mobile than nitrogen in these marsh sediments. (Baker-IVI)
W85-02395

SEDIMENTATION CYCLE OF A FRESHWATER TIDAL FLAT IN THE ST. LAWRENCE ESTUARY,
Laval Univ., Quebec. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W85-02396

DISTRIBUTION AND SEVERITY OF TUNNEL GULLY EROSION IN NEW ZEALAND,
Ministry of Works and Development, Christchurch (New Zealand). Hydrology Centre.
I. H. Lynn, and G. O. Eyles.
New Zealand Journal of Science, Vol. 27, No. 2, p 175-186, 1984. 3 Fig, 7 Tab, 34 Ref.

Descriptors: *Gully erosion, *New Zealand, Land use, Climates, Erosion.

Data from the New Zealand Land Resource Inventory are used to describe the extent and severity of tunnel gully erosion in New Zealand. The total area of 428,000 ha (328,700 ha in the North Island and 99,300 ha in the South Island) within which tunnel gully erosion was reported is 1.6% of the total land area. Tunnel gully erosion in the North Island occurs mainly on sandstone and mudstone lithologies with yellow-brown earth group soils. In the South Island it is recorded mostly on loess-mantled slopes with yellow-grey earth group soils. Slopes of 16 to 35 degrees are affected the most. Two readily identifiable climatic zones contain tunnel erosion, sub-humid to semi-arid and humid. At least 4 distinctive environments were noted as areas of tunnel erosion: loess and mixed loess colluvium in sub-humid to semi-arid climates; soils derived from strongly weathered sedimentary rocks in humid climates; tephra deposits under a cool humid climate; and colluvial footslope deposits on North Island Tertiary sedimentary hill country with a humid climate. In the Northern Island tunnel gullies generally occur on less steep slopes than those in the South Island and, except for flow tephra environments, rarely develop into open gullies. (Baker-IVI)
W85-02412

RUNOFF AND EROSION RESPONSE OF RECLAIMED SURFACES,
Agricultural Research Service, Fort Collins, CO.
For primary bibliographic entry see Field 4D.
W85-02449

LIVE-BED SCOUR AT BRIDGE PIERS,
Auckland Univ. (New Zealand). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W85-02452

LIFT FORCES ON MOVING PARTICLES NEAR BOUNDARIES,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
B. M. Sumer.
Journal of Hydraulic Engineering, Vol. 110, No. 9, p 1272-1278, September, 1984. 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Fluid mechanics, *Suspended sediments, *Entrainment, Sedimentation, Roughness coefficient, Turbulence, Open-channel flow.

The determination of lift forces is necessary for the prediction of the entrainment and suspension of sediment particles. This study concerns the lift on a moving particle near the bottom (either smooth or rough) in turbulent open-channel flow. The lift force on a moving particle is calculated at the instant when the particle is lifted up from near the bottom. In the smooth wall case, the lift force appears to reach a weak maximum, and then decreases with the distance from the wall, while, in the rough wall case, it decreases appreciably with the distance from the wall. The lift force increases markedly with increasing bed roughness. The extra effect of rough wall on the lift force tends to disappear with the distance from the wall. (Baker-IVI)
W85-02455

TRANSFER OF PARTICULATE ORGANIC CARBON AND NITROGEN FROM THE YANGTZE RIVER TO THE OCEAN,
Woods Hole Oceanographic Institution, MA.
J. D. Milliman, Q. Xie, and Z. Yang.
American Journal of Science, Vol. 284, No. 7, p 824-834, September, 1984. 8 Fig, 1 Tab, 17 Ref. Office of Naval Research Contract N00014-81-C-0009.

Descriptors: *Sediment transport, *Nitrogen, *Rivers, *Yangtze River, *China, *Organic carbon, *Particulate matter, *Meybecks curve, Asia.

The Yangtze River transports 12 million tons of particulate organic carbon (POC) to the oceans annually, with a computed yield of 6 t/sq km of drainage basin area. Concentrations of POC can exceed 80 mg/L in near bottom waters but generally range from 4 to 40 mg/L throughout the water column. Most POC percentages vary from 1.7 to 4.0%, the percentage decreasing with increasing suspended matter concentration although at lesser gradient than that predicted by Meybeck, (Meybeck, Michel, 1981. River transport of organic carbon to the ocean, in Flux of Organic Carbon by Rivers to the Oceans: U.S. Office of Energy Research, Conf. 8009140, UC-11, p. 219-267; and Meybeck, Michel, 1982. Am. Jour. Sci., v. 282, p 401-450). The divergence from Meybeck's curve may reflect the anthropogenic influence of abnormally high POC concentrations within the Yangtze. If the high POC were the result of extensive farming in the basin, then a higher POC/TSM relation in autumn would be found than in early or late summer, but such is not the case. If there is an anthropogenic input, it is apparently continuous and not necessarily related to agriculture. Conversely, the observed POC trend in the Yangtze may be representative of turbid rivers in general or at least those in Asia which have considerable human influence. If the Yangtze POC-TSM relationship holds for other turbid rivers in Asia and Oceania, then the POC transport of sediment-rich rivers is significantly greater than that calculated by Meybeck by as much as 50%. (Baker-IVI)
W85-02467

MEANDERING-BRAIDED RIVER THRESHOLD: A REAPPRAISAL,
McGill Univ., Montreal (Quebec). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W85-02492

TURBID BOTTOM WATER LAYER AND BOTTOM SEDIMENT IN THE SETO INLAND SEA,
Government Industrial Research Inst., Tosu (Japan).
K. Kawana, and T. Tanimoto.
Journal of the Oceanographical Society of Japan, Vol. 40, p 175-183, 1984. 8 Fig, 4 Tab, 26 Ref.

Descriptors: *Suspended solids, *Turbidity, *Seto Inland Sea, *Japan, Vertical distribution, Resuspension, Particle size, Bottom sediments, Organic matter, Carbon, Nitrogen, Tidal currents.

Measurement of the vertical distribution of total suspended matter (TSM) was carried out during summer throughout the Seto Inland Sea. TSM concentration near the bottom is influenced significantly by water movement and turbid bottom water is observed in all areas where median grain size (Md phi) of the bottom sediment is more than 4 phi. The high concentration of TSM near the bottom may be due to resuspension of the surface layer of bottom sediments. Comparison of the organic content of the resuspended matter with that of the bottom sediment shows that the resuspended matter contains more organic matter with a lower C:N ratio than the bottom sediment. The C:N ratio of the resuspended matter is similar to that of TSM in the surface layer of the water column. It is thought that TSM in surface waters sinks and settles on the surface of the bottom sediment. This deposited material is then easily resuspended in the water column by tidal currents before becoming permanently incorporated into the bottom sediment. (Author's abstract)
W85-02530

CHANNEL CHANGES FOLLOWING STORM-INDUCED HILLSLOPE EROSION IN THE UPPER KOWAI BASIN, TORLESSE RANGE, NEW ZEALAND,
Oregon State Univ., Corvallis. Coll. of Forestry.
R. L. Beschta.
Journal of Hydrology, Vol. 22, No. 2, p 93-111, 1983. 10 Fig, 36 Ref.

Descriptors: *Erosion, *Upper Kowai Basin, *Torlesse Range, *New Zealand, Storms, Runoff, Chanels, Sediment transport, Sedimentation.

A downstream progression of depositional zones was created in the Upper Kowai Basin during a 1951 storm. Initial deposits were formed by debris flows and other mass failures. These sediments, aong with those from adjacent hillslopes, incised glacial deposits and tributaries, were then reworked by high flows to form additional deposits farther downstream. As distance downstream increased, the widths and lengths of the deposits increased and their depths decreased. Knowledge of this sequential development of depositional zones is fundamental for estimating sediment yields and understanding bed material transport through mountain stream systems. Although flow magnitude affects movement of bed material, sediment availability is an even more significant factor influencing the channel morphology of the Kowai River and its tributaries. (Baker-IVI)
W85-02554

LONG-TERM CHANGES IN CHANNEL WIDTHS OF THE KOWAI RIVER, TORLESSE RANGE, NEW ZEALAND,
Oregon State Univ., Corvallis. Coll. of Forestry.
R. L. Beschta.
Journal of Hydrology, Vol. 22, No. 2, p 112-122, 1983. 4 Fig, 17 Ref.

Descriptors: *Sediment transport, *Erosion, *Kowai River, *Torlesse Range, *New Zealand, Channels, Sediment load, Stream discharge.

Widths of active channels of the lower 2
the Kowai River measured on aerial pho
were used to evaluate channel response
creased sediment availability during 1943
Changes in active channel width of th
River for the period 1943 to 1980 sug
downstream progression of a major wav
material sediment. This wave was initiate
the 1951 storm as a result of storm-induc
lope erosion in the upper reaches of th
River Basin. In 1960, the leading edge of t
was located at a channel distance of about
from the basin divide. As of 1980 the
sediment has moved an additional 11 k
stream, and was only 6 km from the Wai
River confluence. Thus the leading edge w
translated at an average rate of several ki
per decade; an indication that consider
times occurred between the increase in
availability and the resultant downstream
responses. Although the Kowai River is
throughout most of its reach, a periodic
nent in active channel widths was ident
disappeared as the active channel significan
ened between 1972 and 1980. Relative cl
the active channel widths of braided stre
be used as a surrogate variable for indexin
dation where channel widths are not cor
by bedrock, man-made structures, or
banks. (Baker-IVI)
W85-02555

FORMS AND DISTRIBUTION OF CARB
SEDIMENTS OF CASTLE LAKE, CA
NIA, U.S.A.,
Michigan State Univ., Hickory Corners
Kellogg Biological Station.
For primary bibliographic entry see Field 2
W85-02648

TRACE METAL COMPOSITION OF A
CUMULATION RATES OF SEDIMEN
THE UPPER GULF OF THAILAND,
Skidaway Inst. of Oceanography, Savanna
For primary bibliographic entry see Field 5
W85-02654

MODEL FOR FLOW IN MEAND
STREAMS,
Washington Univ., Seattle.
For primary bibliographic entry see Field 2
W85-02671

2K. Chemical Processes

STUDIES ON CHEMICAL SPECIES
SOLVED IN SHALLOW GROUNDWATE
ARIMA RHYOLITE STRATA,
Konan Univ., Kobe (Japan). Dept. of Ch
Y. Kusaka, H. Tsuji, Y. Tamari, K. Nishimu
Y. Fujiwara.
Japanese Journal of Limnology, Vol. 45, N
93-99, April, 1984. 12 Fig, 3 Tab, 5 Ref.

Descriptors: *Sanda, *Nishiwaki, *Japan, *
cal analysis, *Groundwater, *Rhyolite,
quality, Hydrogen ion concentration, Wea
Geochemistry.

Chemical species of the shallow groundwa
lected from the Arima rhyolite strata aroun
and Nishiwaki cities are studied. Since the
cal composition of the igneous effusive
reasonably representative of rocks of the c
crust, the water quality is important from t
chemical and environmental viewpoints. T
centrations of 28 chemical species, pH and
determined by conventional chemical and
activation analyses. By showing log-norma
bution character of the concentrations, the
value schematically obtained in the freque
tribution curve is proposed as most suitabl
chemical composition of groundwaters
strata. It is also pointed out that the CO2 w
ing process is the most dominant phen
controlling the water qualities. (Author's a
W85-02251

LT LAKES AND THEIR ORIGINS IN XIN-NG, CHINA (IN CHINESE),
ghai Inst. of Salt Lake, Xining (China).
primary bibliographic entry see Field 2H.
5-02383

TER QUALITY IMPLICATIONS OF ARTI-IAL FLOW FLUCTUATIONS IN REGULAT-RIVERS,
ughborough Univ. of Technology (England).
pt. of Geography.
R. Foulger, and G. E. Petts.
ence of the Total Environment, Vol. 37, No. 2 3, p 177-185, August, 1984. 2 Fig, 1 Tab, 24

scriptors: *Water quality control, *Rivers, ow control, Chemical properties, Conductivity, cium, Nitrate, Suspended solids, Water re-rces development, Environmental effects.

liminary data collected for seven releases of solute concentration water from Llyn Celyn a channel containing water of significantly ater concentration, indicate that changes in er chemistry during wave passage may be more plex than suggested by simple solute balance ations which show that a simple dilution will ur simultaneously with rising stage. The chemi-determinands showed peak concentrations im-liately prior to peak stage and a lagged dilution. plication of the kinematic-wave theory did not quately explain the observed data, and it ap-rs that solute variations with discharge, are ted to in channel sources, and correlated with decay of the suspended loads, which lasted on rage for 1 hr after a marked peak. This peak is cident with the attainment of maximum dis-rge. Sudden changes of water level in regulated rs are undertaken in response to demands for tricity, irrigation, and flood control. The deter-ation of instream-flow needs for river ecology it consider the acceptable range, rate, and fre-ncy, for flow fluctuation as well as minimum optimum flows. Due consideration must be en not only to the immediate destructive effects large magnitude fluctuations but also to the mulative effects of repeated, relatively low mag-de pulses which, although sublethal, could minate a species over time by adversely affecting roduction or growth, or by favoring a competi-or predator. (Baker-IVI)
5-02413

VERSE WEATHERING IN THE CLOSED-SIN LAKES OF THE ETHIOPIAN RIFT,
ssachusetts Inst. of Tech., Cambridge. Dept. of th and Planetary Sciences.
L. Von Damm, and J. M. Edmond.
erican Journal of Science, Vol. 284, No. 7, p -862, September, 1984. 12 Fig, 4 Ta, 42 Ref.

scriptors: *Reverse weathering, *Closed-basin s, *Rift Valley, *Ethiopia, Chemical proper-, Clay, Salts, Saline waters, Alkalinity, Evapo-on, Calcite, Gypsum, Minerals.

detailed investigation has been carried out on chemistry of continental waters including the Valley Lakes of East Africa. For most of the em, the hydrology is simple and well defined. aporative concentration never proceeds to the nt that the chemistry becomes dominated by precipitation of simple salts. Therefore the cts of fundamentally more important processes authigenic clay mineral formation can be ob-ved directly. The soluble major ions are being oved on an impressive scale. In closed-basin s displaying intermediate degrees of evapora-concentration relative to their inputs the only ple salts that can precipitate are calcite (usually low-magnesium variety) and minor gypsum. re complex removal processes affecting the or cations and alkalinity can be investigated ig mass-balance techniques. Through the appli-on of this process to the lakes of the Ethiopian t it is determined that formation of alumino-cate minerals, reverse weathering, is a major cess accounting for over half the alkalinity defi-in the mass balances. The process does not go completion, however, and alkaline waters result. The reasons such reactions are not important in the oceans is that the maintenance of a relatively low pH by ridge-crest hydrothermal processes in fact precludes their occurrence. (Baker-IVI)
W85-02468

STREAM ECOSYSTEMS IN MOUNTAIN GRASSLAND (WEST CARPATHIANS); 3. CHEMICAL COMPOSITION OF WATER,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
M. Bombowna.
Acta Hydrobiologica, Vol. 24, No. 4, p 321-335, 1982. 4 Fig, 2 Tab, 32 Ref.

Descriptors: *Streams, *Land use, *Water quality control, *West Carpathians, *Poland, Vegetation, Forests, Runoff, Nutrients, Pastures, Erosion, Chemical analysis, Catchments, Phosphates, Nitrogen.

In three mountain streams flowing out of different geological massifs the chemistry of the water was investigated in a two year period. In mountain areas total rainfall is high and plays an important role in the water balance of streams. The flow of stream water affects the load of mineral nutrients and basic cations carried by them. These values varied considerably in different seasons of the year. This pronounced variability of loads throughout the year affected the mean rate of flow of chemical constituents per 1 ha in the different sectors of the Grajcarek catchment basin. A distinct dependence between the geological substratum and the degree of chemical erosion of the chief macroelements was observed. The pastoral use of the catchment basins led to an output of nutritive compounds, while the forest drainage area yielded large amounts of mineral nitrogen compounds. The cumulated fertilization of mountain pastures was reflected by the constant occurrence of phosphates in the stream water and by a pronounced increase in the flow of mineral nitrogen compounds. Permanent pasturing of sheep has been proposed for the investigated catchment basin, hence the cumulated fertilization and, in consequence, increased concentration of nutritive compounds in the water of streams should be taken into consideration. Since large amounts of both ground discharge and runoff appear in the investigated catchment area, the application of fertilizers on frozen soil and before heavy rains should be forbidden. Protective juniper or forest belts between pastures and streams might prevent the flow of suspension and, by using up considerable amounts of nutrients, especially phosphates inhibit their being carried in the streams. (Baker-IVI)
W85-02514

BEHAVIOUR OF PROTEINACEOUS SUBSTANCES IN THE ESTUARY OF THE TAMA RIVER,
Tokyo Univ. of Agriculture and Technology (Japan). Dept. of Environmental Science and Conservation.
For primary bibliographic entry see Field 2L.
W85-02531

EFFECTS OF CANOPY COMPONENTS ON THROUGHFALL CHEMISTRY: AN EXPERIMENTAL ANALYSIS,
Dartmouth Coll., Hanover, NH. Dept. of Biological Sciences.
W. A. Reiners, and R. K. Olson.
Oecologia (Berlin), Vol. 63, No. 3, p 320-330, August, 1984. 6 Fig, 1 Tab, 35 Ref. NSF grant DEB 79-07346.

Descriptors: *Canopy, *Throughfall, *Forests, *Stemflow, Water chemistry, Potassium, Sodium, Nitrates, Ammonium, Rainfall.

To test the influence of various components on throughfall and stemflow chemistry, five canopy components of subalpine balsam fir forests (branches with young needles, branches with old needles, non-foliated twigs, lichen-covered twigs, and boles) were treated with simulated rain. Effects on the fluxes of potassium, sodium, hydrogen, sulfate, nitrate, and ammonium ions by the canopy components were tested in relation to rain application rate, duration of rain, and time since the last rain. Complex interactions were noted between the ionic behavior and components. The ionic behavior generally ranged from high levels of net efflux to mixed influx-efflux to high levels of influx in the order: sulfate, potassium, sodium, nitrate, hydrogen, ammonium. Net flux rates increased with application rate in cases in which application rates produced significantly different results. Branch components mostly ranged from low flux rates to high rates according to the order: young needles < old needles < twigs < lichen-covered twigs. (Baker-IVI)
W85-02560

MICROELECTRODE STUDIES OF INTERSTITIAL WATER CHEMISTRY AND PHOTOSYNTHETIC ACTIVITY IN A HOT SPRING MICROBIAL MAT,
Montana State Univ., Bozeman. Dept. of Microbiology.
N. P. Revsbech, and D. M. Ward.
Applied and Environmental Microbiology, Vol. 48, No. 2, p 270-275, August, 1984. 5 Fig, 30 Ref. NSF grant DEB-8023341.

Descriptors: *Hot springs, *Microbial mats, *Photosynthesis, Dissolved oxygen, Hydrogen ion concentration, Synechoccus, Chloroflexus, Bacteria, Cyanophyta, Solar radiation, Diurnal variation, Primary productivity.

Microelectrodes were used to measure oxygen, pH, and oxygenic photosynthetic activity in a hot spring microbial mat (Octopus Spring, Yellowstone National Park), where the cyanobacterium Synechoccus lividus and the filamentous bacteria Chloroflexus aurantiacus are the only known phototrophs. The data showed very high biological activities in the topmost layers of the microbial mat, resulting in extreme values for oxygen and pH. At a 1-mm depth at a 55 C site, oxygen and pH reached 900 micro M and 9.4, respectively, just after solar noon, whereas anoxic conditions with pH of 7.2 were measured before sunrise. Although diurnal changes between these extremes occurred over hours during a diurnal cycle, microbial activity was great enough to give the same response in 1 to 2 min after artificial shading. Oxygenic photosynthesis was confined to a 0.5- to 1.1-mm layer at sites with tempetatures at or above about 50 C, with maximum activities in the 55 to 60 C region. The data suggest that S. lividus is the dominant primary producer of the mat. (Author's abstract)
W85-02593

CHARACTERIZATION OF PARTICULATE AND COLLOIDAL PHOSPHORUS FORMS IN WATER BY CONTINUOUS FLOW DENSITY GRADIENT CENTRIFUGATION,
Uppsala Univ. (Sweden). Limnologiska Institutionen.
For primary bibliographic entry see Field 2H.
W85-02614

TRANSFERS BETWEEN FORMS OF SEDIMENTARY PHOSPHORUS INDUCED BY NITRATE TREATMENT,
Uppsala Univ. (Sweden). Limnologiska Institutionen.
For primary bibliographic entry see Field 2H.
W85-02621

CALCULATION OF PHOSPHORUS AND NITROGEN LOADINGS TO NATURAL AND ARTIFICIAL LAKES,
Iowa State Univ., Ames. Dept. of Animal Ecology.
For primary bibliographic entry see Field 2H.
W85-02622

CHEMICAL CHARACTERISTICS OF SEVERAL INLAND WATERS IN AFGHANISTAN,
National Inst. for Environmental Studies, Tsukuba (Japan).
Y. Ambe.

Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 289-295, July, 1984. 3 Fig, 3 Tab, 5 Ref.

Descriptors: *Groundwater, *Rivers, *Afghanistan, *Chemical composition, Chlorides, Sulfates, Bicarbonates, Metals, Precipitation, Groundwater, Alkaline waters, Climate, Topography, Geology.

The general chemical components of the inland waters of Afghanistan are described and the relationship of this chemical composition to the environment is considered. Most of the rivers of the country have their origin in the central mountain region and run toward the periphery of the country. The average annual precipitation is about 300 m at Kabul and most of the rain falls in winter to early spring. Evaporation is high and irrigation is needed to farm the land. The highest values of dissolved components observed for river water were found at Qaleh-nau on River Mogol and at Akcha for groundwater. Both showed a predominance of Ca, Mg and sulfate and well as sodium and chloride. All the waters had alkaline properties with the value of pH being 7.2 - 8.2. Extremely high concentrations of total ions in river water appears only in the area below 1000 m. At present no remarkable effect due to human activity has been found in the quality of inland water in Afghanistan; it lies mainly under the influence of the arid climate, soil and other geographical conditions. The river and groundwaters are characterized by their high concentrations of Ca and HCO3(-) and the other components are diversified by local geological and hydrological conditions. The topography of the land is an important factor. High concentrations of ions were found in rivers in the lowland area. (Baker-IVI)
W85-02628

SULFATE IN AFRICAN INLAND WATERS: SULFATE TO CHLORIDE RATIOS,
P. Kilham.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 296-302, July, 1984. 1 Fig, 24 Ref. NSF grants GB-8328X and OCE81-17377.

Descriptors: *Sulfates, *Chlorides, *Chemical composition, *Africa, Biogeochemistry, Natural waters, Maar lakes, Saline lakes, Lakes, Rivers, Precipitation, Rocks, Weathering.

Sulfate versus chloride concentrations are plotted for 400 African waters. Sulfate to chloride ratios in these waters can be used to distinguish between atmospheric precipitation and rock weathering as sources of sulfate. This study demonstrated that sulfate in headwater streams is largely derived from rock weathering. The biogeochemical processes that remove sulfate and lower sulfate/chloride ratios are of particular importance in natural waters because the net biological uptake of sulfate results in the production of permanent alkalinity. Sulfate is primarily lost from these freshwater environments as organic-S compounds, which either remain intact or undergo diagenesis to eventually form pyrite. In studying the loss of sulfate sulfur in 11 of the maar lakes that comprise the Basotu Lake District in Tanzania, sulfate is reduced to sulfide before it is lost to the atmosphere as hydrogen sulfide or precipitated as metal sulfides. One outstanding feature of the sulfate/chloride ratios of most of the saline lakes is that they are usually less than one order of magnitude lower than that of their presumed parent waters. Seven of the eight shallow lakes in the Katwe Volcanic Field are highly concentrated. These lakes differ from most of the other saline lakes in East Africa because minerals containing sulfate precipitation from them. Lake Kitagata has an exceptionally high sulfate/chloride ratio of 3:1. (Baker-IVI)
W85-02629

MEASUREMENT OF OPERATIONALLY DEFINED LEAD FRACTIONS IN SEDIMENTS FROM SEVERAL LAKES,
Trent Univ., Peterborough (Ontario).
For primary bibliographic entry see Field 5B.
W85-02632

ALUMINUM SPECIATION IN SURFACE WATERS ON THE CANADIAN PRE-CAMBRIAN SHIELD,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
P. G. C. Campbell, R. Bougie, A. Tessier, and J.-P. Villeneuve.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 371-375, July, 1984. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Surface waters, *Aluminum, *Chemical speciation, *Precambrian shield, Acidity, Thermodynamics, Acid rain, Water quality.

Aluminum introduced into the aquatic environment through acidification of the environment will be partitioned among various possible physicochemical forms. The resultant speciation will influence the subsequent geochemical behavior of the metal and its biological availability. A simple analytical method is presented for determining the speciation of aluminum in freshwaters inherently sensitive to acid precipitation. The procedure was tested on a variety of natural waters to relate the experimentally determined Al speciation to various other water quality parameters and to compare this speciation with that calculated from thermodynamic equilibrium considerations. The speciation procedure allows one to distinguish among different forms of aluminum on the basis of both their physical state and their kinetic and thermodynamic properties. A considerable range of total aluminum concentrations was observed for each group of lakes. The higher concentrations of aluminum were generally associated with low pH readings. Relatively little of this aluminum was present in acid-extractable particulate form. The major portion of the nonexchangeable Al initially appears to be associated with organic matter. (Baker-IVI)
W85-02634

ORIGIN AND DISTRIBUTION OF CARBON DIOXIDE IN THE UNSATURATED ZONE OF THE SOUTHERN HIGH PLAINS OF TEXAS,
Geological Survey, Reston, VA.
W. W. Wood, and M. J. Petraitis.
Water Resources Research, Vol. 20, No. 9, p 1193-1208, September, 1984. 13 Fig, 4 Tab, 58 Ref.

Descriptors: *Carbon dioxide, *Geochemistry, *Aeration zone, *High Plains, *Texas, Groundwater recharge, Carbonates, Microorganisms, Caliche, Ogallala aquifer, Playa lakes.

The partial pressure of carbon dioxide gas in the unsaturated zone is a major control on the carbonate chemistry of recharge water to an aquifer as well as on the deposition and solution of carbonate minerals in the recharge area. Partial pressures of CO2, O2, N2, and Ar were monitored at two locations near playas on the Southern High Plains of Texas. Samples were collected monthly during parts of 1980-1981 from nine depths ranging from 0.6 to 36 meters below land surface. PCO2 was observed to be greater at depth than in the active soil zone and thus appears to contradict the normal process in which CO2 is generated in the soil zone and diffuses upward to the atmosphere and downward to the water table. The delta C-13 of the CO2 gas was quite uniform and averaged -17.9 per mil. PO2 declined with depth, suggesting in situ generation of CO2 by the oxidation of carbon. The most probable hypothesis was that dissolved and particulate organic carbon introduced by recharging water was oxidized to CO2 by the aerobic microbial community that utilized oxygen diffusing in from the atmosphere. This hypothesis is consistent with the CO2 concentration profile, calculated production profile of CO2, delta C-13 values of CO2 gas, caliche, soil humic acid fraction, and dissolved carbonate in groundwater. Carbonate dissolution is not limited to the near-surface soil zone, a conclusion that explains observed solution permeability and the origin of large cavities in the Ogallala aquifer. The origin of playa lakes on the Southern High Plain may be intimately involved with carbonate dissolution and piping of materials into the unsaturated zone (Moore-IVI)
W85-02661

2L. Estuaries

ABOVE GROUND STANDING CR PRODUCTION OF CAREX GRACIL IN A FEN,
Marburg Univ. (Germany, F.R.). Fachbe logie
M. Droste.
Archive fur Hydrobiologie, Vol. 100, No 538, July, 1984. 2 Fig, 1 Tab, 12 Ref.

Descriptors: *Wetlands, *Fen, *Sedg *Standing crops, Biomass, Trophic level productivity, Alluvial clay.

Above ground standing crop of Carex gr measured by harvest method at six dates d growing season. Climatic conditions ar area were temperate. The fen is situa valley; the soil remains wet all year. The soil consisted of peat and alluvial clay. mass reached 1.009 g/sq m of which 80 were living biomass in early September. mass corresponds to yearly net produc litter amounts to about 800 g/sq m/yr. As of living tissue changed from 6.1% in Ma in July and to 5.6% in October. The c not to the warmest month but to heat uni high production are regarded to be resu quite maritime climate of Europe and t soil of the study site. (Baker-IVI)
W85-02242

AMOUNTS OF SUSPENDED SOLI ELEMENTS TRANSPORTED AN FROM THE TAKAHASHI RIVER (JA ESTUARY (IN JAPANESE),
Okayama Univ., Kurashiki (Japan). Inst. cultural and Biological Sciences.
H. Teraoka.
Japanese Journal of Limnology, Vol. 45, 111-115, April, 1984. 3 Fig, 3 Tab, 17 Ref.

Descriptors: *Takahashi River, *Japan, * ed solids, *Estuarine environment, *Chem ysis, Discharge, Rainfall.

Concentrations of suspended solids and di were measured in the period from 1975 t the Takahashi River systems (111 km long km drainage basin). The sampling site was up the estuary, where the riverbed average above sea level. When the flux of suspen (g/sec) and the discharge (cu m/sec) were on Y axis and X axis, respectively, the rela Y = 2.02 Log X - 0.83 (n = 75, r = 0 found. By substituting the regression line daily average discharge, the flux of su solid (g/day) was estimated. When disch creased very greatly as a result of heavy between June 29 and July 1, 1979, its am hr) was estimated by substituting the abov sion for the hourly average discharge. T amount of suspended solids transported 1979 from river to estuary was estim 7,500,000 kg/yr (discharge: 1,976,000,000 yr), while the amount for the day of reached 28,000,000 kg/day (or 37% of the comparison between the average daily co tions of elements and their concentrations June 29th heavy discharge day was under fully appreciate the effect of heavy rains. (A abstract)
W85-02253

LAGRANGIAN TRANSPORT MODEL F TUARIES,
Najarian, Thatcher and Associates, Inc., NJ.
T. O. Najarian, D.-P. Wang, and P.-S. Huan
Journal of Waterway, Port, Coastal and Engineering, Vol. 110, No. 3, p 321-333, 1984. Maryland Power Plant Siting Progra tract P78-81-04.

Descriptors: *Model studies, *Estuaries, *I gian transport, Circulation, Flow pattern ment transport.

ie applicability of a two-dimensional transient odel for investigations of residual currents in lal waters is demonstrated. The modeling ap- oach appears more versatile and less restrictive an the analytical solution techniques. Tide in- ced mean Lagrangian flows in rectangular and sloping bottom, homogeneous estuaries are land- ard in the surface layers and seaward in the ttom layers. This flow pattern is opposite to the ttern generated by density induced circulation. nsitivity analysis made in channels with a ttom sill and quadratic friction result in mean igrangian flows that are diverging in the surface /ers and converging in the bottom layers. Such a w pattern is not exhibited when computations e made with linear boundary friction assumption. channels of small tidal amplitude, mean current due to the density forcing. The time-varying al currents modify only the eddy coefficients. r modest tidal ampitude, mean current is also nerated by the nonlinear tidal forcing. The tide- luced current usually opposes density induced rrent, and it also modifies salinity distribution by vection. The net effect is weak Lagrangian cir- lation and a more homogeneous vertical salinity ofile. Prediction of mean velocity and salinity tribution in estuaries of strong tidal flow must lude the joint effects of density and nonlinear- . This is because density and nonlinear tidal cing are coupled. The formulation of the Stokes locities are based on the small amplitude dis- icement approximation. (Baker-IVI)
85-02279

ATTERNS OF SUSPENDED PARTICLE DIS- IBUTION AND TRANSPORT IN A LARGE ORDLIKE ESTUARY,
tional Oceanic and Atmospheric Administra- n, Seattle, WA. Pacific Marine Environmental b.
T. Baker.
rnal of Geophysical Research, Vol. 89, No. C4, 6553-6566, July, 1984. 14 Fig, 1 Tab, 39 Ref.

scriptors: *Puget Sound, *Washington, *Sus- ded sediments, *Estuarine environment, *Sedi- nt transport, Water circulation, Seawater, Tur- ity.

asonal and spatial patterns of the distribution and nsport of suspended particles in Puget Sound, a ge fjordlike estuary, are a product of the interac- n of the subtidal circulation with surface and tom particle sources. The particle distribution fers from the distribution of hydrographic prop- ies and is characterized by four persistent fea- es: (1) a thin (< 10 m), high-turbidity surface er, (2) a thick (approximately 50 m), low-turbid- zone centered around the level of no net motion ween net seaward and landward flow, (3) hori- ntal particle fronts at the sill entrances, and (4) a tom nepheloid layer maintained by local resu- nsion. Removal of particles from the surface ters by advective downwelling at the seaward and gravitational settling throughout the basin ke Puget Sound an efficient particle trap. Parti- s sedimented on the basin floor are transported ferentially landward by the action of erosion/ osition cycles enhanced by fortnightly intru- ns of new marine water. (Author's abstract)
85-02294

TTER RATIONALE FOR WETLAND MAN- EMENT,
lson (R. Wayne) and Associates, Inc., Boulder,).
W. Nelson, and E. C. Weller.
vironmental Management, Vol. 8. No. 4, p 295- , July, 84. 4 Fig, 5 Tab, 41 Ref.

scriptors: *Wetland management, *Resources nagement, *Wetlands, Clean Water Act, Natu- resources, Resources development, Environ- ntal protection, Environmental impact.

e present US Federal wetland management itegy under Section 404 of the Clean Water Act s not account for the difference in the natural ues of wetlands and their different vulnerability development pressure. The strategy, aimed at ucing the regulatory burden, provides for dif- ferent levels of wetlands protection, primarily by designating certain activities in or affecting wetlands as essentially harmless, having only minor impacts even when considered for their cumulative effects. Such activities are authorized under general permits precluding any evaluation of project impacts. A sounder, yet practical, rationale for wetland management and regulatory relief should be linked to the scarcity of certain wetland habitats, the habitat diversity or carrying capacity, the degree of degradation from past development, and the incremental losses already incurred within the same wetland ecosystem. The regulatory effort should be concentrated where these characteristics indicate high-value wetlands. Wetland impacts appear to fit into five basic orders of magnitude; these pertain to the relative cost and difficulty of impact mitigation. Up to 13 ecological and public-interest variables can modify the seriousness of the basic impact. Together, the basic orders of impact and modifying variables describe the theoretical framework for wetland managment. However, a practical rationale for better wetland management must be constrained to factors not requiring a field investigation in advance of project planning for construction and development. (Author's abstract)
W85-02295

DIURNAL COURSE OF PLANT WATER POTENTIAL, STOMATAL CONDUCTANCE AND TRANSPIRATION IN A PAPYRUS (CYPERUS PAPYRUS L.) CANOPY,
Trinity Coll., Dublin (Ireland). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W85-02341

ECOLOGICAL STUDIES OF THE MOBARA-YATSUMI MARSH. MAIN PHYSICAL AND CHEMICAL FACTORS CONTROLLING THE MARSH ECOSYSTEM,
Hokkaido Univ., Sapporo (Japan). Dept. of Biosystem Conservation.
K. Yabe, and M. Numata.
Japanese Journal of Ecology, Vol. 34, No. 2, p 173-186, June, 1984. 11 Fig, 3 Tab, 23 Ref.

Descriptors: *Marshes, *Ecosystems, *Physicochemical properties, Wetlands, Japan, Water level, Dissolved oxygen, Succession, Vegetation, Ecology, Swamps, Meadows, Thickets.

The ecosystem in the Mobara-Yatsumi marsh was found to be mainly controlled by the following factors: mean water level, fluctuation of water level, thickness of muck layers and DO of surface water. Of these, mean water level was effective independently, while fluctuation of water level, thickness of muck layers and DO were closely correlated with each other. Among the correlated factors, the most rudimentary factor appeared to be the fluctuation of water level. The successional process was estimated from the relationship between environmental factors and vegetation types. In the process of succession, two types were supposed: the reed swamp - grassy meadow - grass-forb meadow - alder thicket type; and the reed swamp - tussock meadow - alder thicket type. The former occurred under conditions of large fluctuation of water level and underdevelopment of muck layers, but the latter occurred in areas where small fluctuations of water level and thick mucks were observed. The oxidation-reduction potential of soil in the tussock meadow was lower than that in the grassy meadow and the grass-forb meadow. In the process of succession, the tussock meadow maintained the stable phase due to the anaerobic condition of the soil. (Author's abstract)
W85-02381

RELATIONSHIPS BETWEEN ELECTRICAL CONDUCTIVITY, CHLORINITY AND DENSITY OF COASTAL WATERS OF CHINA (IN CHINESE),
Shandong Coll. of Oceanology (China).
X. Min, G. Chen, W. Han, and C. Congjie.
Oceanologia et Limnologia Sinica, Vol. 15, No. 1, p 82-90, 1984. 2 Fig, 9 Tab, 22 Ref.

Descriptors: *Conductivity, *Chlorinity, *Density, *Coastal waters, *China, Mathematical equations, Salinity.

This paper deals with the relationships between electrical conductivity, chlorinity and density of coastal waters of China. The basic equations are as follows: sigma 25 = -2.727 + 1.346 Cl; C(s,25,0) = 5.371 + 2.472 Cl; sigma 25 = -5.660 + 0.545C(s,25,0). When the salinity values are higher than 32.5, the values of density by the Knudsen's Hydrographical Table are a little higher than that of the measured and the values calculated from Cox's equation are much higher than that of the measured. The relationship between salinity and density is closer if the values of salinity and density are calculated directly from the electrical conductivity than from the chlorinity. Taking 53.160 mQ-1/cm as the value of C(35,25,0) in the above equation is appropriate for calculating the values of electrical conductivity of coastal waters of China. (Author's abstract)
W85-02382

NITROGEN AND PHOSPHORUS IN THE SEDIMENTS OF A TIDAL, FRESHWATER MARSH IN MASSACHUSETTS,
Marine Biological Lab., Woods Hole, MA. Ecosystems Center.
For primary bibliographic entry see Field 2J.
W85-02395

SEDIMENTATION CYCLE OF A FRESHWATER TIDAL FLAT IN THE ST. LAWRENCE ESTUARY,
Laval Univ., Quebec. Dept. of Civil Engineering.
J.-B. Serodes, and J.-P. Troude.
Estuaries, Vol. 7, No. 2, p 119-127, June, 1984. 6 Fig, 1 Tab, 22 Ref.

Descriptors: *Tidal flats, *Sedimentation, *St. Lawrence Estuary, *Cap-Tourmente Tidal Flat, *Quebec, Estuaries, Accretion, Seasonal variation, Erosion, Vegetation, Geese.

The Cap-Tourmente tidal flat is located on the north shore of the St. Lawrence middle estuary, 50 km downstream from Quebec city. The annual sedimentological cycle is characterized by very rapid changes which occur during four separate periods. There are two periods of intense erosion in May and October-November which precede and follow a period of very active accretion of approximately 100 days. Of the various factors influencing summer accretion, the most important is the very gradual slope of the upper part of the marsh as it results in a large area which is submerged only at the end of the tidal cycle and therefore is subject to low currents. Vegetation can grow in this part of the flat thereby providing protection against resuspension by tidal currents and wind-induced waves. An unusual factor of erosion is the very large flocks of snow geese which destabilize the sediment cover by walking and probing in the sediment with their beaks, and destroy the protective vegetation cover in a matter of days in the fall. This role of the vegetation in favoring the summer accretion is confirmed by measurements of tidal currents at different positions within the vegetation band in June when the plants are very short and in September when they reach their maximum development. The energy of floods is higher than the ebb resulting in an outflow with a weaker carrying capacity than the inflow. The vegetation modifies the direction of flood currents, orienting them landward, and the direction of ebb current, orienting them perpendicularly to the shoreline. (Baker-IVI)
W85-02396

FOULING COMMUNITY OF THE LOXAHATCHEE RIVER ESTUARY, FLORIDA, 1980-81,
Geological Survey, Tampa, FL.
B. F. McPherson, W. H. Sabanskas, and M. Sabanskas.
Estuaries, Vol. 7, No. 2, p 149-157, June, 1984. 4 Fig, 4 Tab, 19 Ref.

Descriptors: *Estuaries, *Fouling, *Loxahatchee River Estuary, *Florida, Salinity, Temperature effects, Nutrients, Seasonal variation, Barnacles, Mollusks.

The Loxahatchee River estuary is located roughly midway between Biscayne Bay and the Indian

River. It possesses a distinct salinity gradient from freshwater to seawater. Fouling macroinvertebrates belonging to 8 phyla and 10 classes were collected from seawalls, piers, bridges, and mangroves in the estuary. Barnacles and mollusks were the most widely distributed and conspicuous of the fouling macroinvertebrates on these substrates. Hydroids and colonial ascidians were also abundant and conspicuous at some locations. Eight species of barnacles were found, each with a distinct distribution. Some mollusks such as the oyster, Crassostrea virginica, were abundant and widely distributed. Other species had more restricted distributions. The fouling invertebrates that settled and grew on the test panels were predominantly barnacles, hydroids, bryzoans, tube-building amphipods, serpulid polychaetes, and colonial ascidians. Monthly growth varied with season and with location within the estuary. Growth at most sites was lowest in January. Maximum growth occurred during mid-summer to early autumn at the downstream sites, and during late spring or early summer at the upstream sites, before discharge in the river substantially lowered salinity. Periodically low salinity conditions at some test sites inhibited growth cycles. (Baker-IVI)
W85-02398

ZOOPLANKTON ASSOCIATIONS IN THE SWAMPS OF SOUTHERN SUDAN,
Westfield Coll., London (England). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W85-02406

ANALYSIS OF TIDAL RIVER RECORDS BY A HARMONIC REGRESSIVE TECHNIQUE,
Ministry of Works and Development, Christchurch (New Zealand). Water and Soil Science Centre.
D. G. Goring.
Journal of Hydrology, Vol. 73, No. 1/2, p 21-37, July, 1984. 7 Fig, 3 Tab, 8 Ref.

Descriptors: *Tidal rivers, *Flow, Mathematical equations, Flood forecasting, Frequency analysis, Harmonic regressive technique.

A method for calculating the tidal constituents from a period of tidal record is described. The method uses a harmonic approach which allows it to be applied to records which are not entirely tidal, but have some river flow as well. By transforming the time record to the frequency domain, the river contribution can be separated from the tide. The frequency profile of each constituent that it is wished to identify is computed. Then a least squares method is used to evaluate the coefficients of the profiles which correspond to the amplitude and phase of the tidal constituents. For tidally affected river records, the quarter-diurnal constituents tend to be more important than is the case for pure tidal records. This has the effect of distorting the tidal curve and it is suggested that this is caused by nonlinear shallow-water effects. The tidal constituents calculated by this method may be used to predict the tide during periods of steady flow. During periods of nonsteady flow, such as floods, the predictions may be considerably in error because of nonlinear effects in the interaction of the tide with the river flow. These errors take the form of an over estimation of the water level. For simulation, such as is used in engineering design, this represents a conservative estimate and is probably satisfactory. For real-time flood forecasting, information about the current level of the forecasting site needs to be incorporated into the forecasting algorithm. (Baker-IVI)
W85-02457

PRIMARY PRODUCTION IN GRAYS HARBOR ESTUARY, WASHINGTON,
Corps of Engineers, Seattle, WA. Environmental Resources Section.
R. M. Thom.
Bulletin of Southern California Academy of Science, Vol. 83, No. 2, p 99-105, 1984. 1 Fig, 1 Tab, 28 Ref.

Descriptors: *Primary productivity, *Estuaries, *Grays Harbor Estuary, *Washington, Benthic environment, Algae, Phytoplankton, Eelgrass.

The first estimate is presented of total annual primary production for Grays Harbor estuary. This estuary is a large drowned river mouth located on the Pacific coast of Washington. The estuary is characterized by extensive tideflats, channels, and fringe marshes. Several rivers drain into the estuary, the primary one being the Chehalis River located at the eastern end of the estuary. Tides are semidiurnal with mean range of 2.4 m at Aberdeen. The extensive shallow tideflats are occupied by eelgrass and benthic algae. These vegetation types account for the vast majority of carbon fixation within the estuary annually. The green algal Enteromorpha/Blidingia complex had the greatest rate followed by two marsh assemblage types and the eelgrass Zostera marina. Phytoplankton exhibited the lowest rate. Average annual total primary production in the estuary was estimated to be 260000 kgC/sq km. (Baker-IVI)
W85-02470

SEDIMENT-WATER EXCHANGE IN SHALLOW WATER ESTUARINE SEDIMENTS,
Washington Univ., Seattle. School of Oceanography.
For primary bibliographic entry see Field 5B.
W85-02473

ECOLOGICAL VARIATION OF MIRE SITE TYPES IN THE SMALL KETTLE-HOLE MIRE HEINISUO, SOUTHERN FINLAND,
Finnish Forest Research Inst., Helsinki. Dept. of Peatland Forestry.
A. Reinikainen, T. Lindholm, and H. Vasander.
Annales Botanici Fennici, Vol. 21, No. 1, p 79-101, 1984. 16 Fig, 8 Tab, 100 Ref.

Descriptors: *Peat bogs, *Mire, *Chemical reactions, *Vegetation, *Heinisuo, *Finland, Soil water, Topography, Water analysis, Water level.

Combinations of physical and chemical factors, especially those connected with hydrology and nutrient ecology, are examined in relation to the mire site types and vegetational variation on Heinisuo. Fifteen different mire site types, varying from ombrotrophic to eutrophic, were distinguished on a 3 ha kettle hole mire, Heinisuo, southern Finland. Due to its topograhy and hydrology, Heinisuo has remained in a rather fertile stage throughout its development. The mineral contents were usually in the upper end of the range of values reported from similar site types in larger mires. Due to the fluctuations of the ground water and rapid surface flow, three different groups of mire site types could be separated on the relationship between the thickness of the aerobic peat layer and the depth of the water table. The chemical analyses also revealed intercorrelated groups of elements. The vegetation and site types change along a complex gradient involving both the water level and its fluctuations and the nutrient regime. Due to horizontal water movement, the fertile lagg zone is broad and the ombrotrophic part of the mire is of minor importance. (Baker-IVI)
W85-02485

BEHAVIOUR OF PROTEINACEOUS SUBSTANCES IN THE ESTUARY OF THE TAMA RIVER,
Tokyo Univ. of Agriculture and Technology (Japan). Dept. of Environmental Science and Conservation.
N. Ogura, Y. Tanaka, J. Itoh, and K. Takahashi.
Journal of the Oceanographical Society of Japan, Vol. 40, p 184-191, 1984. 4 Fig, 3 Tab, 19 Ref.

Descriptors: *Estuarine environment, *Proteinaceous substances, *Tama River, *Japan, Mixing, Flocculation, Particulates, Dissolved solids, Salinity, Sea water, Organic matter.

During estuarine mixing, some of the dissolved organic and inorganic matter is removed by flocculation. Behavior of dissolved and particulate proteinaceous substances in the estuary of the Tama River (Japan) was investigated through observations and laboratory experiments. Tama River rises in the mountains of Yamanashi Prefecture and runs through the southern part of Tokyo before flowing into Tokyo Bay. Concentrations of dissolved proteinaceous substances in estuarine water were determined at eight stations between the mouth of the Tama River and a point 5 km upstream, and expressed in terms of L-tyrosine phenol active substances (FPAS). FPAS decreased with increasing salinity and the proportion of high molecular weight FPAS (molecular weight greater than 100,000) decreased rapidly in the estuary. The shapes, sizes and numbers of amorphous particulate substances stained by Amido Black 10B, called Amido Black active substances (ABAS), were determined under a microscope. The number of ABAS retained on Millipore HA filters (mean diameter: 10-80 micro m) amounted to 450/ml in estuarine water about 6 km from the mouth of the estuary. Some of these aggregates may be produced in situ by flocculation of high molecular weight FPAS during estuarine mixing. ABAS were also produced in experiments by mixing filtered river water with sea water. This process forms an important part of the biogeochemical cycle of organic substances in the estuarine environment. (Moore-IVI)
W85-02531

YEAR-TO-YEAR CHANGE IN WATER EXCHANGE CHARACTERISTICS IN A SEMI-CLOSED BAY, LAKE HAMANA,
Tokai Univ., Shizouka (Japan). Faculty of Marine Science and Technology.
Y. Mazda.
Journal of the Oceanographical Society of Japan, Vol. 40, p 199-206, 1984. 9 Fig, 1 Tab, 13 Ref.

Descriptors: *Water exchange, *Bays, *Lake Hamana, *Japan, Salinity, Tidal prism, Model studies, Topography, Turnover time.

The year-to-year change in characteristics of water exchange between Lake Hamana, a semi-enclosed bay, and the adjacent open sea is investigated. The destruction of the bay mouth by a typhoon in 1953 and subsequent stabilization work on the bay mouth from 1954 to 1973 resulted in an increase in the tidal prism volume of the bay (Mazda, Estuarine Coast. Oceanogr., 20, 178-188, 1983). In the present paper, a simple model has been constructed in which the magnitude of water exchange depends on the tidal prism, and using this model the year-to-year increase in salinity of the bay water after 1953 can be well explained. Consequently it can be said that the salinity increase after 1953 is a result of a progressive increase in water exchange caused by successive changes in topography of the bay mouth. The extent of water exchange in Lake Hamana, which varies seasonally, has increased gradually since 1953, and became stable after about 1967. For instance, at present the turnover time of the bay for exchange with open sea water reaches a maximum (2.9 months) in January and a minimum (0.9 month) in October, while in 1955 it is estimated to have been about 2.5 times that at present time. (Author's abstract)
W85-02532

EFFECTS OF FLUCTUATIONS IN HYDROGRAPHIC CONDITIONS ON YEAR-CLASS STRENGTH OF AMERICAN SHAD (ALOSA SAPIDISSIMA) IN THE CONNECTICUT RIVER,
Connecticut Dept. of Environmental Protection, Waterford. Marine Fisheries Office.
V. A. Crecco, and T. F. Savoy.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 8, p 1216-1223, August, 1984. 4 Fig, 5 Tab, 38 Ref.

Descriptors: *Shad, *Larval growth stage, *Year-class strength, River flow, Water temperature, Precipitation, Zooplankton, Feeding success, Fish stocks, Recruitment.

Year-class strength of Connecticut River stock of Alosa sapidissima, appears to be established by the end of the larval period. It is less certain when larval survival rates and year-class recruitment

manly influenced by biotic factors, abiotic factors, or their joint interaction with egg production. A correlation analysis was conducted between the relative strength of the 1966-73 and 1978-82 year-classes and mean monthly river flows, water temperatures, and total monthly precipitation data. Zooplankton densities, hydrographic conditions, and larval feeding success were correlated among the 1979 through 1982 year-classes. There was no significant stock-recruitment relationship using female shad population data from 1966 through 1977. Neither linear nor nonlinear spawner-recruit models could account for more than 6.5% of the variation. When the variation due to June river discharge and water temperature on year-class strength was removed, one model accounted for 11% of the remaining variation, although this was not significant. All three environmental variables (mean river discharge, water temperatures, and total monthly precipitation) were significantly correlated with shad year-class strength for the month of June, the period when most American shad larvae emerge. High June river flows and low river temperatures reduce larval feeding success, survival, and ultimately shad year-class strength, providing a reasonable explanation for the lack of a parent-progeny relationship. (Moore-IVI)
W85-02535

TRANSPORTATION OF WATER, PARTICULATE AND DISSOLVED ORGANIC AND INORGANIC MATTER BETWEEN A SALT MARSH AND THE EMS-DOLLARD ESTUARY, THE NETHERLANDS,
Rijksinstituut voor Natuurbeheer, Leersum (Netherlands).
N. Dankers, M. Binsbergen, K. Zegers, R. Laane, and M. R. van der Loeff.
Estuarine, Coastal and Shelf Science, Vol. 19, No. 2, p 143-165, August, 1984. 7 Fig, 9 Tab, 64 Ref.

Descriptors: *Estuaries, *Salt marshes, *Sediment transport, Storms, Water currents, Ammonia, Phosphates, Silica, Nitrates, Nitrite, Carbon, Organic matter.

Transport processes were studied in a gully between a salt marsh and an estuary. After storm tides, ebb currents in the gully reached high values. Particulate matter (both organic and inorganic) is imported into the marsh. Coarse organic debris is exported during storm tides, but this amount is low when compared with the primary production on the marsh. Exports are shown for dissolved organic carbon, ammonia, phosphate and silica, while nitrate and possibly nitrite are imported. Organic matter derived from in situ production and net import is buried and partly mineralized in the marsh. DOC produced in the marsh is also exported to the estuary. From the inorganic nutrients, ammonia and phosphate are exported and nitrate and nitrite are imported into the marsh, especially in the spring. (Baker-IVI)
W85-02655

FLUXES OF ORGANIC CARBON IN A FJORD ON THE WEST COAST OF IRELAND,
University Coll., Galway (Ireland). Dept. of Microbioloby.
T. G. McMahon, and J. W. Patching.
Estuarine, Coastal and Shelf Science, Vol. 19, No. 2, p 205-215, August, 1984. 4 Fig, 3 Tab, 49 Ref.

Descriptors: *Fjords, *Organic matter, *Carbon, *Ireland, Particulate matter, Carbon cycle, Organic carbon, Rainfall, Productivity.

The supply of particulate organic carbon (POC) via freshwater influx, and its exchange with the open sea, were estimated for a fjord-like coastal inlet, Killary Harbor, Ireland, during 1981. Biological production and destruction of organic matter within the inlet were also studied. Two main sources of POC have been identified for Killary Harbor: the supply of POC from freshwater and the contribution from primary productin within the system. The total input of POC with freshwater was estimated to be 514 tonnes. POC levels in rivers feeding the system were correlated with rainfall. The seasonal trend of primary production and phytoplankton standing crop in temperate waters generally follows a bimodal pattern with a major peak in spring and a minor peak in autumn. This pattern is largely determined by water column stability and the availabiltiy of nutrients. In water bodies receiving inputs of POC from sources other than phytoplankton production, the fluctuations in the standing levels of POC are unlikely to correlated closely with the fluctuations in primary productivity. Carbon to nitrogen ratios suggested an increased portion of POC of terrestrial origin at stations influenced by freshwater inflow, and throughout the fjord in the non-productive season. A tentative annual carbon budget is presented. (Baker-IVI)
W85-02656

NITROGEN AND PHOSPHORUS CONCENTRATIONS WITHIN NORTH INLET, SOUTH CAROLINA - SPECULATION AS TO SOURCES AND SINKS,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
T. G. Wolaver, W. Johnson, and M. Marozas.
Estuarine, Coastal and Shelf Science, Vol. 19, No. 2, p 243-255, August, 1984. 8 Fig, 1 Tab, 19 Ref.

Descriptors: *North Inlet, *South Carolina, *Nitrogen, *Phosphorus *Inlets, Estuaries, Water analysis, Sinks, Tidal effects, Ammonium, Orthophosphate, Nitrates, Nitrites, Marshes.

The daily concentrations of ammonium, orthophosphate, and nitrate + nitrite, are all associated with the stage of the tide during specific times of the year, especially when there is negligible freshwater input. Since there are high concentrations of these constituents during low slack water, there is a source for these constituents within the North Inlet system. Ammonium and orthophosphate most likely have their source in sediment diffusion from tidal creek sediments and/or runoff and seepage from the vegetated marsh surface during tidal exposure, while it is hypothesized that the high nitrate + nitrite values found at low tide are primarily caused by nitrification. In general the source of the dissolved inorganic nitrogen and phosphorus species appears to reside within the tidal creeks and not the vegetated marsh surface. The daily variations of dissolved organic nitrogen (DON) and dissolved organic phosphorus (DOP) have no consistent association with any physical forcing functions. Diffusion of DOP from the tidal creek sediments plus a terrestrial source of DON during rainy periods seems to control the concentrations of these constituents. Particulate nitrogen and particulate phosphorus concentrations are only slightly associated with the stage of the tide. It appears that the source of these constituents resides in wave action which scours the tidal creek banks and the marsh surface, rainstorms during tidal exposure which remove particulate material from the marsh surface via runoff, or high tidal velocities scouring the creek bottom. (Baker-IVI)
W85-02657

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

IONS AND WATER TRANSPORT ACROSS CHARGED NAFION MEMBRANES. IRREVERSIBLE THERMODYNAMICS APPROACH,
Nicolas Copernicus Univ. of Torun (Poland). Inst. of Chemistry.
A. Narebska, S. Koter, and W. Kujawski.
Desalination, Vol. 51, No. 1, p 3-17, July, 1984. 8 Fig, 20 Ref.

Descriptors: *Desalination, *Isotherms, *Membrane processes, *Nafion membranes, Transport, Sodium chloride.

The isothermal transport of ions and water across the perfluorinated Nafion 120 membrane in contact with sodium chloride solutions of concentration 0.05 to 4 mol/l has been studied based on irreversible thermodynamics of transport. The interactions of ions with water and polymer matrix on passing across the membrane are considered on the ground of the resistance coefficients, friction coefficients, coupling coefficients, and mobility indexes. The variations of the coefficients with concentration of an external electrolyte allow comment on the structure-selectivity problems and reflect sensitivity of a cluster like morphology of the membrane to sorption and swelling. At a low concentration range the coefficients reflect the mean resistances or interactions within the membrane with the sorbed sodium chloride located mainly within the clusters. At increased sorption, clusters approach the channels in composition. At that stage an electrolyte is distributed within the membrane more or less uniformly giving different mean interactions for the moving particles with the polymer chains and so different phenomenological coefficients. In this indirect way the transport coefficients seem to confirm the morphology of Nafion membranes. They also stress the sensitivity of the structure to sorption and swelling. (Baker-IVI)
W85-02551

EFFECT OF CRYSTALLINITY AND SWELLING ON THE PERMEABILITY AND SELECTIVITY OF POLYMER MEMBRANES,
Koninklijke/Shell-Lab., Amsterdam (Netherlands).
J. G. A. Bitter.
Desalination, Vol. 51, No. 1, p 19-35, July, 1984. 6 Fig, 17 Ref.

Descriptors: *Desalination, *Membrane processes, *Permeability, *Membranes, Reverse osmosis, Selectivity, Crystallization, Swelling, Polymers.

A simplified procedure is proposed for calculating membrane separation of multicomponent mixtures, which is based on the assumption of an exponential concentration gradient inside the membrane in accordance with reported experimental observation. The exponential form, which differs for each composition and set of conditions, can be calculated from the boundary conditions of the membrane. A number of pervaporation, dialysis and reverse osmosis experiments were performed using several hydrocarbon mixtures and polyolefin membranes. The required basic diffusivities were derived from the pervaporation experiments. From these were calculated the fluxes and selectivities of the components for the different modes of membrane operation. The various parameters of the different permeants in the mixtures are coupled through mathematical equations and this forms the basis for the influence of mixture compostion on flux and selectivity. The data relate to a system with pure permeants on either side of the membrane. The theoretical model is able to predict coupled transport without the introduction of a semi-empirical coupling coefficient as is required in more conventional approaches. (Baker-IVI)
W85-02552

NEW THIN-FILM COMPOSITE REVERSE OSMOSIS MEMBRANES AND SPIRAL WOUND MODULES,
Nitto Electric Co. Ltd., Osaka (Japan).
Y. Kamiyama, N. Yoshioka, K. Matsui, and K. Nakagome.
Desalination, Vol. 51, No. 1, p 79-92, July, 1984. 11 Fig, 7 Tab, 7 Ref.

Descriptors: *Desalination, *Membrane processes, *Membrane filters, Reverse osmosis, Membranes, Brackish water, Seawater.

Two new series of thin-film composite reverse osmosis membranes have been developed and fabricated into spiral wound modules. The NTR-7100 series membrane is able to desalt sea and brackish water. The NTR-7250 membrane is designed for use at pressures below 20 kg/sq cm. The membrane has a very high water permeability and is resistant to chemical and microbiological attack. In particular, the membrane is stable to chlorine, as shown by long-term reverse osmosis tests with tap water containing about 1 ppm of residual chlorine. The membrane has an unusual pattern of solute rejection. Salts containing divalent anions, such as sodium sulfate or magnesium sulfate, are rejected more than 98% while salts with monovalent anions

and bivalent cations, such as magnesium chloride, are rejected about 90% and salts with monovalent anions and cations, such as sodium chloride, are rejected 30-50%. Neutral solutes have relatively high rejection; for example, glucose at 90% and sucrose at less than 99%. Thus the NTR-7250 membrane provides high fluxes and low operating pressures, fair rejection of monovalent ions, good rejection of divalent ions, good rejection of organics, excellent chlorine resistance, and good temperature stability. NTR-7250 membranes should find applications in brackish water desalting, water softening, ultrapure water recovery, concentration of fermentation products, and concentration of valuable products by desalination. (Baker-IVI)
W85-02553

3F. Conservation In Agriculture

NEW CROPS FOR ARID LANDS,
Arizona Univ., Tucson.
C. W. Hinman.
Science, Vol. 225, No. 4668, p 1445-1448, September 1984. 20 Ref.

Descriptors: *Arid lands, *Crop production, Plants, Economic aspects.

Five plants are described that could be grown commercially under arid conditions. Once the most valuable component has been obtained from each plant the remaining material holds potential for useful products as well as fuel. The four crops with their most valuable component are guayule which yields rubber; jojoba, seed oil; bladderpod, buffalo gourd; and gumweed, resin. The single-product orientation inherited from present-day agriculture and the chemical industry must change if the arid land crops are to become an economic reality. Certain plants must be viewed as multiple product resources. Perhaps the greatest deterrent to rapid development of these plants is that the research sponsor must be concerned with too many diverse problems: growing, harvesting, and transporting plant material and then processing it into multiple products. (Baker-IVI)
W85-02548

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

DETERMINATION OF OPTIMUM MINIMUM FLOW FROM A DAM BY USING ENERGY ANALYSIS,
South Carolina Univ., Columbia. Dept. of Environmental Health Sciences.
J. B. Williams, and H. N. McKellar, Jr.
Environmental Management, Vol. 8, No. 4, p 345-352, July, 1984. 5 Fig, 5 Tab, 13 Ref.

Descriptors: *Connecticut, *Quinebaug River, *Minimum flow, *Energy analysis, *Dams, *Hydrolelectric plants, Productivity, Aquatic productivity, Aquatic habitats, Flow.

The proposed restoration of an abandoned hydroelectric dam on the Quinebaug River, Connecticut, is studied using energy analysis. The analysis considers the effects of alternative minimum flow releases, ranging from 0 to 34 cubic meters per second (cms), on the total energy flow of the affected system. The principal system components affected by differing minimum flows are hydroelectric power generation, aquatic habitat, and gross aquatic ecosystem productivity. The minimum flow alternative resulting in the highest annual energy flow in the affected system is considered optimal. From this purely analytical point of view, the optimum minimum flow is 0 cms, due to the short length and low productivity of the regulated reach, and the lack of floodplain interactions. Simulations of longer and more productive river reaches were conducted. For very short, unproductive reaches, in the absence of a floodplain, the contribution of aquatic community productivity to total system energy flow is negligible compared to hydroelectric generation. Optimum minimum flows are higher for longer and more productive reaches. For such cases the operation of hydroelectric dams could reduce total system energy flow because the energy supplied by hydroelectric generation may be offset by losses in aquatic productivity due to diminished riverine habitat. (Author's abstract)
W85-02297

FLOOD PROTECTION IN THE LOIRE VALLEY DOWNSTREAM VIENNE CONFLUENCE (PROTECTION DES VALS DE LOIRE EN AVAL DE LA CONFLUENCE AVEC LA VIENNE),
Montpellier-2 Univ. (France). Lab. d'Hydrologie Mathematique.
A. Guilbot, J.-C. Hemain, P. Raous, G. Tessier, and J.-P. Kryn.
Houille Blanche, No. 1/2, p 121-132, 1984. 14 Fig, 7 Ref.

Descriptors: *Flood control, *River basins, *Frequency analysis, *Loire Valley, *France, Statistical analysis, Model studies, Dam construction, Planning, Decision making.

In order to respond to political and economic authorities who were concerned about a possible coincidence of extremely high floodwater on the Loire with very high water levels on the Vienne or the Maine Rivers, a study of floodwater stages on the Loire and its tributaries was performed. The effectiveness of a flood regulating reservoir on the Vienne downstream from its confluence with Creuse was examined along with a study of the risks of levees being submerged by Loire flood waters. Methods used for these studies ranged from descriptive to statistical hydrology for model design. Based on the findings which revealed no series of extraordinary events leading to coincidence of floods coupled with the fact that construction would be difficult, the decision was made to reinforce the levees as opposed to constructing a dam on the Vienne. (Baker-IVI)
W85-02355

STOCHASTIC OPTIMIZATION MODEL FOR REAL-TIME OPERATION OF RESERVOIRS USING UNCERTAIN FORECASTS,
Washington Univ., Seattle. Dept. of Civil Engineering.
B. Datta, and M. H. Houck.
Water Resources Research, Vol. 20, No. 8, p 1039-1046, August, 1984. 3 Fig, 3 Tab, 23 Ref. NSF grant CME-7916819 and Purdue Research Foundation grant XR-0340.

Descriptors: *Reservoir operation, *Model studies, Forecasting, Decision making, Reservoir releases, Reservoir storage, Flow control.

For real time operation of reservoirs, where decisions are made relatively quickly and are based on short-term information, decisions regarding release should be dependent on the starting reservoir storage, penalties for deviations from planned targets, and short-term forcasts. A real-time operation model was developed based on a chance constraint formulation assuming a particular form of the linear decision rule. It uses the conditional distribution function (CDF) of actual streamflows conditioned on the forecasted values. These CDF'S are constructed by incorporating the statistical properties of forecast errors for different time steps. The objective for development of the model was minimization of weighted probable deviations from storage and release targets for operations over a time horizon of several days to a month. These weights are surrogates for the actual loss functions, and the probable deviations are functions of the reliability levels specified in the model. With the use of target values for release and storage, this model is capable of using a release policy that is a subset of a seasonal policy and overcomes the myopic (short-sighted) nature of operation. Simulation of actual operation, using this model for a hypothetical reservoir, demonstrated the feasibility and efficiency of this approach. This mo applicable for a system of reservoirs while r ing within the range of computational feas The restrictions associated with the use of a decision rule are invalid for this model. The should be solved at the beginning of eac with updated forecasts, revised conditional bution functions of future streamflows, a state of the system given by the initial storag as inputs. (Collier-IVI)
W85-02360

IMPACT OF ZOOPLANKTON STATU THE MANAGEMENT OF LAKE KINN (ISRAEL),
Kinneret Limnological Lab., Tiberias (Israel)
For primary bibliographic entry see Field 2H
W85-02410

OXYGEN CONSUMPTION BY THE C FISH ORCONECTES PROPINQUUS (GIR EXPOSED TO AQUASHADE,
Indiana Univ.-Purdue Univ. at Indianapolis. of Biology.
For primary bibliographic entry see Field 5C
W85-02420

MANIPULATION OF THE PELAGIC F WEB BY STOCKING WITH PREDAC FISHES,
Technische Univ., Dresden (German D.R.) eich Hydrobiologie.
J. Benndorf, H. Kneschke, K. Kossatz, and E Penz.
Internationale Revue der Gesamten Hydro gie, Vol. 69, No. 3, p 407-428, 1984. 7 Fig, 60 Ref.

Descriptors: *Water quality control, * *Fish, *Predators, *Nutrients, Population d ics, Eutrophication, Zooplankton, Crustacea, chain.

After studying the original status in a small trophic pond in a former quarry for two yea pond was densely stocked with predacious fis the spring of 1981. The response of the ecos to this intervention was observed up to the 1981. The virtual elimination of the small feeding on zooplankton by stocking the pon predacious fishes leads, even in the presenc very efficient predacious invertebrate, Chao flavicans, to a major reduction of mortality a the herbivorous zooplankton. During the s half of the summer and during autumn, the body weight of the crustacean increased rap 1981, which was not observed in the water original state. This was due to the almost co disappearance of the small crustaceans, an dominance of larger species. The Chaob larvae, due to their diurnal migration, their p ence for moderately sized prey and their life cannot exert the same grazing pressure as the fishes. The mean and maximum crustacean bi and the mean individual body weight of the c ceans were very much higher in 1981 than years with a very large stock of small fish phytoplankton growth is definitely limited b trients, biomanipulation of the kind describe has only a very slight effect on the mea maximum summer phytoplankton biomass even when nutrient limitation is marked, this of biomanipulation induces a distinct change species composition of the phytoplankton. D this change, the Secchi depth increases alt the phytoplankton biomass remains the When using biomanipulation as a means of quality management, it is obviously necessa take into account internal ecological control anisms that are much too complicated to b pressed as simple schemes. (Baker-IVI)
W85-02565

MANAGING WATER RESOURCES IN NEW ORLEANS AREA,
Environmental Professionals, Metairie, LA.
H. Miller, and E. Silberhorn.
Journal of the Water Pollution Control Feder Vol. 56, No. 9, p 995-1002, September, 1984. 1 Tab, 14 Ref.

Descriptors: *New Orleans, *Louisiana, *Water resources development, *Management, Decision making, Mississippi River, Lake Pontchartrain, Flood control.

New Orleans' dependence on water for shipping, fishery resources, and drinking water has led to numerous management and control programs for water resources in the area. Some of the most promising issues facing local residents includes flood control and water quality of the Mississippi River, factors affecting the Lake Pontchartrain basin, loss of wetlands, and erosion of the Louisiana coastline. Flood control on the Mississippi includes flow diversion projects, along with levees, channel, and tributary basin improvements. Problems solved concerning Lake Pontchartrain included bacterial pollution, wetlands loss, and dredging of the lake. (Baker-IVI)
W85-02581

SHORT-TERM, SINGLE, MULTIPLE-PURPOSE RESERVOIR OPERATION: IMPORTANCE OF LOSS FUNCTIONS AND FORECAST ERRORS,
Washington Univ., Seattle. Dept. of Civil Engineering.
B. Datta, and S. J. Burges.
Water Resources Research, Vol. 20, No. 9, p 1167-1176, September, 1984. 10 Fig, 19 Ref.

Descriptors: *Reservoir operation, *Forecasting, *Loss functions, *Multipurpose reservoirs, Optimization, Reservoir releases, Reservoir storage, Model studies, Streamflow.

Short-term operation policy for multipurpose reservoirs can be derived from an optimization model with the objective of minimizing short-term losses (opportunity costs). Construction of such loss functions requires the definition of target values for the decision variables, assessment of reliabilities with which inflows can be predicted, and an explicit statement of operational objectives. Formulation and evalution of a model is complicated by the uncertainties inherent in the prediction of future streamflows and by controversies about the criteria of evaluation. A series of synthetic short-term forecasted values (which satisfy a specified distribution of forecast errors) is used to examine operation of a single reservoir. The quality of forecasted values is represented by the mean and variance of these errors or the coefficient of prediction (Cp). The objective function of the operation model is assumed to be the best possible tradeoff between probable deviations from two operation targets: release and storage volume. Reservoir release was effected according to the solution of the optimization model conditioned upon the forecasted streamflow volumes for a given time increment. The storage volume was then corrected to reflect actual streamflow for the forecasted period. This became the initial storage for the next forecast period. Actual losses, deviations between actual and forecasted losses, the variance of storage and release volumes, and operational performance measures, including reliability, resiliency, and vulnerability, were sensitive to the relative importance given to deviations from release or storage targets and the quality of forecasts. The performance of an operation policy based on a model that uses predicted streamflow as deterministic inputs cannot be correlated directly with the shape of the assumed loss function. (Author's abstract)
W85-02658

MONTE CARLO OPTIMIZATION FOR RESERVOIR OPERATION,
Humboldt State Univ., Arcata, CA. Dept. of Environmental Resources Engineering.
R. Willis, B. A. Finney, and W.-S. Chu.
Water Resources Research, Vol. 20, No. 9, p 1177-1182, September, 1984. 6 Fig, 2 Tab, 13 Ref.

Descriptors: *Reservoir operation, *Optimization, *Monte Carlo method, *Mad River Basin, *California, Reservoir releases, Reservoir storage, Streamflow, Model studies.

The probability distribution function for the optimal reservoir release, which is conditioned on the state and input variables of the reservoir system, is developed using a Monte Carlo optimization approach. The optimal release for each time period in the operational horizon is determined by using linear programming. After repeating this procedure for a large number of synthetic streamflow sequences, an operational release policy is determined by utilizing the probability mass function of the optimal releases, conditioned on observable hydrologic conditions. The methodology is applied to the Mad River Basin in northern California to develop monthly reservoir release policies that use reservoir storage and inflow as the observed conditioning hydrologic variables. The Monte Carlo optimization methodology is a practical tool for developing reservoir release policies. Although a series of large linear models are solved initially, the computational requirements do not exceed the resources needed by currently available real-time operational models. The release policies developed from the Monte Carlo optimization methodology can provide target storages for real-time models. (Moore-IVI)
W85-02659

4B. Groundwater Management

GROUNDWATER AND INTERGOVERNMENTAL RELATIONS IN THE SOUTHERN SAN JOAQUIN VALLEY OF CALIFORNIA: WHAT ARE ALL THESE COOKS DOING TO THE BROTH,
B. T. Andrews, and S. K. Fairfax.
University of Colorado Law Review, Vol. 55, No. 2, p 145-271, Winter, 1984, 2 Fig, 1 Tab, 701 Ref.

Descriptors: *Groundwater management, *Legal aspects, *California, *San Joaquin Valley, History, Planning, Federal jurisdiction, State jurisdiction.

An institutional analysis of groundwater use in California's southern San Joaquin Valley is presented. The often intricate interactions between the local, state and federal factors responsible for groundwater management in the Valley are highlighted. Commonly held perceptions about the interrelationship between surface and groundwater policies, Valley attitudes toward groundwater use and the growing state wide desire for greater state and federal involvement in the regulation of groundwater in the southern San Joaquin Valley are reassessed. The approach taken in this study differs in four major ways from that found in most of the literature regarding the management of groundwater resources. First, the inquiry treats groundwater as just one aspect of overall water resource management, rather than as a separate entity. Secondly, the inquiry suggests that the virtues of local management relating to Valley groundwater use merit wider recognition and public discussion. Thirdly, the crucial role of imported surface water in local groundwater management is examined with underscoring of the prominence of the state and federal water supply agencies in the southern San Joaquin Valley. Fourthly, the research stresses not the need for new authorities and programs, but the importance of considerable unexercised authorities at the local, state and federal levels of government. (Baker-IVI)
W85-02184

OPTIMIZING PUMPING STRATEGIES FOR CONTAMINANT STUDIES AND REMEDIAL ACTIONS,
Robert S. Kerr Environmental Research Lab., Ada, OK.
For primary bibliographic entry see Field 5G.
W85-02217

CALCULATION OF COMPLETE INTERCEPTION OF GROUNDWATER INFLOW TO 'PERFECT' TRENCHES BY LIGHT WELLPOINT INSTALLATIONS,
V. M. Grigorev.
Hydrotechnical Construction, Vol. 17, p 618-626, December, 1983. 5 Fig, 3 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 12, p 21-25, December, 1983.

Descriptors: *Intercepting ditches, *Mathematical equations, *Draining engineering, Draining, Permeability, Soil properties, Groundwater, Wellpoints.

It is considered that under real conditions at construction sites complete interception by light wellpoint vacuum groundwater lowering installations can be successfully accomplished only when draining fine-grained soils with a permeability coefficient equal to 0.05-2 m/day, with the artificial creation of considerable negative heads in the receiving links of the wellpoints in the initial period of operation of the installation with the use of wellpoints with a high sand filling around them or well points with air pipes. The simplest method, not requiring a modification of the standard design of the wellpoints, is the placement of a high sand filling around them. This variant of organization of complete interception of water is examined. A comprehensive calculation of complete interception can be performed by the method given determining the order of performing the calculation operations. (Baker-IVI)
W85-02229

METHOD FOR OPTIMAL OBSERVATION NETWORK DESIGN FOR GROUNDWATER MANAGEMENT,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
J. Carrera, E. Usunoff, and F. Szidarovszky.
Journal of Hydrology, Vol. 73, No. 1/2, p 147-163, July, 1984. 5 Fig, 1 Tab, 23 Ref. US - Spain Joint Committee for Scientific and Technological Cooperation grant T3770171.

Descriptors: *Network design, *Kriging, *Groundwater management, Decision making, Planning, Soil properties, Fluoride, Water quality, Hydrology.

A method for selecting optimal locations from a discrete set of possible measurement points is based on nonlinear programming and a special branch and bound technique. It is simple and data requirements are small. The method is applied to the optimal location of measurement points in the San Pedro River basin, Arizona, to estimate the fluoride concentration of the groundwater. While the measurement point location procedure can be applied successfully in hydrology, further applications may include heads and/or transmissivity estimation, water quality, and soil properties. If drift is present, a number of specific methods can be used to estimate the variogram, such as universal kriging, or iterative processes. The methodology described can be extended into a multiobjective framework by using cokriging, if the functions are correlated, or by a simple extension of the proposed methodology. In general, the results in terms of optimal configuration, are expected to be insensitive to small variations of the kriging parameters. If that is not the case, their uncertainty can be handled by using Bayesian decision theory. (Baker-IVI)
W85-02463

SIMPLIFIED GRAPHICAL SOLUTION OF THE THEIS EQUATION,
Victoria State Rivers and Water Supply Commission, Tatura (Australia).
W. T. Griffiths, and D. Ife.
Journal of Hydrology, Vol. 73, No. 1/2, p 177-186, July, 1984. 7 Fig, 4 Ref.

Descriptors: *Aquifer characteristics, *Pumping tests, *Theis equation, Transmissivity, Storage coefficient, Specific yield, Drawdown.

The Theis type curve solution has been graphicaly extended to permit analysis of pumping test results without numerical calculation. The graphical technique proposed enables various analyses of pumping test data to be carried out in the field as tests proceed. It should also lead to a better understanding of the inter relationship between variables in the mathematically complex Theis equation. The method employs a transparent overlay which permits direct reading of transmissivity and storage coefficient for any set of time-drawdown readings.

Distance-drawdown readings can also be analyzed in the same way, and the overlay can be used to determine the time-drawdown curve for a known set of aquifer parameters. A single time-drawdown point can produce one aquifer characteristic if an assumption of the other characteristic is made. The costs involved in the preparation of the special data sheet and overlay would be offset by the benefits and versatility provided by this technique, as this method will assist in understanding the ways in which the various parameters of the Theis equation interrelate and as such can be used in the design and interpetation of aquifer tests. (Baker-IVI)
W85-02465

STRESSES AND DISPLACEMENTS IN AN AQUIFER DUE TO SEEPAGE FORCES (ONE-DIMENSIONAL CASE),
Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Ingenieria.
For primary bibliographic entry see Field 2F.
W85-02489

INFLUENCE OF SEEPAGE ON THE DEPTH OF WATER TABLES IN DRAINAGE,
Instituut voor Cultuurtechniek en Waterhuishouding, Wageningen (Netherlands).
J. G. Wesseling, and J. Wesseling.
Journal of Hydrology, Vol. 73, No. 3/4, p 289-297, August, 1984. 4 Fig, 2 Tab, 4 Ref.

Descriptors: *Drainage, *Water tables, *Seepage, *Groundwater flow, Aquifers, Subsoil drainage.

A theory has been developed that describes the depth of the water table in the case of a soil underlain by an artesian aquifer which is drained by means of a subsoil drainage system. The theory is based on two-dimensional groundwater flow and solutions were obtained for both steady- and non-steady-state conditions. The problem under discussion consists of an aquifer with a layer of sand covered by a layer of less permeable peat or clay in which the drains are situated. Drain level is taken as zero-level, and therefore the piezometric head of the groundwater in the aquifer itself, designated by H, is considered to be constant. Since H is larger than the piezometric level of the phreatic water in the covering layer (h), an upward vertical flow of seepage water takes place. Near the drains the largest difference in heads exists and hence the largest seepage flow will take place there. This implies that the seepage and hence the feeding of the drains is not uniformly distributed over the surface as is generally the case with rainfall. (Bkaer-IVI)
W85-02490

FLOW TOWARD STORAGE TUNNELS BENEATH A WATER TABLE; 2. THREE-DIMENSIONAL FLOW,
Tel-Aviv Univ. (Israel). Faculty of Engineering.
A. Tal, and G. Dagan.
Water Resources Research, Vol. 20, No. 9, p 1216-1224, September, 1984. 10 Fig, 13 Ref.

Descriptors: *Groundwater movement, *Recharge wells, *Artifical recharge, Water table, Mathematical models, Oil storage, Gas storage, Underground storage, Well spacing.

In a system of galleries for storage of oil products or liquefied gas which are excavated in saturated rock beneath a water table, the natural recharge has to be supplemented by an artifical one. By adjusting the recharge, a steady state can be achieved with the free surface kept in a fixed position and the total recharge equal to the discharge into galleries. The water table is prevented from descending and is maintained in a steady position by a battery of recharging wells. The three-dimensional flow problem is solved first by a simplified linearization approximation which is valid for flat water table which is sufficiently high above the gallery. The full nonlinear free surface problem is subsequently solved numerically by the boundary integral element method, and the range of validity of the linearized approximation is established. The solution provides the tools needed in order to design an optimal well system (spacing, length, discharge) for given gallery setup, product pressure, and water table height. A comparison between the approximate and numerical solutions for a few configurations suggests that the first is quite accurate if the free surface average slope above the cavern roof is smaller than 10%. For larger slopes the well spacing is determined by the approximate solution in a conservative manner, the use of the numerical scheme is recommended. (Moore-IVI)
W85-02663

FIELD TESTING THE HYPOTHESIS OF DARCIAN FLOW THROUGH A CARBONATE AQUIFER,
Geological Survey, Tampa, FL.
J. J. Hickey.
Ground Water, Vol. 22, No. 5, p 544-547, September-October, 1984. 4 Fig, 8 Ref.

Descriptors: *Groundwater movement, *Carbonate aquifers, *Darcian flow, *Pinellas County, *Florida, Drawdown, Transmissivity, Storage coefficient, Pumping tests, Leakance.

The acceptability of the hypothesis of Darcian flow through a semiconfined carbonate aquifer was tested prior to running a multiple-day aquifer test in Pinellas County, Florida. The approach used to test the hypothesis was to run a number of hour-long aquifer tests at different discharges with drawdown measured at the same time during each test in two observation wells, one at 35 feet and the other at 733 feet from the pumped well. If the hypothesis were acceptable, a plot of drawdown versus discharge should describe a straight line. A linear relation was described in 15-minute and 1-hour data plots of drawdown versus discharge for both observation wells. Thus, the hypothesis of Darcian flow through the semiconfined carbonate aquifer was deemed acceptable. Drawdown data from the distant observation well collected during the following multiple-day aquifer test were then analyzed for aquifer-property values of transmissivity, storage coefficient, and leakance coefficient using standard methods. Discharge for the multiple-day test was within the discharge range of the hour-long tests. (Author's abstract)
W85-02686

OPTIMAL SPACING OF INTERFERING WELLS: AN ANALYTIC SOLUTION,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. Briscoe.
Ground Water, Vol. 22, No. 5, p 573-578, September-October, 1984. 5 Fig, 10 Ref, 1 Append.

Descriptors: *Well spacing, *Interfering wells, Optimization, Well fields, Costs, Pipelines, Transmissivity, Pumping.

The optimal spacing of pumped wells in a well field involves a trade-off between pumping costs (which increase as well spacing is reduced and interference increases) and the costs of connecting pipelines (which decrease as well spacing is reduced). An expression is derived analytically for the optimal spacing between wells in a rectangular field in an ideal, confined aquifer. A simple, practical method for determining the optimal spacing is presented. The optimal spacing is substantially different from the spacing determined by use of the Theis formulation. The economic savings resulting from use of the revised approach are considerable, especially when the number of wells is large and the transmissivity of the aquifer low. (Moore-IVI)
W85-02690

NUMERICAL METHOD OF PUMPING TEST ANALYSIS USING MICROCOMPUTERS,
Birmingham Univ. (England). Dept. of Civil Engineering.
K. S. Rathod, and K. R. Rushton.
Ground Water, Vol. 22, No. 5, p 602-608, September-October, 1984. 3 Fig, 4 Tab, 7 Ref.

Descriptors: *Computer models, *Pumping tests, Mathematical models, Computers, Aquifers.

A numerical method of pumping test ana which has proved to be useful in many prac situations, can be run on microcomputers. basis of the numerical approach is to solve time-variant differential equation using a finit ference approach in which the radial dimensi divided into discrete intervals which increas garithmically from small values near the we large values towards the boundary. The tim mension is also divided into discrete steps w increase logarithmically. Full details of a versi the numerical model program in BASIC and a problem are provided. It is essential to check program thoroughly since the accuracy of co tation varies for different microcomputer syst The use of this numerical model is both for analysis of pumping tests which are difficul interpret using conventional methods, and for prediction of the likely response due to exter pumping from an aquifer. (Moore-IVI)
W85-02694

SIMPLE ANALYTICAL SOLUTIONS FOR T HP41CV PROGRAMMABLE CALCULATOR
Kleinfelder (J.H.) and Associates, Fresno, CA.
S. J. Baker.
Ground Water, Vol. 22, No. 5, p 609-616, Sep ber-October, 1984. 3 Fig, 1 Tab, 6 Ref, 3 App

Descriptors: *Computer models, *Pumping t *Aquifers, Drawdown, Mathematical models.

Two useful programs have been developed for Hewlett Packard HP41CV programmable calc tor. The THEIS program is designed to simula well pumping from a confined or unconfined a fer. Drawdown, residual drawdown, t/t sub 1 t/r sq are calculated. The BOUN program is signed to solve for drawdown in a well pum from an aquifer bounded by two parallel imper able barriers. The programs can be used in aqu pumping test design, pumping test analysis, aquifer response predictions. (Author's abstr
W85-02695

4C. Effects On Water Of Man's Non-Water Activities

BETTER RATIONALE FOR WETLAND MA AGEMENT,
Nelson (R. Wayne) and Associates, Inc., Boul CO.
For primary bibliographic entry see Field 2L.
W85-02295

RECREATIONAL IMPACTS ON COLORA RIVER BEACHES IN GLEN CANYON, ARIZ NA,
Museum of Northern Arizona, Inc., Flagst Dept. of Biology.
For primary bibliographic entry see Field 5C.
W85-02298

ALTERATION OF STREAMFLOW CHARA TERISTICS FOLLOWING ROAD CONSTRU TION IN NORTH CENTRAL IDAHO,
Intermountain Forest and Reange Experiment S tion, Moscow, ID. Forestry Sciences Lab.
For primary bibliographic entry see Field 2E.
W85-02372

INFLUENCE OF FORESTRY DRAINING O RUNOFF AND SEDIMENT DISCHARGE THE YLIJOKI BASIN, NORTH FINLAND,
National Board of Waters, Helsinki (Finland).
P. Seuna.
Aqua Fennica, Vol. 12, p 3-16, 1982. 14 Fig, 5 T 17 Ref.

Descriptors: *Drainage effects, *Runoff, *Se ment transport, *Forest managment, *Ylijoki ba *Finland, Suspended solids, Seasonal variati Floods, Melting.

The effects on runoff and on the transport suspended solids caused by forestry draining in

Ylijoki basin, northern Finland are discussed. The control basin method was used. The drainages were performed mainly in 1979 and the total area drained amounted to 17% of the Ylijoki basin. Additionally a small amount of forestry plowing was carried out, the effects of which are included in the following changes. Peat soils comprise about 60% of the catchments; dominating mineral soils are coarse sand and coarse sand moraine. During the two first years after the drainage, runoff changes were approximately as follows: for mean annual + 10%, for spring maximum - 10%, for summer maximum + 35% and for winter and summer mimima + 50%. The annual transport of suspended solids increased 6.16 t/sq km in 1980 and 10.48 t/sq km in 1981. Both increases were more than four times the computed 'undrained' yield and statistically significant (risk < 0.1%). Of the total annual yield 91% came during spring flood, while the respective figure before draining was about 65%. The concentration of suspended solids became very dependent on runoff, which was not the case before draining. In a separate ditching plot, Kettumaa, the discharge of suspended solids was as much as 230 t/sq km during the first spring flood after draining. The highest concentration occurred during the rise of flood (> 1500 mg/l) and right after the melt of soil frost (> 2000 mg/l), in spring of 1980 following the drainage. The same procedure occurred in the next spring although on a much lower level. (Author's abstract)
W85-02384

SIMULATION OF GROUND-WATER FLOW IN A MINED WATERSHED IN EASTERN OHIO,
Geological Survey, Columbus, OH.
J. S. Weiss, and A. C. Razem.
Ground Water, Vol. 22, No. 5, p 549-560, September-October, 1984. 18 Fig, 11 Ref.

Descriptors: *Groundwater movement, *Coal mining, *Simulation, *Ohio, *Muskingum County, Strip mines, Groundwater recharge, Permeability coefficient, Geohydrology, Surface-groundwater relations, Leakage, Hydraulic head.

A 43-acre watershed in Muskingum County, Ohio, was studied to determine the hydrologic consequences of strip mining for coal. A quantitative description of the effects on the ground-water flow components of the hydrologic system has been obtained using digital models. The premining watershed was characterized by nearly flat-lying sedimentary rocks of the Pennsylvanian System. Underclay beneath the two major coal beds formed bases for perched zones, creating three separate aquifers. Recharge to the ground-water system occurred mainly by percolation of precipitation. Most of the discharge from the top and middle aquifers occurred by downward leakage to the underlying aquifers. A smaller amount of discharge occurred as springflow or streamflow near the intersections of the underclays and land surface. Mining has destroyed the top aquifer, and has replaced the bedrock by spoil material. Water levels in the spoils are at a much lower altitude than existed in the premining top aquifer because of a combination of (1) a larger hydraulic conductivity, (2) areal variations of the hydraulic characteristics of the confining bed, and (3) a slower rate of recharge from precipitation caused by removal exposed portions of the middle aquifer and a lower hydraulic head in the spoils has allowed less recharge to the middle aquifer. Additional flow is induced across the western boundary of the watershed and has reduced the outflow across the eastern boundary. Discharge from the middle aquifer as downward leakage and streamflow is less than before mining. (Author's abstract)
W85-02687

4D. Watershed Protection

RUNOFF AND EROSION RESPONSE OF RECLAIMED SURFACES,
Agricultural Research Service, Fort Collins, CO.
D. M. Hartley.
Journal of Hydraulic Engineering, Vol. 110, No. 9, p 1181-1199, September, 1984. 4 Fig, 10 Tab, 17 Ref.

Descriptors: *Land reclamation, *Erosion control, *Runoff, *Model studies, Rainfall, Precipitation, Soil loss, Computers, Strip mines, Land reclamation, Soil control.

A method for characterizing the runoff and erosion behavior of reclaimed surfaces is described and demonstrated using data from a surface coal mine. The method used data from simulated rainfall field tests to calibrate or estimate parameters in a long term soil water balance model and a single event water and sediment routing model. Distributed parameter model simulations provide realistic comparisons of reclamation options because they explicitly treat local precipitation characteristics and represent the responses of different treatments based on their respective infiltration, hydraulic, and soil erodibility characteristics. After parameter values have been estimated, soil loss and runoff comparisons for a range of precipitation and topographic conditions are easily obtained. A simulation of the responses of four different surface treatments to five different first years of historical precipitation from the study area indicates substantial differences between the treatments. Predicted soil losses are low for all treatments at moderate topographic conditions. At more extreme topographic conditions, these differences appear to take on greater significance. The simulation study demonstrates the dominance of infrequent, intense precipitation events in causing the bulk of soil losses. This points out the need to establish treatment features such as mulching rates, contour furrows and surface gradients based on design storms of a given frequency rather than average annual events. The simulation technique illustrated can be used to make comparisons of alternative treatments. (Baker-IVI)
W85-02449

STREAM ECOSYSTEMS IN MOUNTAIN GRASSLAND (WEST CARPATHIANS); 1. INTRODUCTION AND DESCRIPTION OF THE INVESTIGATED AREA,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
For primary bibliographic entry see Field 6G.
W85-02512

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

INTRASPECIFIC VARIATION IN COPPER SUSCEPTIBILITY OF THE BLUEGILL SUNFISH,
Maryland Univ., Solomons. Chesapeake Biological Lab.
For primary bibliographic entry see Field 5C.
W85-02194

MULTIPLE BIOASSAYS TO ASSESS THE TOXICITY OF A SANITARY LANDFILL LEACHATE,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
S. Plotkin, and N. M. Ram.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 2, p 197-206, March, 1984. 3 Fig, 9 Tab, 36 Ref.

Descriptors: *Landfills, *Leachates, *Toxicity, *Bioassay, *Fitchburg, *Massachusetts, Fathead minnows, Daphnia, Chlorophyta, Bacteria, Algal growth, Water pollution effects.

Fitchburg, Massachusetts sanitary land-fill leachate was subjected to toxicity tests using: fathead minnows (Pimephales promelas), zooplankton (Daphnia magna), green algae (Selenastrum capricornutum) and aerobic luminescent bacteria (Photobacterium phosphorium). The leachate was highly toxic to the test bacteria, moderately toxic to daphnids, and slightly toxic to fathead minnows. Algal cells, unable to grow at 10% leachate exposure level, recovered after centrifugation and reinnoculation into algal nutrient medium. Low-flow summer hydrological data indicated that the leachate contributed about 7% to the total flow of the receiving stream, Flagg Brook, and about 0.6% to Sawmill Pond water located further downstream from the leachate outfall. These data, together with observed toxicity values for the test organisms, indicate that the leachate concentration in Flagg Brook impacts the diversity of aquatic life in this system, but may be less severe in Sawmill Pond where increased dilution results in leachate levels below the acutely toxic level. The considerable variation between toxicity test results obtained with the four test organisms, demonstrates the importance of conducting several such toxicity tests using organisms from different trophic levels, to assess the potential impact of a pollutant discharge on an aquatic ecosystem. (Author's abstract)
W85-02202

DETERMINATION OF PICLORAM IN SOIL AND WATER BY REVERSED-PHASE LIQUID CHROMATOGRAPHY,
Auburn Univ., AL. George W. Andrews Forestry Science Lab.
M. J. M. Wells, J. L. Michael, and D. G. Neary.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 2, p 231-235, March, 1984. 3 Fig, 1 Tab, 20 Ref.

Descriptors: *Picloram, *Pollutant identification, *Liquid chromatography, Herbicides, Pesticide residues, Soil contamination.

The environmental impact downstream from the treatment of forested areas with the herbicide picloram is of concern because of the solubility of the potassium salt of picloram and the slow degradation by soil microorganisms. A reverse-phase liquid chromatographic method is presented for the determination of picloram in the parts per billion (ppb) range in soil, soil solution, and stream samples. Quantification is effected by UV absorption at 254 nm. The method permits 92% +/- 7.1 recovery from water samples and 61.8% +/- 11.1 recovery from soil samples. Derivatization of picloram by diazomethane is avoided because the compound is detected by UV absorbance as the underivatized free acid. (Moore-IVI)
W85-02204

NICKEL UPTAKE AND LOSS IN THE BIVALVES CRASSOSTREA VIRGINICA AND MYTILUS EDULIS,
Environmental Research Lab., Narragansett, RI.
G. E. Zaroogian, and M. Johnson.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 4, p 411-418, July, 1984. 5 Fig, 29 Ref.

Descriptors: *Bioindicators, *Nickel, *Oysters, *Mussels, Heavy metals, Seawater, Water pollution.

Nickel uptake and loss by Crassostrea virginica and Mytilus edulis were studied at naturally occurring seawater temperatures and salinity to determine their potential as indicators of nickel pollution. After 12 wks treatment with 5 and 10 micro g Ni/kg seawater, mean tissue concentrations in C. virginica were 9.62 +/- 3.56 and 12.96 +/- 5.15 micro g/g dry weight. Mean nickel concentrations in M. edulis treated with 5 and 10 micro g Ni/kg seawater for 12 wks were 10.40 +/- 2.66 and 16.43 +/- 3.19 micro g/g dry weight, respectively. Significant linear relationships were found between nickel uptake by C. virginica and M. edulis and seawater nickel concentrations over the concentration range. A significant inverse relationship exists between tissue nickel concentration and dry weight in both C. virginica and M. edulis. After holding nickel-treated M. edulis in ambient flowing seawater for 28 weeks, a 73 and 89% loss of nickel concentration occurred in M. edulis treated with 5 and 10 micro g Ni/kg, respectively. When treated similarly, C. virginica from both the 5 and 10 micro g Ni/kg treatments lost 48 and 68% respectively, of their tissue nickel concentration. The evidence suggests that M. edulis would be a better

indicator of nickel pollution in its environment than C. virginica. (Author's abstract)
W85-02212

APPLICABILITY OF SOME NUMERICAL METHODS AND THE EVALUATION OF BRYOPHYTA INDICATOR SPECIES FOR THE COMPARISON OF THE DEGREE OF POLLUTION BETWEEN TWO RIVERS,
Ljubljana Univ. (Yugoslavia). Biological Inst.
D. Vrhovsek, A. Martincic, and M. Kralj.
Archiv fur Hydrobiologie, Vol. 100, No. 4, p 431-444, July, 1984. 5 Fig, 2 Tab, 16 Ref.

Descriptors: *Water quality, *Water pollution detection, *Bioindicators, *Bryophytes, *Yugoslavia, Sora River, Savinja River.

The possibility of establishing a qualitative and quantitative comparison of bryophyte indicator species and numerical methods for evaluating a degree of pollution in geographically distant rivers was investigated. The rivers Sora and Savinja are tributaries of the main Solvenian River, Sava. Both rivers have a prealpine character and only the upper part of Savinja is more alpine. The hydrographic character of the lower parts of both rivers is very similar. The geographical basis of both rivers is formed from triadic calcereous rocks and dolomite. In the Sora, pollution is mainly organic, while in the lower part of the Savinja, especially from the city Celje, pollution is also inorganic. The degree of pollution in the rivers could be adequately determined from the presence of indicator species, Jaccard's coefficient of similarity and Newbould's coefficient of difference. The application of joint species frequency and coefficient of development were not satisfactory due to small qualitative and quantitative differences in species composition between sampling points. (Baker-IVI)
W85-02238

STATISTICAL PROCEDURES FOR APPLYING HILSENHOFF'S BIOTIC INDEX,
Wisconsin Dept. of Natural Resources, Madison. Water Quality Evaluation Section.
R. P. Narf, E. L. Lange, and R. C. Wildman.
Journal of Freshwater Ecology, Vol. 2, No. 5, p 441-448, August, 1984. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Water quality, *Measuring instruments, *Streams, Hilsenhoff's Biotic Index, Wisconsin, Evaluation, Statistical methods.

The water quality of Wisconsin streams was evaluated using Hilsenhoff's biotic index (HBI). The variability of the HBI must be known or estimated in order to detect significant differences in water quality. Based on this study, the best estimate of the HBI standard deviation in fall samples is 0.197. From the standard deviation and variance estimate two statistical procedures are presented that test for significant differences between paired HBI values - the detectable difference method for equal sample sizes and the t-test for unequal sample sizes. The detectable difference method provides a means for determining the statistical difference between two index values derived from an equal number of samples collected from different streams, different locations on the same stream, or the same stream location sampled in the fall season of different years. (Baker-IVI)
W85-02245

WATER QUALITY ASSESSMENT OF SEVEN RIVERS IN NOTO PENINSULA USING EPILITHIC DIATOM COMMUNITIES ON RIVER BED AS BIOLOGICAL INDICATORS (IN JAPANESE),
Meiho High School, Kanazawa City (Japan).
M. Sumita, and T. Watanabe.
Japanese Journal of Limnology, Vol. 45, No. 2, p 134-143, April, 1984. 2 Fig, 7 Tab, 7 Ref.

Descriptors: *Japan, *Noto Peninsula, *Wakayama-gawa River, *Machino-gawa River, *Kawarada-gawa River, *Fugeshi-gawa River, *Yamada-gawa River, *Togi-gawa River, *Misogigawa River, *Pollution index, *Diatoms, Water quality, Water pollution, Species composition, Ecological effects.

A previously developed equation for determining a river pollution index (RPI sub B) used water quality chart data acquired through the traditional method of water quality estimation by indicator organisms. The value of RPI sub B obtained from such a water quality chart was somewhat ambiguous for estimation of the degree of pollution, because the traditional water quality chart indicates the distribution of an area with only four to six different degrees of water pollution. However, the degree of water pollution in the river actually changes gradually and continuously and they can not thus be divided numerically into definite classes by degrees. A previously reported new approach to the general estimation of river pollution that uses a new diatom community index (NDCI) was used for determining river pollution indices (RPI sub D) in seven rivers in the Noto Peninsula of Ishikawa Prefecture. The rivers surveyed and their respective RPI sub D values were: R. Wakayama-gawa, 60; R. Machino-gawa, 82; R. Kawarada-gawa, 66; R. Fugeshi-gawa, 58; R. Yamada-gawa, 63; R. Togi-gawa, 54; R. Misogigawa, 33. The water quality of the rivers was worse than expected and the degree of water pollution approximated those of rivers polluted by waste water. (Collier-IVI)
W85-02255

ASSAY FOR BIOLOGICALLY AVAILABLE PHOSPHORUS USING PROTEOLYTIC AEROMONAS HYDROPHILA,
Vermont Univ., Burlington. Dept. of Microbiology and Biochemistry.
A. I. Ratsep, and R. E. Sjogren.
Freshwater Biology, Vol. 14, No. 4, p 423-429, August, 1984. 4 Fig, 1 Tab, 30 Ref.

Descriptors: *Phosphorus compounds, *Bacterial physiology, *Aeromonas, *Bioassay, *Assay, Orthophosphates, Trophic level, Spectrophotometry, Phosphates.

Through enzymatic hydrolysis and excretion of organic acids by aquatic organisms, substantial quantities of biologically available phosphorus (BAP) from phosphorus containing compounds other than inorganic orthophosphate can easily be mobilized into the biological cycle. An assay procedure was developed as a first step in ascertaining whether or not the measurement of BAP could be used to assess the trophic state of freshwater lakes. BAP was measured by using Aeromonas hydrophila in a proteolytic assay system in which the release of the chromogen from an insoluble azure dye derivative of hide powder (HPA) was determined spectrophotometrically. The time necessary to hydrolyze 50% of the HPA was found to be directly dependent on the amount of BAP present. BAP within the range 2-250 micro g/L phosphate-phosphorus was detected. Various organic phosphorus compounds such as ADP, ATP, GMP, IMP, UMP, cytidylic acid, adenylic acid, as well as macromolecules RNA and DNA were usable as a source of BAP by A. hydrophyilla. BAP does not constitute a single phosphorus fraction but is found to occur naturally as a part of both organic and inorganic phosphorus compunds. Therefore, no physically definable phosphorus fraction(s) in the aquatic ecosystem can be measured chemically as BAP. Application of this assay for the measurement of BAP in freshwater offers the potential of monitoring the biological response of a freshwater ecosystem to phosphorus. (Collier-IVI)
W85-02285

CHROMATOGRAPHIC TRACE ANALYSIS OF GUANIDINE, SUBSTITUTED GUANIDINES AND S-TRIAZINES IN WATER,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
E. P. Burrows, E. E. Brueggeman, and S. H. Hoke.
Journal of Chromatography, Vol. 294, p 494-498, June, 1984. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Guanidine, *Triazines, *Industrial wastewater, *Chromatography, Urea, Cyanamide, Thin layer chromatography, High performance liquid chromatography.

Nitroguanidine is a frequent component of military propellants. To insure that Army production facilities remain in compliance with wastewater
charge limits, we were tasked with developmen
highly sensitive analytical methods for determi
tion of the trace organics known or suspected to
present in nitroguanidine production wastewa
These included nitrosoguanidine, cyanoguanidi
guanidine, urea, cyanamide, melamine, and amm
line, in addition to nitroguanidine. Until the em
gence of reversed-phase high-performance liq
chromatography (RP-HPLC), separation and an
ysis of these small, highly polar compounds w
generally limited to thin-layer chromatograp
(TLC) on cellulose in aqueous systems. Relative
HPLC, TLC procedures are insensitive (frequen
by several powers of ten) and difficult to ap
quantitatively because the compounds can only
visualized by chromogenic spray or dip reage
Recently, RP-HPLC separations of nitroguanidi
and nitrosoguanidine and of melamine and amm
line have been described. We here report t
highly sensitive, reproducible, and rapid R
HPLC methods for quantitative estimation of thi
substituted guanidines and two triazines, and th
application to trace analysis of wastewater. Gua
dine, classically determined by fluorescence sp
trophotometry of the ninhydrin complex, has ins
ficient UV absorbance alone for detection
HPLC. We have developed a novel ion chromat
graphic method for its estimation, which was n
subject to interference by other cations present
the wastewater. Cyanamide and urea were det
mined by spectrophotometric procedures d
scribed elsewhere. (Author's abstract)
W85-02303

**GAS CHROMATOGRAPHIC METHOD FO
THE DETERMINATION OF ELEMENTA
SULPHUR IN SEDIMENTS,**
Waterworks of Hajdu-Bihar County, Debrec
(Hungary).
C. Heim, I. Devai, and J. Harangi.
Journal of Chromatography, Vol. 295, No. 1,
259-263, July, 1984. 2 Fig, 13 Ref.

Descriptors: *Pollutant identification, *Gas chr
matography, *Sulfur, *Sediments, *Lake Balato
Hungary, Lake sediments.

The sulfur circulation, the qualitative and quantit
tive determination of sulfur compounds arisi
from sediments and the bacterial background
the transformations were investigated in sedimen
from Lake Balaton. A method was required f
determining small amounts of sulfur in the pre
ence of large amounts of other sulfur compoun
including sulfides, sulfites, and sulfates. For th
extraction of sulfur from sediments n-hexa
proved to be the best solvent. The chlorinate
hydrocarbon components, adsorbed on the silic
gel, could be eluted with benzene and used
pesticide analysis. The gas chromatographic analy
sis of elemental sulfur is based on the formation
hydrogen sulfide from sulfur in a hydrogen atmo
phere below 300 degrees C. Using this method th
elemental sulfur content of the sediment of Lak
Balaton was determined and the results of seve
measurements on the same sample gave minim
sulfur content, 170.80; maximum sulfur conten
186.20; average sulfur content, 179.74; and stand
ard deviation, 5.00. (Baker-IVI)
W85-02305

**ELECTROCHEMICAL PRECONCENTRATIO
COMBINED WITH ATOMIC ABSORPTIO
SPECTROMETRY FOR THE DETERMINA
TION OF HEAVY METALS IN WATER SAM
PLES,**
Bari Univ. (Italy). Dept. of Chemistry.
G. Torsi, and F. Palmisano.
Science of the Total Environment, Vol. 37, No. 1
p 35-40, July, 1984. 1 Tab, 23 Ref.

Descriptors: *Water analysis, *Heavy metals
*Atomic absorption spectrometry, *Electrochemi
cal deposition, Pollutant identification, Trac
metals.

The coupling of electrochemical deposition (ED
with atomic absorption spectrometry (AAS) as
means of suppressing matrix effects is reviewed
The coupling of ED with AAS represents an inter

esting approach to the problem of trace metals determination in complex matrices. The ED step is particularly effective in separating and removing the analyte from the sample matrix, extending the working concentration range of AAS downward. In some cases this approach is the only one that succeeds in the AAS determination of heavy metals in the sub-ppb range. ED-AAS is particularly appealing compared to chemical preconcentration as it avoids long and tedious manipulations of the sample that are also responsible for serious contaminations. The main drawbacks of the ED-AAS methods are: the applicability to only those metals that can be electrodeposited and subsequently atomized, under actual working conditions; and the non-multielementary capabilities, that is, a single metal can be determined from a single deposition. Multielemental analysis coupled to a single deposition could be attempted with deposition on graphite, but the enhanced contamination risks and the long time required for the deposition step make the method impractical. (Baker-IVI)
W85-02307

ELECTROCHEMICAL SPECIATION AND DETERMINATION OF ORGANOMETALLIC SPECIES IN NATURAL WATERS,
Pisa Univ. (Italy). Ist. di Chimica Analitica.
M. P. Colombini, R. Fuoco, and P. Papoff.
Science of the Total Environment, Vol. 37, No. 1, p 61-70, July, 1984. 8 Fig, 2 Tab, 19 Ref.

Descriptors: *Pollutant identification, *Speciation, *Organolead compounds, Organometallic compounds, Lead, Electrochemical speciation, Tetraalkyllead.

The analytical problem to be solved in tetraalkyllead pollution of natural water is not merely restricted to the detection and determination of the non-ionic compounds, but, owing to the attitude of tetraalkyllead in giving R3Pb(+), R2Pb(2+), up to inorganic lead, and owing to the quite different poisoning effect of such compounds, the problem has to be extended to determining all the degraded products up to Pb(2+). A procedure is described for the consecutive determination of Me4Pb, Et4Pb, Me3Pb(+), Et3Pb(+), Me2Pb(2+), Et2Pb(2+), and inorganic Pb(2+) in a water sample. The method is based on selective organic phase extraction coupled with differential pulse electrochemical techniques. Once irreversible chemical reactions during sample handling have been avoided, the only equilibria to be considered concern, respectively, R3Pb(+), R2Pb(2+), and Pb(2+) ions, which in natural water may be shared among different complexes. The analysis can be carried out in 3 to 4 hr. Owing to the reactivity and the thermal instability of the organolead compounds, concentrating the solution by solvent evaporation is not possible. The detection limit for the optical detector in gas chromatography may be therefore too high in respect to the actual needs. This may account for the very few data reported in literature for organolead, as compared with those relevant to arsenic, mercury, selenium and tin compounds. (Baker-IVI)
W85-02309

ELECTROANALYSIS OF ORGANIC POLLUTANTS IN AQUATIC MATRICES,
University Coll., Cork (Ireland). Dept. of Chemistry.
W. F. Smyth, and J. A. Healy.
Science of the Total Environment, Vol. 37, No. 1, p 71-81, July, 1984. 3 Tab, 28 Ref.

Descriptors: *Pollutant identification, *Electrochemistry, Polarography, Voltammetry, Stripping voltammetry, Chromatography, Trace analysis, Aromatic compounds, Carbamates, Anilines, Benzidines, Carbonyl compounds, Organophosphorus compounds, Sulfur compounds.

The electroanalysis of organic pollutants in aquatic matrices is reviewed. Attention is directed to the application of polarography, voltammetry, stripping voltammetry and online electrochemical detection following high-performance liquid chromatography separation to the identification and determination of trace concentrations of selected groups of organic compounds and their metabolites in aquatic matrices. Where possible, a critical comparison is made between the methods and alternative analytical methods based primarily on chromatographic and spectroscopic techniques. Compounds included in the discussion include those with carbonyl groupings, soluble aromatic compounds (nitrocompounds, phenolic compounds, polychlorinated compounds), carboxylic acids, alkyl sulfonates and alkyl benzene sulfonates, organophosphorus compounds, compounds containing endocyclic and exocyclic azomethine groups, compounds containing the -SH group, carbamates, halogenated anilines, and benzidines. (Baker-IVI)
W85-02310

TECHNIQUES OF ELECTROCHEMICAL DETERMINATION OF ORGANIC POLLUTANTS IN WATER,
Ceskoslovenska Akademie Ved, Prague. J. Heyrovsky Inst. of Physical Chemistry and Electrochemistry.
M. Kopanica.
Science of the Total Environment, Vol. 37, No. 1, p 83-90, July, 1984. 3 Fig, 1 Tab, 23 Ref.

Descripors: *Water analysis, *Pollutant identification, *Electrochemistry, Trace analysis, Polarography, Voltammetry, Chromatography, Organic compounds, Thioureas, Trichlorophenyls, Surfactants.

Progressive polarographic and voltammetric techniques for analysis of trichlorobiphenyl thiourea and other compounds in water are discussed. A new type of electrochemical detector for high pressure liquid chromatography (HPLC) is described. Adsorptive accumulation of analyzed substances plays an important role in the polarographic or voltammetric analysis of organic compounds because in many cases this mode of analysis allows a decrease in the detection limits of the corresponding electrochemical determinations. How this principle can be applied to the determination of some pollutants in natural waters is discussed, with specific reference to trichlorobiphenyl, thiourea and related compounds, and surfactants and crude oil products. In analyses where low amounts of organic pollutants are present, electrochemical methods are advantageous due to their high sensitivity, but in some cases these methods lack selectivity. Interest is therefore focused on the combination of polarographic or voltammetric methods with effective separation techniques. The application of electrochemical detectors in high performance liquid chromatography is very promising. (Baker-IVI)
W85-02311

ELECTROCHEMICAL MEASUREMENT OF DISSOLVED OXYGEN IN WATER,
Ceskoslovenska Akademie Ved, Prague. J. Heyrovsky Inst. of Physical Chemistry and Electrochemistry.
L. Serak.
Science of the Total Environment, Vol. 37, No. 1, p 107-111, July, 1984. 3 Fig, 6 Ref.

Descriptors: *Dissolved oxygen, *Polarography, *Water quality control, *Monitoring, Natural waters, Wastewater analysis.

Polarographic estimation of dissolved oxygen has become very important in the analysis of biological systems, including natural and waste waters. The recessed indicator microelectrode was developed as a new type of sensor for use in the field. The decisive step in the research was the introduction of a membrane-covered sensor. Some practical aspects of the application of an electrochemical Clark-type sensor are discussed. One of the difficulties encountered in the use of this sensor is the electrolyte layer which is confined between the membrane and the surface of the indicator electrode. Attention is paid to improvement of its function, through the introduction of a spacer between the indicator electrode and the membrane to define the thickness and diameter of the layer of electrolyte close to the surface of the electrode. (Baker-IVI)
W85-02314

ELECTROCHEMICAL METHODS AND SENSORS FOR MONITORING OF WATER,
Ceskoslovenska Akademie Ved, Prague. J. Heyrovsky Inst. of Physical Chemistry and Electrochemistry.
For primary bibliographic entry see Field 7B.
W85-02315

ION SELECTIVE ELECTRODES FOR MEASUREMENTS IN FRESH WATERS,
Rome Univ. (Italy). Ist. di Chimica Analitica.
For primary bibliographic entry see Field 7B.
W85-02316

INFLUENCE OF SURFACTANTS ON THE DETERMINATION OF CU, PB, AND CD BY ASV,
Newcastle Univ. (Australia). Dept. of Chemistry.
A. Beveridge, and W. F. Pickering.
Water Research, Vol. 18, No. 9, p 1119-1123, 1984. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Water analysis, *Surfactants, *Copper, *Lead, *Cadmium, Voltammetry, Anodic stripping, Pollutant identification.

Small amounts of water soluble surfactants alter significantly the uptake of metal ions by clays, and in view of their sorptive/reactive properties an investigation was undertaken into the possible influence of the same range of these soluble surfactants on the anodic stripping voltammetric (ASV) behavior of microgram/liter levels of Cd, Pb, and Cu using analytical equipment marketed for environmental studies. The presence of commercial surfactants caused some changes in peak current with little change in peak position or width. In general, there tended to be 20% increases in Cu response, 10% enhancement of Pb peaks, and decreases in Cd systems containing higher concentrations of organic matter. Concentrations as low as 10 micrograms/l produced measurable effects. The response of Cu in particular was sensitive to pH. Cu peak heights were also markedly affected by the presence of low concentrations of chloride ions. The precision achieved with the ASV Analyzer varied with the element studied, and the state of the Hg film. The percentage relative standard error of the means derived from five successive deposition and stripping cycles was 5% for Cd and Pb, 12-14% for Cu. It is recommended that when analyzing waters suspected of containing surfactants, extra care be taken in the calibration stage. (Baker-IVI)
W85-02429

IMPROVED AMMONIA OXIDATION BY OZONE IN THE PRESENCE OF BROMIDE ION DURING WATER TREATMENT,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
W. R. Haag, J. Hoigne, and H. Bader.
Water Research, Vol. 18, No. 9, p 1125-1128, 1984. 1 Fig, 1 Tab, 14 Ref.

Descriptors: *Wastewater treatment, *Ozonation, *Ammonia, *Bromine, Chemical reactions, Ozone, Oxidation, Kinetics, Catalysts.

Ammonia oxidation by ozone proceeds more rapidly in the presence of bromide ion than in its absence. Unlike the direct ozonation of ammonia, the bromide-catalyzed process is little affected by changes in pH. A reaction scheme is proposed in which bromide is oxidized to HOBr, which then brominates ammonia to produce NG2Br.NH2Br which in turn reacts with ozone to form NO3(-) and also to generate Br(-), which thus acts as a catalyst. Ammonia depletion in the presence of a constant ozone concentration does follow zero-order kinetics, except perhaps at low Br(-) concentrations. The rates correlate linearly with the added Br(-) concentration but are essentially independent of pH or initial ammonia concentration. Part of the ammonia losses observed in this study could have been due to bromine ammonia breakpoint reactions. Ozonation of bromide containing water in the absence of ammonia can lead to the formation of bromoorganics and bromate due to the intermediate formation of HOBr. The presence

of ammonia which intercepts the HOBr to produce less reactive brominating agents should tend to retard such reactions. (Baker-IVI)
W85-02430

OPTIMAL MANUAL PROCEDURE FOR AMMONIA ANALYSIS IN NATURAL WATERS BY THE INDOPHENOL BLUE METHOD,
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Center for Marine Research.
I. Ivancic, and D. Degobbis.
Water Research, Vol. 18, No. 9, p 1143-1147, 1984. 2 Fig, 3 Tab, 21 Ref. NSF grant F7F022Y.

Descriptors: *Ammonia, *Water analysis, *Indophenol blue method, Natural waters.

Experiments which lead to a modified analytical procedure for ammonia determination are presented. The Solorzano procedure using phenol-alcohol, nitroprusside, alkaline citrate and hypochlorite as reagents for determination of ammonia in water is considered suitable for routine analysis and has been widely adopted. Replacing the hypochlorite with sodium dichloro-iso-cyanurate, adding the catalyst after all other reagents, and increasing the working pH has resulted in improvements in this method. While concentration factors are statistically the same as in the original procedure, the reagent blanks are lower and the color develops faster, both in fresh and in sea water. (Baker-IVI)
W85-02433

COMPARISON OF METHODS FOR THE DETERMINATION OF CONDITIONAL STABILITY CONSTANTS OF HEAVY METAL-FULVIC ACID COMPLEXES,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
R. M. Sterritt, and J. N. Lester.
Water Research, Vol. 18, No. 9, p 1149-1153, 1984. 1 Fig, 1 Tab, 19 Ref.

Descriptors: *Water analysis, *Heavy metals, *Voltammetry, *Polarography, *Dialysis, *Ion-selective electrodes, Cadmium, Copper, Lead, Fulvic acid.

Values for the conditional stability constant K' for a particular set of defined experimental conditions of pH and ionic strength, and total ligand concentration (L') may be determined experimentally by titrating a ligand with metal ions using an analytical method to distinguish free metal from complexed metal. This study was undertaken to compare the values of K' and (L') for complex formation between fulvic acid and cadmium, lead and copper, in order to assess the influence of interference and selectivity of the analytical methods employed on the results obtained. The methods compared included the use of ion selective electrodes, dialysis and differential pulse anodic stripping voltammetry. Most information was obtained from the ion selective electrodes (ISE) which indicated that all three metals formed two types of complex with the fulvic acid. Weak cadmium complexes were undetectable when dialysis was used to separate bound and free metal. Only the stronger complexes of copper and cadmium were detected by polarography. The stability constant of the copper complex determined by polarography was lower than the equivalent values obtained from the other techniques, suggesting partial lability, while the lead complex was completely undetectable. The ISE analysis appeared to give the most reliable results in terms of applicability and sensitivity. (Baker-IVI)
W85-02434

DETERMINATION OF BROMIDE IN NATURAL WATERS BY ION CHROMATOGRAPHY USING A CONCENTRATOR COLUMN,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
C. M. Morrow, and R. A. Minear.
Water Research, Vol. 18, No. 9, p 1165-1168, 1984. 3 Fig, 3 Tab, 12 Ref.

Descriptors: *Water analysis, *Bromides, *Ion chromatography, *Concentrator columns, Chromatography, Sulfates, Nitrates, Chlorides, Natural waters.

When using conventional ion chromatography (IC) separation techniques, it is possible that other matrix anions also common to natural waters may coelute with bromide. Separation of bromine from all other matrix anions was shown to be possible using a trace anion separator, a standard anion suppressor and slightly weakened standard eluent at 30% flow. Qualitative analysis of micro g/l levels of bromine in the presence of high concentrations of other ions possessing higher affinities for the column than bromide can lead to less than 100% retention of bromide, in the event that the micro-equiv capacity of the concentrator column is exceeded. In the presence of 100 mg/l chloride, there was 100% recovery of 80 microg/l bromide. In the presence of 100 mg/l NO3(-), only 16.2% of the bromide was recovered, and there was no response for 80 micrograms/l Br(-) in the presence of 1000 mg/l sulfate, indicating 0% recovery. Evaluation of micro-equiv concentrator capacity yielded 8.5, 10.6, 6.8, 13.9, 11.7, and 14.6 for the 6 columns subjected to analysis. Evaluation of the concentrator found to possess the highest micro-equiv capacity (14.6) for percent recoveries of 80 micro g/l bromide in the presence of varying amounts of nitrate and sulfate, at a concentration of 50 ml, revealed that nitrate in excess of 17 mg/l and that sulfate in excess of 25 mg/l interfered with the elution of bromide. In the absence of interfering constituents, results of the IC and spectrophotometric analysis are quite comparable and may be used to validate one another. Use of the IC method for general analyses coupled with the capacity for backup analyses by the spectrophotometric method to allow for validation of the IC data is preferable. (Baker-IVI)
W85-02436

RAPID METHOD FOR SEPARATING PHOSPHORUS COMPOUNDS BY MOLECULAR WEIGHT USING EXCLUSION GELS AND CENTRIFUGATION,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
P. Brassard, and J. C. Auclair.
Water Research, Vol. 18, No. 9, p 1181-1183, 1984. 2 Fig, 9 Ref.

Descriptors: *Phosphorus, *Water analysis, *Lakes, *Gels, Organic compounds, Chromatography, Centrifugation, Batch analysis.

The separation of the various phosphorus compounds present in lakewaters is needed to assess their availability and role in algal assemblages. Separating these compounds by gel chromatography can take several hours, and denaturation can occur during that time. It is possible to accelerate the procedure by using several batch extractions in sequence. The method described allows the simultaneous analysis of 4 samples in about 20 minutes using Sephadex G-25 exclusion gel. After a suitable preparation the gel is packed in a small cylindrical extractor and centrifuged to near dryness. The gel is then spiked with sample no greater than the void volume of the gel. The first extract is forced out of the bed by centrifugation and collected. Then, an identical volume of eluent solution is added to the dry gel, allowing it to swell again. A second extract is centrifuged out, to be followed by another eluent addition. The process is repeated until 10 extracts, including the first one, are collected. By that time all the sample should have left the gel bed. The whole molecular weight profile of the sample is thus spread over the 10 extracts, with the void volume at the first one. The gain in time is obtained at the expense of resolution since the shallow elution profile is spread over 10 samples. The method is simple and efficient in applications where the speed of separation is more important than resolution. (Baker-IVI)
W85-02439

UNRELIABILITY OF THE KINETIC APPROACH TO MEASURING BACTERIAL MINERALIZATION ACTIVITIES AT LOW IN SITU TEMPERATURES IN AN ACIDIC AQUATIC ENVIRONMENT,
Laurentian Univ., Sudbury (Ontario). Dept. of Biology.
G. D. Ferroni, and L. G. Leduc.
Water Research, Vol. 18, No. 9, p 1185-1188, 19
3 Fig, 1 Tab, 23 Ref

Descriptors: *Bacteria, *Mineralization, *Wa analysis, *Kinetics, *Whitson Lake, *Onta Acidic waters, Heterotrophic activity meth Glucose.

The kinetic approach was used to determine rates of glucose mineralization in Whitson La situated 12 km north of Sudbury, Ontario. Wa samples showed the lake to be moderately acic Plots of the amount of glucose mineralized vs ti of incubation were linear at both high and l concentrations of added glucose. When sam water buffered around the in situ pH was used these time studies, linear relationships were ag evident, but there was a reduction in the rates glucose mineralization activity. Even so, the kin ic approach usually failed to generate the Mich lis-Menten response at the necessary level of sta tical significance to justify calculations of turnov times and V(max) values. And, buffering the p around the in situ pH did not insure that t Michaelis-Menten response would be obtain Previously it had been reported that the heterot phic activity method was unreliable when appli to the water column of an extremely acidic la (Leduc, L.G. and Ferroni G.D., 1984 Water R 18, 609-612). The results of this study show t method, as currently in use, is also unreliable wh applied to the open water of less acidic lak (Baker-IVI)
W85-02440

ISOLATION OF PATHOGENIC BACTER PRESENT IN WATER USING IMMUNOA SORBENTS (ISOLEMENT DE BACTERI PATHOGENES CONTAMINANT UNE EAU L'AIDE D'IMMUNOADSORBANTS),
Institut Pasteur, Paris (France). Dept. d'Immuno gie.
B. Guilbert, B. Goud, M. Guillou, S. Avrameas, and A. Dodin.
Water Research, Vol. 18, No. 9, p 1189-1191, 198 1 Tab, 7 Ref.

Descriptors: *Immunoabsorbents, *Bacter Drinking water, Water quality control, Publ health, Bacterial analysis.

A method is described which allows direct isol tion from water of the main pathogenic bacter which are common fecal contaminants. These i clude Salmonella typhimurium, Escherichia coli 88 and K 99 and Vibrio cholerae of the El T biotype. Contaminated water is filtered throug small immunoabsorbant columns packed with p lyacrylamide-agarose beads coupled to specif antibodies against bacterial antigenic structure Water samples containing a mixture of 1000 each of the four bacteria were filtered throug beads coated with different antibodies. Bacter retained on the beads were only those again which antibodies were directed. Analysis of th column effluent waters after passing 1000 bacter through the relevant columns showed no bacter after filtration, suggesting most of the bacter were retained on the beads. Bacteria were found column effluent waters when the water sampl contained more than 100,000 bacteria. This tec nique is highly specific and allows the filtration relatively large quantities of water. (Baker-IV W85-02441

FOREIGN ELEMENTS IN A CLAM SHELL: CLUE TO THE HISTORY OF MARINE POL LUTION EVENTS,
National Sun Yat-Sen Univ., Kaohsiung (Taiwan Inst. of Marine Biology.
L.-S. Fang, and P. Shen.
Marine Ecology Progess Series, Vol. 18, No. 1-2, 187-189, June, 1984. 2 Fig, 12 Ref.

Descriptors: *Shells, *Clams, *Monitoring, Marin environments, Water pollution effects, Calcium Zinc, Sulfur, Iron, Zinc, Chlorine.

Individuals of the clam Meretrix lusoria were collected from a shallow-water culture farm in Taiwan. The shells were analyzed using scanning electron microscopy combined with energy dispersive analysis by X-ray. In the inner and intermediate layers only Ca was detected. Significant amounts of Ca, S, and Fe, with minute amounts of Cu, Zn and Cl were detected in the outer layer (periostracum). The maximum quantity of the elements studied was found at the surface and along the edges of the shell. Foreign elements accumulate on the outer surface of the shell and the amounts of S, Fe, Cu and Zn decrease with age; this indicates that caution is necessary when using shells as a monitor for environmental pollution. When clams with large, thick shells are analyzed for bulk composition, the degree of pollution may be considerably underestimated. (Moore-IVI)
W85-02541

DEVELOPMENT AND USE OF AN AQUATIC MICRO-ECOSYSTEM AS A TEST SYSTEM FOR TOXIC SUBSTANCES. PROPERTIES OF AN AQUATIC MICRO-ECOSYSTEM IV,
Rijksinstituut voor Natuurbeheer, Leersum (Netherlands).
K. Kersting.
Internationale Revue der Gesamten Hydrobiologie, Vol. 69, No. 4, p 567-607, 1984. 22 Fig, 1 Tab, 33 Ref.

Descriptors: *Ecosystems, *Toxicity, *Herbicides, Daphnia, Chlorella, Bacteria, Algae, Cyanophyta, Dichlorbenil, Diuron, Regression analysis, Stress.

A series of experiments was performed with microecosystems, using several modifications of a microecosystem made up of three subsystems connected by a unidirectional flow of recirculating water. The three subsystems represent roughly the trophic levels of autotrophs (algae), herbivores (Daphnia magna), and decomposers (sand filter with bacteria). The particle concentration was determined weekly, using a Coulter Counter, and the Daphnia population was counted. The experimental conditions did not prevent contamination of the system by algae. Other species than the seeded Chlorella emerged in the systems. The resulting species composition was variable, and usually cyanobacteria became dominant after a period. Possibly, the low light intensity was responsible for the succession. The Daphnia population and the algal concentration varied considerably with time, and a slightly decreasing trend was usually observed. In several micro-ecosytems, the herbicide dichlobenil was introduced once or several times, and in one microecosystem, the herbicide diuron was added. Dichlobenil at 1 ppm had no effect. Diuron as a granulate at a dosage of 0.2 ppm led to a drastic decrease of the algal concentration, and the simultaneous death of the Daphnia population. The algal concentrations and the Daphnia numbers were correlated to each other by regression analysis and according to a dynamic system approach. In both cases, the effect of herbicides was better discerned than in the separate analysis of the data. In the dynamic systems approach, a normalized ecosystem strain was defined as a parameter to measure effects of stress on the ecosystem level. (Moore-IVI)
W85-02570

RELATIONSHIPS AMONG OBSERVED METAL CONCENTRATIONS, CRITERIA, AND BENTHIC COMMUNITY STRUCTURAL RESPONSES IN 15 STREAMS,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
T. W. LaPoint, S. M. Melancon, and M. K. Morris.
Journal of the Water Pollution Control Federation, Vol. 56, No. 9, p 1030-1038, September, 1984. 10 Fig, 2 Tab, 55 Ref.

Descriptors: *Bioindicators, *Water quality, *Metals, *Benthic fauna, Streams, Monitoring, Water pollution effects, Watersheds, Land use.

Fifteen streams were chosen to provide broad geographical representation and a wide range of watershed types and uses, pollution sources, water quality characteristics, biota, and habitats. The primary objectives were to document the concentration and distibution of toxic metals in the streams, determine the biological state of the receiving waters where the aquatic life criteria for metals were exceeded, report the extent to which criteria levels were exceeded, and develop explanatory hypotheses when healthy biota existed where criteria were exceeded. In general, the study supports the supposition that benthic fauna can reflect changes in water quality. It is suggested that a seasonal monitoring regime be used in which the sampling schedule is based on critical flow periods, to assess the toxicity of effluent discharges to the aquatic fauna. Only known seasonal invertebrate responses will allow a determination of whether a given criterion is adequate or overprotective for aquatic communities. (Baker-IVI)
W85-02584

ANAEROBIC INCUBATION OF MEMBRANE FILTER CULTURES FOR IMPROVED DETECTION OF FECAL COLIFORMS FROM RECREATIONAL WATERS,
Arizona Univ., Tucson. School of Renewable Natural Resources.
J. D. Doyle, B. Tunnicliff, S. K. Brickler, R. E. Kramer, and N. A. Sinclair.
Applied and Environmental Microbiology, Vol. 48, No. 2, p 324-326, August, 1984. 1 Fig, 1 Tab, 19 Ref. Forest Service grant RM-81-161-GR.

Descriptors: *Anaerobic incubation, *Membrane filtration, *Fecal coliforms, Recreational waters, Water quality, Beaches, Bacterial analysis.

Membrane filtration (MF) is the method of choice for monitoring recreational water quality, because of ease of use, applicability to large sample volumes, precision, and rapidity of results. The use of this technique for natural waters is sometimes hampered by high background densities of nonfecal coliforms. Anaerobic incubation of MF cultures significantly enhanced detection of fecal coliforms in surface-water samples from recreational beaches. In contrast to standard aerobic incubation, anaerobic incubation suppressed overgrowth of masking, noncoliform bacteria but did not increase the frequency of fecal coliform recovery. The simplicity and low cost of anaerobic incubation as adapted to the MF procedure may allow agencies which monitor recreational water quality to make expedient management decisions based on more reliable data. (Moore-IVI)
W85-02595

ISOLATION OF AEROMONAS HYDROPHILA FROM A METROPOLITAN WATER SUPPLY: SEASONAL CORRELATION WITH CLINICAL ISOLATES,
Princess Margaret Children's Medical Research Foundation, Perth (Australia).
For primary bibliographic entry see Field 5F.
W85-02596

ISOLATION OF AEROMONAS SPP. FROM AN UNCHLORINATED DOMESTIC WATER SUPPLY,
Princess Margaret Children's Medical Research Foundation, Perth (Australia).
For primary bibliographic entry see Field 5F.
W85-02597

EVALUATION OF M-T7 AGAR AS A FECAL COLIFORM MEDIUM,
Montana State Univ., Bozeman. Dept. of Microbiology.
M. W. LeChevallier, P. E. Jakanoski, A. K. Camper, and G. A. McFeters.
Applied and Environmental Microbiology, Vol. 48, No. 2, p 371-375, August, 1984. 3 Fig, 2 Tab, 14 Ref. EPA grant R807092.

Descriptors: *Fecal coliforms, *Injured coliforms, *Culture media, Effluents, Chlorination, Bacterial analysis, Coliforms, Wastewater treatment.

Coliforms in chlorinated sewage effluents may be stressed or injured and may not grow when selective media are used. A medium (m-T7 agar) designed to improve recoveries of injured total coliforms was evaluated for its effectiveness as a fecal coliform medium. Time and temperature of preincubation were crucial to the optimal recovery of fetal coliforms. Isolation rates for fecal coliforms on m-T7 agar from sewage effuents were the highest when plates were preincubated at 37 C for 8 h before transfer to 44.5 C for 12 h. The medium produced consistently higher fecal coliform counts than all other methods tested. Recoveries were 3.1 times greater than the standard m-FC method and 1.7 times greater than the two-layer enrichment, temperature acclimation procedure. Verification rates for fecal coliforms isolated on m-T7 agar averaged 89.0%, whereas verification rates for m-FC agar averaged only 82.8%. Both media isolated similar fecal coliform populations. Results of the study indicate that 66.8% of the coliforms in the chlorinated sewage effluents examined were injured. (Moore-IVI)
W85-02598

ISOLATION OF ENTEROVIRUSES FROM WATER, SUSPENDED SOLIDS, AND SEDIMENTS FROM GALVESTON BAY: SURVIVAL OF POLIOVIRUS AND ROTAVIRUS ADSORBED TO SEDIMENTS,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
V. C. Rao, K. M. Seidel, S. M. Goyal, T. G. Metcalf, and J. L. Melnick.
Applied and Environmental Microbiology, Vol. 48, No. 2, p 404-409, August, 1984. 1 Fig, 7 Tab, 34 Ref.

Descriptors: *Enteroviruses, *Poliovirus, *Rotavirus, *Suspended solids, *Sediments, *Galveston Bay, *Texas, Estuarine environment, Seawater, Viruses, Water pollution.

The distribution and quantitation of enteroviruses among water, suspended solids, and compact sediments in a polluted estuary are described. Samples were collected sequentially from water, suspended solids, fluffy sediments (uppermost layer of bottom sediments), and compact sediment. A total of 103 samples were examined of which 27 (26%) were positive for virus. Polioviruses were recovered most often, followed by coxsackie B viruses and echoviruses 7 and 29. Virus was found most often attached to suspended solids: 72% of these samples were positive, whereas only 14% of water samples without solids yielded virus. Fluffy sediments yielded virus in 47% of the samples, whereas only 5% of compact bottom-sediment samples were positive. When associated with solids, poliovirus and rotavirus retained their infectious quality for 19 days. The same viruses remained infectious for only 9 days when freely suspended in seawater. Collection of suspended solids at ambient water pH appears to be very useful for the detection of virus; it has advantages over collecting and processing large volumes of water, with accompanying pH adjustment and salt addition for processing. (Author's abstract)
W85-02599

APPLICATION OF DERIVATIVE SPECTROSCOPY IN BIOASSAYS ESTIMATING ALGAL AVAILABLE PHOSPHATE IN LAKE SEDIMENTS,
Hoogheemraadschap van Rijnland, Leiden (Netherlands).
C. Bruning, and S. P. Klapwijk.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 172-178, July, 1984. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Spectroscopy, *Bioassays, *Lake sediments, *Phosphates, Acidity, Algae, Biomass, Hydrogen ion concentration.

The derivative spectroscopy technique is shown to be a very quick, sensitive and reliable biomass parameter in bioassays which are disturbed by sediment. It can even be used in sediment/algal mixtures, where only 6% of the total absorption (at 680 mm) is caused by the presence of algae. Therefore the technique can perhaps also be applied to determine the presence of algae in natural sedi-

ments. The study also demonstrated that the rising pH in bioassays with sediment can greatly increase the availability of sediment phosphates. In this study the potentially occurring precipitation of calcite with coprecipitation of phosphate did not balance the release of iron and aluminum bound phosphates from the sediments at higher pH levels. (Baker-IVI)
W85-02615

5B. Sources Of Pollution

ACCUMULATION AND FATE OF TRI-N-BUTYLTIN CATION IN ESTUARINE BACTERIA,
National Bureau of Standards, Gaithersburg, MD. Center for Materials Science.
W. R. Blair, G. J. Olson, F. E. Brinckman, and W. P. Iverson.
Microbial Ecology, Vol. 8, No, 3, p 241-251, 1982. 3 Fig, 3 Tab, 34 Ref.

Descriptors: *Bacteria, *Butyltin, *Bioaccumulation, *Fate of pollutants, Chesapeake Bay, Metabolism, Organotin compounds, Estuarine environment, Biocides.

Organotins are being used in increasing amounts as plastics stabilizers, catalysts, and biocides. Estuarine bacteria resistant to tributyltin were studied to examine the mode of tributyltin accumulation and possible degradation and/or detoxification processes. Eight tributyltin-resistant bacterial isolates obtained from Baltimore Harbor, Chesapeake Bay, and three other resistant strains were used in the studies. The bacterial isolates accumulated tributyltin to 3.7-7.7 mg tin per g dry weight of cells by nonenergy requiring process, probably by adsorption to the cell envelope. Chemical speciation of cell extracts and culture media by combined liquid chromatography-atomic absorption spectrophotometry and tin-selective purge and trap flame photometric gas chomatography for possible tributyltin degradation products revealed no significant biotransformation of tributyltin cation by the tributyltin-resistant isolates. Apparently the isolates accumulate, but do not metabolize tributyltin. (Moore-IVI)
W85-02185

SURVIVAL AND VIABILITY OF NONCULTURABLE ESCHERICHIA COLI AND VIBRIO CHOLERAE IN THE ESTUARINE AND MARINE ENVIRONMENT,
Shandon Coll. of Oceanography (China). Dept. of Marine Biology.
H.-S. Xu, N. Roberts, F. L. Singleton, R. W. Attwell, and D. J. Grimes.
Microbial Ecology, Vol. 8, No. 4, p 313-323, 1982. 4 Fig, 2 Tab, 24 Ref. PHS grant 5R22-AI-14242, NSF grant DEB 77-14646, National Sea Grant NA81AA-D-00040, NOAA grant NA79AA-D-00062 and WHO grant C6/181/70.

Descriptors: *Bacteria, *Bioindicators, *Estuarine environment, *Marine environment, *Viability, *Survival, Fate of pollutants, Pathogenic bacteria, Vibrio, Escherichia, Public health.

Plating methods for estimating survival of indicator organisms, such as Escherichia coli, and waterborne pathogens including Vibrio cholerae, have severe limitations when used to estimate viable populations of these organisms in the aquatic environment. By combining the methods of immunofluorescent microscopy, acridine orange direct counting, and direct viable counting, with culture methods such as indirect enumeration by most probable number (MPN) estimation and direct plating, it was shown that both E. coli and V. cholerae undergo a 'nonrecoverable' stage of existence, but remain viable. Following 2-week incubations in saltwater (5-25% NaCl) microcosms, total counts, measured by direct microscopic examination of fluorescent antibody and acridine orange stained cells, remained unchanged, whereas MPN estimates and plate counts exhibited rapid decline. Results of direct viable counting, a procedure permitting estimate of substrate-responsive viable cells by microscopic examination, revealed that a significant proportion of the nonculturable cells were, indeed, viable. Thus, survival of pathogens in the aquatic environments must be re-assessed. The 'die-off' or 'decay' concept may not be completely valid. Furthermore, the usefulness of the coliform and fecal indices for evaluating water quality for public health purposes may be seriously compromised, in the light of the finding. (Author's abstract)
W85-02186

WATERBORNE TRANSMISSION OF CAMPYLOBACTER ENTERITIS,
Center for Infectious Diseases, Atlanta, GA. Div. of Bacterial Diseases.
For primary bibliographic entry see Field 5F.
W85-02188

DISTRIBUTION AND POSSIBLE INTERRELATIONSHIPS OF PATHOGENIC AND NONPATHOGENIC ACANTHAMOEBA FROM AQUATIC ENVIRONMENTS,
American Type Culture Collection, Rockville, MD.
P. M. Daggett, T. K. Sawyer, and T. A. Nerad.
Microbial Ecology, Vol. 8, No. 4, p 371-386, 1982. 2 Fig, 2 Tab, 26 Ref. NIH contract N01-RR-9-2104 and NSF DEB 7907336.

Descriptors: *Acanthamoeba, *Marine environment, *Coastal waters, *Distribution, Sludge disposal, Ocean dumping, Pathogenic protozoa, Protozoa, Marine sediments.

An overview of surveys on the distribution of Acanthamoeba spp. in marine, coastal waters, and tributaries of the northeastern US coast is presented. To confirm the species assignments, based upon morphological criteria, selected strains from these environments were compared isoenzymatically with pathogenic and nonpathogenic Acanthamoeba from other environments. The interrelationships among the strains examined, based on this analysis, are also reported. There appears to be particular association between the presence of Acanthamoeba in marine sediments and the sites of oceanic sludge dumping. Starch gel electrophoretic analysis of enzymes suggests that some isolates of Acanthamoeba from oceanic sludge dump-sites are not members of previously recognized pathogenic species. Current laboratory methods provide only a conservative estimate of the frequency with which Acanthamoeba are recovered from environmental samples. Continued research on methodology, ecology, and distribution of Acanthamoeba should confirm present indications that they are universally distributed in soil, water, and marine sediments. (Moore-IVI)
W85-02189

PARTITIONING AND SHORT-TERM PERSISTENCE OF FENITROTHION IN NEW BRUNSWICK (CANADA) HEADWATER STREAMS,
Maritimes Forest Research Centre, Fredericton (New Brunswick).
D. C. Eidt, A. J. Sosiak, and V. N. Mallet.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 1, p 43-52, January, 1984. 1 Fig, 11 Tab, 31 Ref.

Descriptors: *Fenitrothion, *Fate of pollutants, *Stream pollution, *New Brunswick, Insecticides, Suspended matter, Liverworts, Insects, Sediment contamination, Aquatic plants, Aquatic animals, Pesticide residues.

Fenitrothion is one of the principal insecticides used to minimize damage to the northeastern spruce-fir forest by the spruce budworm. There is reason for concern if fenitrothion or toxic degradation products concentrate and persist in compartments of the environment where they may affect organisms that find their niches in these compartments. Two streams were sprayed from the banks with a backpack mist blower, one with emulsifiable concentrate in water, and the other with an oil-based formulation. There were no consistent differences in concentration of fenitrothion in streamwater with depth, or between midstream and slow water at the stream edge. This was true of both aqueous and oil-based formulations. A large p portion of the fenitrothion was taken up by s pended material; in sediment, it was taken mainly by the organic fraction. Concentrations fenitrothion were above prespray values in m plants and insects sampled, and in some, abo peak concentrations found in the water. High and most persistent residues were found in a liv wort. Highest residues in an animal were found black fly larvae, perhaps explained by their filt feeding on suspended matter with high fenitroth concentrations. Peak concentrations in plants a animals usually occurred at 6 or 24 hr postspr sampling times, and in all cases decreased there ter. Aminofenitrothion and fenitrooxon in se ments and 3-methyl-1-4-nitrophenol in plants a insects were seldom and inconsistently detected was confirmed that fenitrothion disappears rapi in streamwater, including the suspended matter, it flow downstream. (Moore-IVI)
W85-02190

PRESENCE AND BIOMAGNIFICATION O ORGANOCHLORINE CHEMICAL RESIDU IN OXBOW LAKES OF NORTHEASTER LOUISIANA,
Missouri Univ.-Columbia. School of Forest Fisheries and Wildlife.
K. R. Niethammer, D. H. White, T. S. Baskett, a M. W. Sayre.
Archives of Environmental Contamination a Toxicology, Vol. 13, No. 1, p 63-74, January, 19 4 Fig, 6 Tab, 30 Ref.

Descriptors: *Organochlorines, *Pesticides, *La Bruin, *Lake Providence, *Lake St. John, *Lou ana, *Biological magnification, Polychorinated phenyls, DDT, Toxaphene, Organic compoun

Ninety-eight samples of 16 species of animals we collected at Lake Providence, 88 samples of species at Lake Bruin, and 21 samples of 5 spec at Lake St. John, Louisiana between July a September of 1980. In these samples residues of different organochlorine compounds were foun The lakes act as sumps, accumulating residues fr nearby agricultural land, and allowing substant concentrations of many of these compounds build up in the food webs. The principal organoc lorines detected were DDT and its metaboli toxaphene, and polychlorobiphenyls. Biomagni cation was clearly illustrated in most cases. It suggested that residue level in immature gree backed herons and one or more of the longer-liv predators such as snakes, gars, or largemouth ba could be monitored to evaluate levels of organoc lorine chemical contaminants in aquatic habita (Baker-IVI)
W85-02191

IDENTIFICATION AND MEASUREMENT O COMPONENTS IN GASOLINE, KEROSEN AND NO. 2 FUEL OIL THAT PARTITIO INTO THE AQUEOUS PHASE AFTE MIXING,
Health Effects Research Lab., Cincinnati, OH.
W. E. Coleman, J. W. Munch, R. P. Streicher, H. P. Ringhand, and F. C. Kopfler.
Archives of Environmental Contamination an Toxicology, Vol. 13, No. 2, p 171-178, Marc 1984. 6 Fig, 3 Tab, 15 Ref.

Descriptors: *Oil spills, *Hydrocarbons, *Gas line, *Kerosene, *Fuel oil, Water soluble fractio Aromatic compounds, Fate of pollutants.

The water-soluble fractions (WSF) of gasolin kerosene, and No. 2 fuel oil were added to drin ing water and extracted into the aqueous pha under simulated field conditions. Initial aspects the study dealt with the identification and distribu tion of the major components to the aqueous pha using pentane extraction and capillary column ga chromatography/mass spectrometry (GC/MS) fo analyses. For all three fuels, aromatics comprise 50% or less of the weight of the product whe analyzed directly. In each case aromatics com prised >93% by weight of the WSF. The larges weight percentages of the WSF were represente by C8 aromatics in gasoline (35%), C10 aromatic in kerosene (33%), and C11 aromatics in No. 2 fu

oil (40%). Any toxicological and biological testing should be concentrated on aromatic compounds, particularly C6-C13 benzenes and naphthalenes. It may be feasible to use UV absorption analyses of the WSF as a gross parameter for measuring aromaticity to correlate with mutagenic activity. (Moore-IVI)
W85-02199

CHARACTERIZATION OF ORGANIC COMPOUNDS IN SIMULATED RAINFALL RUNOFFS FROM MODEL COAL PILES,
Texas Univ. Health Science Center at Houston. School of Public Health.
R. G. Stahl, Jr., J. G. Liehr, and E. M. Davis.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 2, p 179-190, March, 1984. 6 Fig, 6 Tab, 38 Ref.

Descriptors: *Coal, *Water pollution sources, *Organic compounds, Rainfall runoff, Simulation, Sulfur, Phenanthrene, Aliphatic compounds, Polycyclic aromatic hydrocarbons, Hydrocarbons.

Model coal piles were constructed and leached with distilled water under simulated rainfall conditions. The piles were composed of one of four coals: two of high sulfur content (Illinois No. 6 and Western Kentucky), one of low sulfur content (Montana Nerco), and one of variable sulfur content (Texas lignite). There were nine rainfall simulations spaced 15 days apart. The runoffs were collected, extracted at acid and base pH, and analyzed by capillary column gas chromatography/mass spectrometry (GC/MS). Also, an extreme case was simulated by stir-extracting a coal with three different organic solvents in an acid and base medium, and the extracts were analyzed by GC/MS. The most common organic compound identified in any extract was phenanthrene. Aliphatic hydrocarbons and polycyclic aromatic hydrocarbons (PAHs), and methyl and ethyl substituted PAHs were also identified. The concentration of most of the compounds did not exceed 50 micro g/L. The concentrations of compounds in the extreme case simulations ranged from below detection (< 1 micro g/L) up to 107 micro g/L. The data demonstrated that runoffs from coal piles may contain numerous organic compounds including many PAHs. (Author's abstract)
W85-02200

LEACHING OF OXIDATION PRODUCTS OF ALDICARB FROM GREENHOUSE SOILS TO WATER COURSES,
Institute for Pesticide Research, Wageningin (Netherlands).
M. Leistra, A. Dekker, and A. M. M. van der Burg.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 3, p 327-334, May, 1984. 5 Fig, 5 Tab, 12 Ref.

Descriptors: *Greenhouses, *Aldicarb, *Leaching, Pesticides, Water pollution sources, Pesticide residues, Computer models, Aldoxycarb, Irrigation rate, Greenhouse soils.

The transformation kinetics of the insecticide/nematicide aldicarb were studied in three greenhouse soils. Most of the aldicarb applied to soil oxidizes rapidly to aldicarb-sulfoxide, and a fraction of this oxidizes further to aldoxycarb. The transformation rates of the parent compound and its first oxidation product were high, while the amounts of aldoxycarb remained low. The transformation and movement of aldicarb and its oxidation products in a simplified greenhouse-soil system were simulated with a computation model. When the highest transformation rates were introduced into the computations in combination with high irrigation rates, the computed leaching was only 0.006% of the dose, with a maximum concentration of 0.15 micro g/L in the tile-drain water. With lower transformation rates, the computed leaching was 1.39% of the dose with a maxiumum concentration of 21.0 micro g/L, but in combination with a lower irrgation rate the leaching was computed to be much less. Water from drain pipes and pits was sampled in three greenhouses that had received regular applications of aldicarb: the concentrations measured by high performance liquid chromatography (HPLC) varied from less than 1 micro g/L to more than 30 micro g/L. Most of the concentrations measured in water courses in an area with many greenhouses were low, but some were high, ranging up to 21 micro g/L. With lower irrigation rates, the leaching of mobile pesticide residues from greenhouse soils to water courses could be much less. An even distribution of irrigation water and a decrease in the gift of irrigation water per event could contribute to such a reduction. (Moore-IVI)
W85-02208

ACCUMULATION OF TRACE ELEMENTS, PESTICIDES, AND POLYCHLORINATED BIPHENYLS IN SEDIMENT AND THE CLAM CORBICULA MANILENSIS OF THE APALACHICOLA RIVER, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. F. Elder, and H. C. Mattraw, Jr.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 4, p 453-469, July, 1984. 11 Fig, 9 Tab, 56 Ref.

Descriptors: *Apalachicola River, *Florida, *Trace elements, *Pesticides, *Clams, *Polychlorinated biphenyls, Organic compounds, Heavy metals, Sediment contamination, Detritus, Water pollution sources.

A survey of trace element and synthetic organic compound concentrations in bottom materials was conducted on the Apalachicola River in northwest Florida in 1979-80 as part of the Apalachicola River Quality Assessment. Substances analyzed included trace elements (predominantly heavy metals), organochlorine insecticides, organophosphorus insecticides, chlorinated phenoxy-acid herbicides, and polychlorinated biphenyls (PCBs). Three kinds of materials were surveyed: fine-grained sediments, whole-body tissue of the Asiatic clam Corbicula manilensis, and bottom-load organic detritus. No hazardous levels of any of the substances were found. Concentrations in the fine-grained sediments and clams were generally at least ten times lower than maximum limits considered safe for biota of aquatic systems. A comparison of trace-substance data from the Apalachicola River with data from Lake Seminole (upstream) and Apalachicola Bay (downstream) showed lower concentrations in riverine clams. Sediment concentrations in all parts of the system were comparable. Most trace substances in the Apalachicola River enter the river from the upstream part of the basin (the Chatahoochee and Flint Rivers in Georgia and Alabama) and from nonpoint sources throughout the basin. There are no major point discharges along the Apalachicola. Trend analysis was limited by the scope of the study but did not reveal any spatial or temporal trends in concentrations of any of the substances analyzed. Concentrations of organic compounds and most metals in Corbicula manilensis did not correlate with those in sediments. (Author's abstract)
W85-02213

FATE OF HEXACHLOROCYCLOPENTADIENE IN WATER AND GOLDFISH,
Illinois Univ. at Chicago Circle. Dept. of Biological Sciences.
A. A. Podowski, and M. A. Q. Khan.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 4, p 471-481, July, 1984. 3 Fig, 5 Tab, 31 Ref.

Descriptors: *Hexachlorocyclopentadiene, *Fate of pollutants, *Goldfish, Degradation, Industrial wastes, Biotransformation.

Hexachlorocyclopentadiene (Hex) is an intermediate in the synthesis of cyclodiene insecticides and other industrial chemicals. Environmental contamination with Hex and its by-products and end-products (which contain about 1% Hex) during and after the manufacture of end-products may be possible. Hex underwent chemical alterations in water, forming both lipophilic and hydrophilic products. Its half-life in goldfish of about nine days, which was less than that of cyclodienes, was due to its rapid degradation. The lipophilic nonpolar products in fish were extremely volatile. Three days after the intraperitoneal injection of C-14 labeled Hex, ethyl acetate-extractable radioactivity was approximately 47% while water-solubles and unextractables were 11 and 20% of the injected radioactivity, respectively. The remaining radioactivity was eliminated in the water. About 97% of the injected radioactivity was accounted for. Ethyl acetate extracts of fish included at least eight unidentified breakdown products. Water-solubles from fish and from exposure water included at least 4 and 11 unidentified products, respectively. The studies of the biotransformation of Hex in goldfish are complicated by the fact that Hex and its metabolites are very reactive, many being very volatile and extremely lipophilic. (Moore-IVI)
W85-02214

GROUND WATER QUALITY IN THE AQUIFER OF THE UPPER MAD RIVER VALLEY 1940 TO 1983,
J. D. Pennino.
Ground Water Monitoring Review, Vol. 4, No. 3, p 27-38, 1984. 12 Fig, 3 Tab, 6 Ref.

Descriptors: *Mad River Valley, *Ohio, *Ground water, *Water quality, Dissolved solids, *Sulfates, Fluorides, Calcium, Magnesium, Potassium, Chloride, Sodium, Iron, Zinc, Arsenic, Barium, Lead, Water pollution sources.

More than 40 years of ground quality monitoring data from the aquifer of the Upper Mad River Valley have been accumulated by various agencies in Ohio. The data consists of concentrations for more than 30 chemical substances found in the ground water. Evaluation of this data using statistical analysis, tables and graphs indicates that there have been moderate increases in total dissolved solids, sulfate, fluoride, calcium, magnesium and potassium. More significant increases were discovered for chloride and sodium. Iron and zinc show a general decline in concentration. The metals arsenic, barium and lead also show increases in recent years. However, large variations in the concentrations and limited data for these metals limit the reliability of the apparent trends shown in the tabulated data. The increases in chloride and sodium are attributed to the use of road de-icing salt. Increases in sulfate and potassium may be due to use of fertilizers in a region which is largely agricultural. The most recent data may indicate that the ground water quality is improving in terms of these two parameters. Although most of the data indicate increases in concentrations with time, inconsistencies in sampling procedures and difficulties in assessing many factors which affect ground water quality preclude the broad conclusion that urbanization and industrialization have caused regional ground water quality degradation. The inability to interpret much of the data underlies the need for an integrated environmental monitoring program. Such a program should provide a data base for assessing factors such as air and river quality and historical land use practices so that their impact on ground water quality in the Mad River Valley can be better understood. (Author's abstract)
W85-02216

TRANSPORT OF CARBON, NITROGEN, PHOSPHORUS, AND MAJOR SOLUTES IN THE GAMBIA RIVER, WEST AFRICA,
California Univ., Santa Barbara. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2H.
W85-02220

EFFECTS OF FEEDING RATES ON PRODUCTION OF COMMON CARP AND WATER QUALITY IN PADDY-CUM-FISH CULTURE,
Indian Council of Agricultural Research, New Delhi.
S. K. Ghosh, B. H. Mandal, and D. N. Borthakur.
Aquaculture, Vol. 40, No. 2, p 97-101, July, 1984. 1 Fig, 2 Tab, 6 Ref.

Descriptors: *Fish farming, *Water quality, *Feeding rates, Economic aspects, Carp, Rice paddies, Growth, Water pollution sources.

A 90 day study was conducted of the effects of artificial feeding on production of common carp and on water quality in paddy-cum-fish culture. An increasing trend in the growth of individual fish and fish yield with increasing feeding rates was noted. Concentrations of nitrite, nitrate, chemical oxygen demand, and particulate organic matter also increased with increasing feeding rates. The concentration of dissolved oxygen decreased. A low pond conversion value is indicative of efficient utilization of high quality feed, while a high pond conversion value indicates poor feed quality and low utilization. Pond conversion factors for the present study were calculated and it was determined that a feeding rate of 8.8% of the total body weights of the fish, calculated on the Mitscherlich model would be ideal for economic reasons. A feeding rate beyond 4% was wasteful, and accumulation of the feed caused deterioration in water quality. (Baker-IVI)
W85-02236

SEWAGE SLUDGE FOR CULTIVATING FRESHWATER ALGAE AND THE FATE OF HEAVY METAL AT HIGHER TROPHIC ORGANISMS; IV. HEAVY METAL CONTENTS IN DIFFERENT TROPHIC LEVELS,
Chinese Univ. of Hong Kong, Shatin. Dept. of Biology.
For primary bibliographic entry see Field 5E.
W85-02237

TWO-DIMENSIONAL TIME-DEPENDENT SIMULATION OF CONTAMINANT TRANSPORT FROM A LANDFILL,
Miami Univ., Coral Gables, FL. Coll. of Engineering.
For primary bibliographic entry see Field 5G.
W85-02272

WATER QUALITY PREDICTION IN MIXING ZONES OF RIVERS,
Gore and Storrie Ltd., Toronto (Ontario). Water Resources Div.
T. P. H. Gowda.
Journal of Environmental Engineering, Vol. 110, No. 4, p 751-769, August, 1984. 9 Fig, 3 Tab, 32 Ref.

Descriptors: *Mixing zones, *Mixing zone models, *Water quality, *Stream tube models, Decay rates, Chlorine, Wastewater outfall, Ontario, Path of pollutants.

Steady state models based on the stream tube concept are presented to predict far-field concentration distributions of pollutants in mixing zones of rivers. Analytical solutions for pipe and diffuser outfall sources, presented by N. Yotsukura and E. D. Cobb (1972, U. S. Geological Survey Professional Paper 582-C, USGPO, Washington, D. C., 19pp), are modified to account for the reach-dependency of pollutant decay rate, transverse diffusion factor and channel hydraulic parameters. The models are validated using field data for a conservative tracer (chloride ion) and a nonconservative pollutant (total residual chlorine) collected in shallow rivers located in Southern Ontario, Canada. In general, the models presented in this paper are applicable to conservative and exponentially decaying pollutants. (Author's abstract)
W85-02275

MOISTURE TRANSPORT IN A SOLID WASTE COLUMN,
Stevens Inst. of Tech., Hoboken, NJ. Dept. of Ocean Engineering.
G. P. Korfiatis, A. C. Demetracopoulos, E. L. Bourodimos, and E. G. Nawy.
Journal of Environmental Engineering, Vol. 110, No. 4, p 780-796, August, 1984. 9 Fig, 1 Tab, 36 Ref.

Descriptors: *Solid waste disposal, *Fluid flow, *Unsaturated flow, Mathematical models, Leachate, Landfills, Sanitary landfills.

The physical processes governing moisture transport in solid waste landfills are analyzed by the theory of unsaturated flow through homogeneous porous media and experimental work. A laboratory column was constructed and monitored to determine the behavior of unsaturated flow through solid wastes. The hydraulic properties of the refuse were determined from small scale experiments. A mathematical model was formulated and the experimental results were used to calibrate and verify it. Comparisons of measured and computed leachate discharges showed reasonable agreement. The theory of unsaturated flow through homogeneous porous media was successfully used to model moisture transport through the refuse material of a laboratory column. (Author's abstract)
W85-02276

ACCURATE MODELING OF RIVER POLLUTANT TRANSPORT,
Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Science Centre.
G. B. McBride, and J. C. Rutherford.
Journal of Environmental Engineering, Vol. 110, No. 4, p 808-827, August, 1984. 10 Fig, 31 Ref.

Descriptors: *Waipa River, *New Zealand, *Path of pollutants, Model studies, Dissolved oxygen, Biochemical oxygen demand, River flow.

A simple, accurate, Lagrangian numerical scheme is developed for modeling the advection and dispersion of an nonconservative pollutant in one-dimensional, nonuniform river flow. The scheme is free from the common propensity to produce false oscillations and smearing in steep front regions. Testing of the scheme demonstrates its high accuracy, which is maintained on very coarse grids. A successful application is demonstrated in which it has been used to model the passage of patches of anoxic water down the Waipa River, New Zealand. Longitudinal dispersion coefficients were inferred by matching model predictions to observed steep fronts of DO and BOD5. These were confirmed by subsequent dye studies. River reaeration and deoxygenation coefficients were also inferred, these being useful for managament oriented simulation in this river and elsewhere. (Author's abstract)
W85-02277

CHLORINATED HYDROCARBONS IN THE SEAWATER AND SURFACE SEDIMENTS OF BLANCA BAY, ARGENTINA,
Instituto Argentino de Oceanografia, Buenos Aires. Lab. de Quimica Marina.
J. L. Sericano, and A. E. Pucci.
Estuarine, Coastal and Shelf Science, Vol. 19, No. 1, p 27-51, July, 1984. 3 Fig, 12 Tab, 40 Ref.

Descriptors: *Fate of pollutants, *Chlorinated hydrocarbons, *Pesticides, *Seawater, *Sediments, BHC, Lindane, Heptachlor, Aldrin, DDT, Heptachlor epoxide, Water pollution sources, Particulates.

Of the eleven organochlorine pesticides searched for, 7 could be detected in seawater: alpha-BHC, lindane, heptachlor, delta-BHC, aldrin, o-p'-DDT, and p-p'-DDT, and only 3 in surface sediments: alpha-BHC, lindane, and heptachlor. Dieldrin, heptachlor epoxide, o-p'-DDD and p-p'-DDD concentrations were all below detection limits. The major areas of concentration for the compounds in seawater were in the inner portion of the study area. The highest concentrations in both seawater and sediments were found at a particular site due to the influence of the emptying of the main sewer of Bahia Blanca. The air-sea interface water layer had 18 times more organochlorine compounds than did water from the bottom layer. A study of the correlation between chlorinated hydrocarbon content and particulate matter present in seawater showed that lindane, heptachlor and delta-BHC mean concentrations decreased in those samples containing little particulate matter whereas alpha-BHC and aldrin presented no important changes. No significant correlation was noted between organochlorine levels and the amount of particulate organic material in seawater samples. (Baker-IVI)
W85-02289

WATER QUALITY STUDIES AROUND SEWAGE SLUDGE DUMPING SITE IN LI POOL BAY,
Ministry of Agriculture, Fisheries and Food, ham on Crouch (England). Fisheries Lab
M. G. Norton, P. G. W. Jones, A. Franklin, a M. Rowlatt.
Estuarine, Coastal and Shelf Science, Vol. 19 1, p 53-67, July, 1984. 6 Fig, 5 Tab, 27

Descriptors: *Liverpool Bay, *England, * quality, *Sludge disposal, *Mersey River, disposal, Industrial wastes, Zinc, Copper, C um, Nickel, Fate of pollutants.

Liverpool Bay (England) receives effluents several sources including direct discharge coastal outfalls and the rivers Mersey and which carry sewage and industrial discharg addition, substantial quantities of sewage s and some industrial wastes are dumped at about 30 km off the Mersey, and dredged from the maintenance of the Mersey channel docks are dumped primarily at site 'Z' whi between the river mouth and the sludge dump Concentrations of zinc, copper, cadmium nickel were measured in solution and in suspe at a series of stations from the mouth of the Mersey to seaward of the sewage sludge dun ground during two studies in 1978 and 1979. solved metal concentrations were found to be correlated with salinity and no significant e tions due to dumping were apparent. Partic metal concentrations, on the other hand, found to be substantially elevated near the d ing ground in 1979. The effect on the conce tions of suspended particulate metal at the site short-lived - less than a few days. (Collier-
W85-02290

SEWAGE SLUDGE DUMPING AND C TAMINATION OF LIVERPOOL BAY S MENTS,
Ministry of Agriculture, Fisheries and Food, F ham on Crouch (England). Aquatic Environ Protection Div. II.
M. G. Norton, S. M. Rowlatt, and R. S. Nunny
Estuarine, Coastal and Shelf Science, Vol. 19, 1, p 69-87, July, 1984. 14 Fig, 2 Tab, 24

Descriptors: *Liverpool Bay, *England, * ments, *Sludge disposal, Organic carbon, Merc Cadmium, Copper, Zinc, Lead, Nickel, Chrom Fate of pollutants.

The results of four Ministry of Agriculture, Fis ies, and Flood surveys (1975-1980) of the sedim in and around the sewage sludge dumping si Liverpool Bay are presented. Sediments were lyzed for particle size distribution, organic ca concentrations and concentrations of Hg, Cd, Zn, Pb, Ni and Cr. Concentrations of org carbon and metals were found to be elevated in fine (< 90 micro m) fraction in areas associ with the major inputs of these substances to bay-near the mouth of the Mersey, near the sew sludge dumping site and at the dredged s dumping site. In an attempt to determine any t poral trends between surveys, stations w grouped into four 8 x 8 km areas from offshor the dumping ground to the mouth of the Mer Change in the metal concentrations in sediment the square nearest the sewage sludge dumping were larger than in the other squares including nearest the Mersey. Comparison of temporal tre near the sewage sludge site with the quanti actually dumped showed a correlation between two, consistent with sewage sludge dumping be a major contributor to the metal levels in sediments near the dumping ground. (Author's stract)
W85-02291

BEHAVIOUR OF PB, ZN, NI, AND CU IN T SEDIMENTS OF THE LOUKKOS ESTUA AND THE CLOSE SHELF (ATLANTIC CO OF MORROCO) (COMPORTEMENT DU ZN, NI, ET CU DANS LES SEDIMENTS L'ESTUAIRE DU LOUKKOS ET DU PROC PLATEAU CONTINENTAL (COTE ATLAN QUE MAROCAINE)),

nstitut de Geologie du Bassin d'Aquitaine, Talence (France).
M. Snoussi.
Bulletin de l'Institute de Geologie du Bassin d'Aquitaine, Bordeaux, Vol. 35, p 23-30, 1984. 4 Fig, 8 Ref.

Descriptors: *Loukkos Estuary, *Close Shelf, *Morroco, *Lead, *Zinc, *Nickel, *Copper, *Sediments, Fate of pollutants, Organic carbon, Iron, Estuarine environment.

The primary objective of this work is to study the behavior of some heavy metals (Pb, Zn, Ni and Cu) within the Loukkos estuary and the adjacent littoral prism. Metallic element concentrations in the bulk sediment do not appear to vary systematically from the oued region to the ocean. Conversely, normalization of global content within the < 2 micro m grain-size fraction with organic carbon or iron, reveals the lithologic contribution to the distribution of Pb and also the other metal anomalies, namely at the inlet and off the Loukkos estuary. The abnormally high metallic contents recorded could be related to the physico-chemical processes commonly reported at inlet zones. They could also be encountered in the Larache agglomeration and in industrial plants associated with port activities, south of the estuary inlet. (Author's abstract)
W85-02293

PETROWATCH: PETROLEUM HYDROCARBONS, SYNTHETIC ORGANIC COMPOUNDS, AND HEAVY METALS IN MUSSELS FROM THE MONTEREY BAY AREA OF CENTRAL CALIFORNIA,
California State Dept. of Fish and Game, Monterey. Marine Pollution Studies Lab.
M. Martin, and W. Castle.
Marine Pollution Bulletin, Vol. 15, No. 7, p 259-266, 1984. 4 Fig, 4 Tab, 21 Ref. NOAA Office of Zone Management grant NA 81 AAHCZ 162.

Descriptors: *Monterey Bay, *California, *Hydrocarbons, *Organic compounds, *Heavy metals, *Mussels, Trace metals, Polychlorinated biphenyls, Chlorinated hydrocarbons, Pesticides, Zinc, Lead, Mercury, Bioconcentration, Chlordane, DDT, DDE.

Mussel Watch techniques were used to measure the concentrations of petroleum hydrocarbons, synthetic organic hydrocarbons, and trace metals in a preliminary study of the Monterey Bay area in central California. Resident mussels were found to have higher-than-expected petroleum hydrocarbon body burdens in Carmel Bay, an area thought to be relatively contaminant free. A 'hot spot' of PCB 1254 and pp DDE was measured at Ano Nueuvo Island, a site previously recognized because of elevated levels of mercury in mussels. PCB 1254 concentrations at Ano Nueuvo Island were high in relation to the remainder of coastal United States and Baja California, reflecting entrainment of this compound at a biologically active area. The Monterey Harbor Jetty location showed the highest contamination levels for zinc and lead. In fact, this location has the second highest lead concentrations in mussels for the California coast. Biological cycling of certain compounds (PCB, DDT and mercury) in remote locations such as Ano Nuevo Island, is hypothesized as a mechanism for these elevated concentrations in mussels. Levels of other synthetic organic hydrocarbons were generally low, with chlordanes showing higher concentrations in the more urbanized locations of the study area, i.e. the Monterey Harbor Jetty. (Author's abstract)
W85-02326

CHEMICAL CONTENT OF SNOW AND EFFECT OF MELTING ON CASCADE MOUNTAIN LAKES,
Washington Univ., Seattle. Dept. of Civil Engineering.
E. B. Welch, W. H. Chamberlain, and D. E. Spyridakis.
Northwest Science, Vol. 58, No. 2, p 85-93, May, 1984. 3 Fig, 2 Tab, 15 Ref.

Descriptors: *Cascade Mountains, *Washington, *Snow, *Copper Lake, *Big Heart Lake, *Angeline Lake, Chemical composition, Melting, Sulfates, Nitrates, Hydrogen ion concentration, Alkalinity, Chemistry of precipitation, Conductance, Stratification, Mixing.

Washington's Cascade Mountain lakes have been classified as some of the most sensitive waters in the United States. Their low buffering capacity is due to the granitic and basaltic bedrock and thin soil development surrounding many of these high elevation lakes. Sulfate and nitrate content in snow cores collected in the spring of 1982 indicated that deposition of those ions is greater in the Cascade Mountains, downwind from the Seattle-Tacoma urban-industrial area, than in the Olympic Mountains. Subsequent observations on changing chemical content in the waters of Angeline, Big Heart, and Copper Lakes - located in the Alpine Lakes Wilderness area at 1219 to 1555 m elevation - indicated that snowmelt and iceout did not result in episodes of low pH and alkalinity. The minimum pH was 5.8 and neither pH nor alkalinity showed a seasonal trend following iceout, although specific conductance did decrease slightly. The lack of an acidification episode was not surprising because of pH of snow from a site near the studied lakes averaged 5.3. The snow was richer in cations than had been reported earlier in precipitation from the Cascades, even though sulfate concentrations were similar. Chemical stratification was apparent in the surface 20 m layer of the lowest elevation lake (Copper Lake), while the upper 50 m of the highest elevation lake (Angeline Lake) was similar in alkalinity content to that observed in snow. The intermediate elevation lake (Big Heart Lake) showed a slight tendency to stratify in the upper 50 m. These observations suggest that snowmelt does not mix with the whole lake volume in these deep lakes with relatively low watershed:lake surface area ratios and low flushing rates as might be expected in lakes with more extreme characteristics. (Collier-IVI)
W85-02329

SORPTION OF CHLORINATED PHENOLS BY NATURAL SEDIMENTS AND AQUIFER MATERIALS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
K. Schellenberg, C. Leuenberger, and R. P. Schwarzenbach.
Enivonmental Science and Technology, Vol. 18, No. 9, p 652-657, 1984. 5 Fig, 4 Tab, 20 Ref. Swiss Department of Commerce project COST 64b bis.

Descriptors: *Phenols, *Chlorinated hydrocarbons, *Sediments, *Aquifers, *Sorption, Partition coefficients, Fate of pollutants, Ionic strength, Hydrogen ion concentration.

Laboratory experiments have been conducted to study the sorption of chlorinated phenols by sediments and aquifer materials. It is shown that sorption not only of the nondissociated phenols but also of their conjugate bases (phenolates) can occur. At typical ambient concentrations, sorption equilibrium can be described by the equation S = DC, where S = concentration in the solid phase, D = overall distribution ratio, and C = concentration in the liquid phase. In natural waters of low ionic strength (i.e., I < or = 0.001 M) and pH not exceeding the pK sub a of the phenol by more than one log unit, phenolate sorption can be neglected and the overall distribution coefficient may be expressed by D = (K sub p)Q, where K sub p = partition coefficient of the nonionized phenol and Q = degree of protonation. K sub p may be estimated from the octanol/water partition coefficient of the compound and from the organic carbon content of the sorbent. In the case of tetra- and pentachlorophenol, phenolate sorption usually has to be considered. It is strongly influenced by the organic carbon content of the sorbent and by the ionic strength of the aqueous medium. (Author's abstract)
W85-02344

GAS CHROMATOGRAPHY/MASS SPECTROSCOPY ANALYSIS OF MUTAGENIC EXTRACTS OF AQUEOUS CHLORINATED HUMIC ACID. A COMPARISON OF THE BY-PRODUCTS TO DRINKING WATER CONTAMINANTS,
Health Effects Research Lab., Cincinnati, OH.
W. E. Coleman, J. W. Munch, W. H. Kaylor, R. P. Strelcher, and H. P. Ringhand.
Environmental Science and Technology, Vol. 18, No. 9, p 674-681, 1984. 2 Fig, 4 Tab, 40 Ref.

Descriptors: *Humic acids, *Gas chromatography, *Mass spectroscopy, *Chlorinated hydrocarbons, *Drinking water, *Mutagenicity, Water pollution sources, Chlorination, Water treatment, Bromides, Solvent extraction, Hydrogen ion concentraton, Chromatography, Spectroscopy.

Formation of mutagenic activity as a result of aqueous chlorination of a model humic acid substrate has been previously demonstrated. In the present study, solvent extracts of solution of the chlorinated model substrate, which responded positively in the Ames test, were analyzed by gas chromatography/mass spectroscopy (GC/MS) in an attempt to identify the mutagenic components. Results of GC/MS analyses of methylene chloride, ether, and closed-loop-stripping extracts indicated that trihalo-methanes and haloacetic acids, -acetonitriles, -propanones, -propenals, -propenenitriles, -propenes, -phenols, and -thiophenes were formed by the aqueous chlorination of humic acid at neutral pH. The concentrations of nine of the halogenated byproducts accounted for about one-fourth of the total organic halogen (TOX) content of the aqueous chlorinated humic acid solution. The similarity of mutagenic compounds identified in this study with compounds previously identified in drinking water suggests that the reaction of chlorine with natural aquatic humic material is a likely source of mutagen formation in drinking water. Some data on the production of halogenated compounds from the chlorination of the model humic acid in the presence of bromide (Br-) are also included. (Author's abstract)
W85-02345

POLYCYCLIC AROMATIC HYDROCARBONS IN WASHINGTON COASTAL SEDIMENTS: AN EVALUATION OF ATMOSPHERIC AND RIVERINE ROUTES OF INTRODUCTION,
Washington Univ., Seattle. School of Oceanography.
F. G. Prahl, E. Crecellus, and R. Carpenter.
Environmental Science and Technology, Vol. 18, No. 9, p 687-693, 1984. 3 Fig, 6 Tab, 33 Ref.

Descriptors: *Washington, *Columbia River, *Suspended sediments, *Polycyclic aromatic hydrocarbons, *Air pollution, *Particulate matter, Hydrocarbons, Water pollution sources, Isotope studies, Lead radioisotopes.

Polycyclic aromatic hydrocarbon (PAH) compositions were characterized monthly over a 1-year period in atmospheric particulate material (APM) collected from three locations in western Washington state and riverine suspended particulate material (SPM) collected near the mouth of the Columbia River. PAH mixtures of APM are dominated by compounds of combustion origin, with minor levels of the resin acid-derived PAH retene often present. SPM contained comparable levels of individual combustion PAH, retene, and perylene. Atmospheric and riverine contributions of individual combustion PAH to the Washington coastal environment were estimated from these data and other available information. Comparison of estimates with respective PAH accumulation rates measured in lead-210 dated coastal sediments shows that > 30 % of all combustion PAH, retene, and perylene in these sediments is supplied by SPM discharge from the Columbia River and direct atmospheric input accounts for at most 10 % of the combustion PAH. Atmospherically transportable PAH are removed from the air over land to soils and freshwaters within the river drainage basin, eroded on particles, and discharged into the Washington coastal environment along with other nonatmospherically transportable PAH such as perylene as intrinsic constituents of the Columbia River's suspended sediment load. (Author's abstract)
W85-02346

INCIDENCE AND LEVELS OF 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN IN LAKE ONTARIO COMMERICAL FISH,
Health and Welfare Canada, Ottawa (Ontario). Health Protection Branch.
J. J. Ryan, P.-Y. Lau, J. C. Pilon, D. Lewis, and H. A. McLeod.
Environmental Science and Technology, Vol. 18, No. 9, p 719-721, 1984. 1 Tab, 12 Ref.

Descriptors: *Dioxins, *Lake Ontario, *Fish, *Fate of pollutants, Catfish, Eel, Smelt, Bass, Crappie, Pumpkinseed, Polychlorinated biphenyls, Chlorinated hydrocarbons, Great Lakes.

Analysis of commerical fish taken in 1980 mostly from one area of Lake Ontario was undertaken to obtain information on the levels and incidence of the contaminant 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Sixty-two (62) samples of fish comprising 10 different species were analyzed by using a validated extraction, cleanup, and detection procedure. Seven of the 10 species contained measurable levels of the isomer 2,3,7,8-TCDD, between 2 and 39 parts per trillion (ppt) with five samples above 20 ppt. Channel catfish, American eel, and rainbow smelt had the highest values, and the lowest levels were found in rock bass, black crappie, and pumpkinseed. The presence of high levels of PCB (> 1 ppm) and high lipid content (> 3%) indicated a high probability of dioxin contamination. Comparison of this data with those generated by other laboratories from all the Great Lakes indicated that the larger species of commercial fish such as channel catfish and carp particulary from Lake Ontario and part of Lake Huron have the highest levels and incidence of 2,3,7,8-TCDD. (Author's abstract)
W85-02349

IODOMETHANE AS A POTENTIAL METAL MOBILIZING AGENT IN NATURE,
Cincinnati Univ., OH. Dept. of Chemistry.
J. S. Thayer, G. J. Olson, and F. E. Brinckman.
Enviromental Science and Technology, Vol. 18, No. 9, p 726-729, 1984. 2 Fig, 4 Tab, 27 Ref.

Descriptors: *Baltimore Harbor, *Maryland, *Chesapeake Bay, *Sediments, *Iodomethane, *Trace metals, *Metal sulfides, Gas chromatography, Atomic adsorption spectrometry, Tin, Copper, Lead, Fate of pollutants.

Naturally occuring iodomethane, an ubiquitous biogenic metabolite, might react with metal sulfides present in anoxic sediments or finished metals in human artifacts or aquatic systems, thereby creating volatile or water-soluble derivatives. Sulfur atoms in metal sulfides have a large degree of covalent character and serve as bridges between metal atoms to form large polymeric arrays. Oxidative addition by iodomethane would break such bridges, at sulfur or metal centers, weakening the lattice and eventually allowing the metal to dissolve. Samples from anoxic sediment from Baltimore Harbor were treated with iodomethane; aliquots of the supernatant water were analyzed with purge-and-trap gas chromatography-flame photometric gas chromatography. Appreciable quantities of dimethylstannane and dimethyl sulfide appeared almost immmediately; tetramethyltin and dimethyl disulfide appeared after overnight standing. Similar studies using atomic absorption spectrometry showed that after 24 h iodomethane had caused dissolution of other metals from the Baltimore Harbor sediments. Samples of sediments from less polluted Chesapeake Bay sediments showed little or no CH3I-stimulated Cu or Pb release. There is insufficient evidence to state that iodomethane enhances the overall circulation of metals throughout the environment, the evidence does point to that strong possibility in certain local environmental compartments. (Collier-IVI)
W85-02350

BOUNDARY INTEGRAL SOLUTION TO SEAWATER INTRUSION INTO COASTAL AQUIFERS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2F.
W85-02371

SUBSTANCE DISCHARGES IN THE DRAINAGE AREA OF THE LIMINKA BAY,
Joensuu Univ. (Finland). Dept. of Biology.
J. Siira.
Aqua Fennica, Vol. 13, p 8-26, 1983. 8 Fig, 18 Tab, 28 Ref.

Descriptors: *Liminka Bay, *Finland, *Water pollution sources, *Drainage basins, Peat, Forests, Agriculture, Soil type, Population, Fertilizers, Phosphorus, Nitrogen, Color, Electrolytes.

Liminka Bay, located in western Finland, has a drainage basin which is 1394 sq km in area. The drainage basin is 55% peatland, 27% forest, and 18% fields. The discharge of 19 substances was studied at 33 sampling stations in the basin during the years 1974-1976. The following factors contributing to the discharge were analyzed: number of inhabitants and livestock, percentage of cultivated fields, forest and peatland, percentage of forest drainage, quantity of artificial fertilizers applied, grain size of mineral soil, and the organic matter, N, P, K, and Ca contents of the soil. The effects of these factors were determined by correlation and regression analysis. Color correlates negatively with population, agriculture, and mineral soil, and positively with peat soil and forests. The cultivated field percentage is the most important single explanatory factor. It explains 92% of the total electrolyte discharge, 74% of the total nitrogen and 56% of the total phosphorus discharge. The field percentage and the number of inhabitants together have explanatory power of 90% for the total nitrogen, and the number of livestock and the forest percentage explain 77% of the total electrolyte discharge. (Moore-IVI)
W85-02390

FECAL COLIFORM IN THE SALT RIVER RECREATION AREAS OF ARIZONA,
Tonto National Forest, Phoenix, AZ.
D. E. Nelson, and W. R. Hansen.
Journal of Forestry, Vol. 82, No. 9, p 554-555, September, 1984. 2 Fig, 1 Tab, 3 Ref.

Descriptors: *Coliforms, *Recreation facilities, *Tonto National Forest, *Arizona, Salt River, Feces, Monitoring, Swimming, Public health, Bacteria.

Monitoring for fecal coliform bacteria has been carried out at water recreation sites on the Tonto National Forest in Arizona for the past 12 years. Standards which exist are: geometric means of samples must be less than 200 fecal coliform per 100 milliliters of sample water; no more than 10% of the samples in a 30-day period may exceed 400 fecal coliform per 100 ml; and no single sample may exceed 800 fecal coliform per 100 ml. Large fluctuations in fecal coliform populations were found at all sites. Levels vary widely within short distances (200 feet) and short time periods (hours). High fecal coliform counts are usually associated with periods of heavy use. Counts are usually low on the lower Salt River, despite heavy use, probably due to the continuous supply of fresh water from the upstream dam. No correlation was found between water clarity measurements and fecal coliform counts. Coves and bays isolated from lake currents tend to build up higher fecal coliform populations than sites on the main part of the lake. Speciation of bacteria during the summer indicates that they are coming from both human and animal sources. Given the potential for contamination by stormflows, recreation managers may wish to avoid stream inlets when selecting sites for swimming areas. (Baker-IVI)
W85-02394

RECOVERY OF SELECTED PATHOGENS FROM NAPLES BAY, FLORIDA, AND ASSOCIATED WATERWAYS,
University of South Florida, Tampa. Dept. of Biology.
M. E. Peterson, B. J. Yokel, and D. V. Lim.
Estuaries, Vol. 7, No. 2, p 133-138, June, 1984. 3 Tab, 21 Ref.

Descriptors: *Pathogenic bacteria, *Bays, *Naples Bay, *Florida, Salmonella, Coliforms, Monitoring, Public health, Water quality control.

The possible presence of potentially pat
bacteria was investigated in Naples Bay,
Specific attention was given to Salmonella
cholerae, V. parahaemolyticus, and Pseud
aeruginosa. Vibrio cholerae was isolated
the samples (33.6%) taken from February
to January 5, 1982. All of the V. cholerae
were nonagglutinable in 01 type antiser
parahaemolyticus was not recovered from
the samples. Salmonella was isolated in 33
samples (28.4%). The numbers of P. aer
were low at all stations sampled in thi
except for the months of July and Aug
cholerae was recovered at all sites exce
Water temperatures and salinity were
which affected the presence of bacteria. The
ria were recovered from areas with both h
low numbers of total and fecal coliforms.
IVI)
W85-02397

LEAD HAZARD CONTROLLED IN SCO
WATER SYSTEMS,
Umgeni Water Board, Pietermaritzburg
Africa).
W. N. Richards, and M. R. Moore.
Journal of the American Water Works A
tion, Vol. 76, No. 8, p 60-67, August, 1984. 7
Tab, 34 Ref.

Descriptors: *Lead, *Drinking water, *Sc
*Orthophosphates, *Hydrogen ion concent
Water treatment, Pipes, Water storage,
health, Lime.

In many places in Scotland, drinking wat
concentrations of lead far above established
This lead enters the drinking water throug
tact with lead lined pipes. In Glasgow before
dial water treatment, approximately 50%
water samples randomly taken from houses
lead content exceeding 100 micro g/L. A
automatic closed loop lime dosing system w
stalled at the Milngavie Treatment Works.
the pH of the water was raised from 6.3
80% of random daytime samples of water h
the plant contained less than 100 micro g
Exceptionally high lead levels were also de
in drinking water for the coastal town of A
pH of 7 was achieved in spring of 1981 by re
ing the output of the Knockjarder Trea
Works and mixing the water with pH-cor
water from another chemically treated supply
pH was raised to 9.0 a few months later foll
the installation of an auxiliary lime dosing sy
In other parts of Scotland, in spite of raise
levels, the water samples continued to have e
ed lead concentrations either because the
was held for long periods in a series of s
reservoirs, causing depressed pH levels, or be
of the plumbing configurations of individual
ings, in particular the storage of water in lead
cisterns. Sodium dihydrogen orthophosphate
tions were added to the water to give a no
orthophosphate concentration of 2 mg P/L
the average, samples from dwellings so t
contained less than 25% of the lead which
been present before the addition of phos
With decreased levels of lead in the dri
water, the levels of lead in the blood of the
sumers was also significantly reduced. (Baker
W85-02402

NITRATE LEACHING FROM GRASSLAN
Grasslands Research Inst., Hurley (England).
For primary bibliographic entry see Field
W85-02404

SEASONAL VARIATION OF ARSENIC C
CENTRATION IN WELL WATER IN L
COUNTY, OREGON,
Oregon Univ., Eugene. Dept. of Biology.
J. J. Nadakavukaren, R. L. Ingermann, G.
Jeddeloh, and S. J. Falkowski.
Bulletin of Environmental Contamination
Toxicology, Vol. 33, No. 3, p 264-269, Septe
1984. 4 Fig, 10 Ref. NSF grant EPP 750

Descriptors: *Wells, *Arsenic, *Lane Co
*Oregon, Seasonal variation, Groundwater p
tion, Water quality.

Fourteen wells in Lane County were used for analysis. The municipal well system of the city of Lowell was chosen for study because of excessive arsenic concentrations found in October of 1974. All of the wells were modern cased types of comparable depth, 20-50 m, and none were near agricultural operations using arsenicals. Arsenic concentrations in water from the wells followed several seasonal patterns. There was no apparent correlation between arsenic concentrations and pH. Rainfall appears to be the major factor influencing the arsenic content in these wells, yet some of these wells also show large excursions and a spring peak that have no obvious relation to rainfall. Rainfall could influence the groundwater arsenic content directly by recharging the aquifer, or indirectly through the water usage rate - if high pumping rates depress the water table in the vicinity of the well, deeper groundwater could enter the aquifer. Well depth may also be a contributing factor. No consistent geochemical or environmental factors could be found to account for these variations. Accurate water quality asessment requires repeated sampling over an extended period. If this is not possible, an optimal season for sampling should be determined locally. In Lane County, arsenic analyses of summer water samples are likely to be more valuable than winter samples in assessing water quality. (Baker-IVI)
W85-02414

CONSTITUENT BIOCONCENTRATION IN RAINBOW TROUT EXPOSED TO A COMPLEX CHEMICAL MIXTURE,
G. Linder, H. L. Bergman, and J. S. Meyer.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 3, p 330-338, September, 1984. 4 Fig, 2 Tab, 12 Ref. NIH grant ES-07073.

Descriptors: *Biological magnification, *Fish, *Organic compounds, Water pollution effects, Oil spills, Oil shale, Fate of pollutants.

Classically, aquatic contaminant fate models predicting a chemical's bioconcentration factor (BCF) are based upon single-compound derived models, yet such BCF predictions may deviate from observed BCFs when physicochemical interactions or biological responses to complex chemical mixture exposures are not adequately considered in the predictive model. Rainbow trout were exposed to oil-shale retort waters. Such a study was designed to model the potential biological effects precluded by exposure to complex chemical mixtures such as solid waste leachates, agricultural runoff, and industrial process waste waters. Chromatographic analyses of aqueous and nonaqueous liquid-liquid reservoir components yielded differences in mixed extraction solvent HPLC profiles of whole fish exposed for 1 and 3 weeks to the highest dilution of the complex chemical mixture when compared to their corresponding control, yet subsequent whole fish extractions at 6, 9, 12, and 15 weeks into exposure demonstrated no qualitative differences between control and exposed fish. Liver extractions and deproteinized bile samples from exposed fish were qualitatively different than their corresponding controls. These findings support the projected NOEC of 0.0045% dilution, even though the differences in bioconcentration profiles suggest hazard assessment strategies may be useful in evaluating environmental fate processes associated with complex chemical mixtures. (Baker-IVI)
W85-02416

ENVIRONMENTAL FATE AND TOXICITY IN WASTEWATER TREATMENT OF QUATERNARY AMMONIUM SURFACTANTS,
Environmental Protection Agency, Washington, DC. Office of Toxic Substances.
R. S. Boethling.
Water Research, Vol. 18, No. 9, p 1061-1076, 1984. 2 Fig, 2 Tab, 80 Ref.

Descriptors: *Biodegradation, *Quaternary ammonium compounds, *Wastewater treatment, *Fate of pollutants, *Reviews, Environmental effects, Water pollution sources, Chemical reactions.

Considerable research has been devoted in recent years to the biodegradation of quaternary ammonium compounds (QACs), both in wastewater treatment and in receiving waters, and to the toxicity of QACs to microbial populations in wastewater treatment systems. Specific topics covered in this review include the analysis of QACs; toxicity of QACs in wastewater treatment; environmental fate of QACs, including fate in wastewater treatment, and fate in receiving waters. A mass of evidence suggests that QAC concentrations in the soluble phase should be reduced by at least 90% in publicly owned treatment works under normal circumstances. Both sorption and biodegradation contribute to QAC removal, but sorption is more rapid, so that biodegradation is expected to occur mainly on sludge solids. Many QACs will undergo ultimate biodegradation in aerobic biological treatment. Whereas toxicity of QACs would obviously be mitigated by any opportunity for acclimation and by the relatively low concentrations in sewage, anionic surfactants will also play a role in reducing toxicity. Anionic surfactants, which should normally be present in sewage at levels much higher than those of QACs form stoichiometric complexes with QACs, and this reaction by itself may reduce or even eliminate toxicity. Results from recent monitoring studies confirm these predictions. (Baker-IVI)
W85-02424

ENVIRONMENTAL FATE OF A DISPERSED EKOFISK CRUDE OIL IN SEA-IMMERSED PLASTIC COLUMNS,
Bergen Univ. (Norway). Dept. of Chemistry.
K. Tjessem, D. Pedersen, and A. Aaberg.
Water Research, Vol. 18, No. 9, p 1129-1136, 1984. 4 Fig, 5 Tab, 23 Ref.

Descriptors: *Oil spills, *Detergents, *Toxicity, *Photochemical reactions, Oxidation, Oil pollution, Marine environments, Cleanup operations.

Particular emphasis is placed on the strong photochemical impacts of this crude oil under field conditions at 60 degrees latitude with the understanding that the oil dispersant-photooxidation interactions may well be a component of much of the observed detergent toxicity effects occurring during cleanup operations after oil spills. Both tritiated and unlabelled Ekofisk crude oil were poured (.5 L each) onto the water surface of two large plastic enclosures north of Bergen, Norway during June 1980. A nonlabelled detergent Corexit 9527 was used to treat the slicks 24 hr after the initial addition of the oil to the water surface. Two replicate ecosystems without the added detergent served as control. A high concentration of polar petroleum derived components exceeding the concentration of petroleum hydrocarbons several times was formed inside the oil/dispersant enclosures which, together with transformation products of the dispersant, proved fairly toxic to several marine biota, virtually eliminating the total planktonic biomass. Photooxidation of the oil/dispersant mixture has been invoked as a primary mechanism to explain the formation of polar substances being leached into the water column. These findings suggest that the dispersed hydrocarbons or the original detergent itself are not likely to be responsible for most of the observed toxicity. The toxicity of the transformation products of the oil and detergent contain many reactive groups and are a much more valid concern. (Baker-IVI)
W85-02431

MODELING SEDIMENT AND WATER COLUMN INTERACTIONS FOR HYDROPHOBIC POLLUTANTS. PARAMETER DISCRIMINATION AND MODEL RESPONSE TO INPUT UNCERTAINTY,
Universidad Simon Bolivar, Caracas (Venezuela). Dept. de Procesos y Sistemas.
P. R. Jaffe, and R. A. Ferrara.
Water Research, Vol. 18, No. 9, p 1169-1174, 1984. 2 Fig, 5 Tab, 8 Ref.

Descriptors: *Lake sediments, *Model studies, *Fate of pollutants, Pesticides, Evaporation rate, Latin hypercube, Pore water, Partition coefficient, Runoff, Chemical reactions, Simulation.

Circumstances were examined under which detailed model descriptions of sediment bed/water column interactions are necessary. Efforts were made to determine which parameters are most critical to the situation and how accurately they must be determined. Model simulations were conducted on a hypothetical sedimentation pond for which typical values were chosen for yearly storm runoff data including runoff volume, sediment mass, and pesticide load. A Latin hypercube sampling scheme for model response analysis to nine model parameters simultaneously was used. Compared to a full factorial design for the same variables and sampling intervals, the Latin hypercube results in a much smaller sample, and consequently a less expensive analysis. The model output is most sensitive to the partition coefficient and the dissolved phase reaction rate coefficient. It is important to have an accurate estimate of the partition and reaction rate coefficients and wherever possible, site-specific values should be determined. For the remaining seven parameters, literature estimates may be used satisfactorily. For compounds with high partition coefficients the interactions between the fractions of the compound contained in the bottom sediments and the water column are significant, while for compounds with low partition coefficients these interactions are not significant. In both cases as long as sorption occurs, removal of the sorbed phase due to sedimentation is still an important process. (Baker-IVI)
W85-02437

SIMULATION OF THE BEHAVIOUR OF NITROGEN IN SOILS (SIMULATION DE L'IMPACT DE PRODUITS REACTIFS DANS LES SOLS - CAS DE L'AZOTE),
Centre National de la Recherche Scientifique, Toulouse (France). Inst. de Mecanique des Fluides.
B. Caussade, and M. Prat.
Journal of Hydrology, Vol. 73, No. 1/2, p 89-104, July, 1984. 9 Fig, 36 Ref.

Descriptors: *Model studies, *Soil water, *Nitrogen, Nitrification, Mineralization, Ion exchange, Ammonium, Soil properties, Unsaturated flow, Simulation, Path of pollutants.

A one-dimensional unsteady-state numerical model is presented to simulate the behavior of nitrogen in soil. The model takes into consideration the various influences of soil-water movement, temperature variations, and plant uptake to simulate nitrogen transport and transformations through a homogeneous soil under unsaturated flow conditions. Transformations which are considered include: nitrification, immobilization, mineralization and ionic exchange of ammonium. The model is solved using a finite difference method, the validity of which is tested by comparing numerical simulation results with field experimental data concerning nitrogen-fertilized wheat growing land. (Baker-IVI)
W85-02460

STUDY AND MANAGEMENT MODEL OF SURFACE-WATER NITROGEN CONCENTRATION IN A CULTIVATED CATCHMENT (MODELE D'ETUDE ET DE GESTION DE LA TENEUR EN AZOTE DES EAUX DE SURFACE DANS UN BASSIN-VERSANT SOUS CULTURE),
Centre National de la Recherche Scientifique, Toulouse (France). Inst. de Mecanique des Fluides.
B. Caussade, D. Pierre, and M. Prat.
Journal of Hydrology, Vol. 73, No. 1/2, p 105-128, July, 1984. 16 Fig, 1 Tab, 25 Ref.

Descriptors: *Nitrogen compounds, *Agricultural chemicals, *Sediment transport, *River basins, Fertilizers, Runoff, Model studies, Transport, Leaching, Temperature effects.

A simulation of nitrogen transformations and transport for river basins with various fertilized crops is presented in a model study. The origin of nitrogen in this study consists of various non-point sources. Nitrogen tranformation and transport toward the river outlet are simulated. Experimental data from a small basin in the southwest of France was used to validate the model. The influence of various phenomena on water quality are demonstrable

using the model including leaching, temperature, fertilizer use and crop types. (Baker-IVI)
W85-02461

BIOACCUMULATION OF HEAVY METALS BY BIVALVES FROM LIM FJORD (NORTH ADRIATIC SEA),
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
D. Martincic, H. W. Nurnberg, M. Stoeppler, and M. Branica.
Marine Biology, Vol. 81, No. 2, p 177-188, August, 1984. 7 Fig, 1 Tab, 53 Ref.

Descriptors: *Heavy metals, *Bioaccumulation, *Lim Fjord, *Mollusks, *Adriatic Sea, *Fate of pollutants, Oysters, Mussels, Zinc, Lead, Cadmium, Copper.

The accumulation of trace metals (Zn, Cd, Pb and Cu) by two bivalves (Mytilus galloprovincialis and Ostrea edulis) growing at the same station and therefore under the same physicochemical conditions was studied. The oysters were more effective bioaccumulators for zinc, cadmium, lead and copper than the mussels. Oysters accumulate about 10-fold higher quantities of zinc than mussels, 16-fold higher for copper, 3-fold higher cadmium, and 2-fold higher lead concentrations. The observed differences in the copper and zinc distribution within the investigated organs can be attributed to some recently recognized blood cells in the oyster which are rich in zinc and copper. The tissue copper and zinc distribution in this animal depends on where these cells are at the time of sampling. The mussel contains no such cells. (Baker-IVI)
W85-02471

CHRONOLOGY OF LEAD POLLUTION CONTAINED IN BANDED CORAL SKELETONS,
Nova Univ. Oceanographic Center, Dania, FL.
R. E. Dodge, and T. R. Gilbert.
Marine Biology, Vol. 82, No.1, p 9-13, August, 1984. 3 Fig, 1 Tab, 50 Ref. NOAA grant NA80 RAD 00045.

Descriptors: *Lead, *Corals, *St. Croix, *Virgin Islands, Fate of pollutants, Heavy metals, Pollution indicators, Bioindicators.

The possibility of the annual skeletal growth bands of reef-building corals containing a record of lead additions to the marine environment was investigated using coral skeletons from St. Croix, Virgin Islands. Concentrations of lead within a coral from a polluted reef averaged 395 ng/g, five fold higher than within a coral from a pristine site, 87 ng/g. The lead chronologies of both corals showed a significant increase in concentration towards the present during the past 26 yr. The increase in lead concentration in the coral from the pristine site is suggested to represent the increase in lead availability from global pollution. Coral skeletons offer the probability of development into tools for long term chemical recorders of levels of lead and possibly other metals or compounds in seawater. (Baker-IVI)
W85-02472

SEDIMENT-WATER EXCHANGE IN SHALLOW WATER ESTUARINE SEDIMENTS,
Washington Univ., Seattle. School of Oceanography.
S. Emerson, R. Jahnke, and D. Heggie.
Journal of Marine Research, Vol. 42, No. 3, p 709-730, May, 1984. 7 Fig, 4 Tab, 40 Ref.

Descripors: *Puget Sound, *Interstitial water, *Estuarine environment, *Fate of pollutants, *Sediments, Shallow water, Metals, Sediment-water interfaces.

Most reactive inorganic and organic pollutants that are introduced to the environment will, at some point in their journey to the sea, be buried or recycled within estuaries. Processes at the estuarine sediment-water interface play an important role in determining the ultimate fate of these substances. Pore water distributions are described in Quartermaster Harbor, Puget Sound over the period of 1976-1979 along with an in situ tracer experiment designed to monitor the transport of water across the sediment-water interface. Transport processes in sediment pore waters of the Sound were dominated by molecular diffusion in the top few centimeters with animal activity being the most important transport process below this to 20-70 cm. The value of the transport parameter for the nonlocal process is 1 to 5 to the minus 7th power/second. Using this value and pore water concentrations it can be demonstrated that animal activities are the dominant process driving sediment-water dissolved fluxes except for elements with dramatic bottom water-pore water concentration gradients. For the metals Fe, Mn, Cu, Ni and Cd the dominant transport mechanism depends on the depth at which the metal is released to the pore waters. Probably the most important effect of biological activity on metal remobilization is the removal of sulfide from the pore waters, via ventilation of sediments with oxic overlying water, allowing the enrichment of dissolved metals which might otherwise be very low in concentration due to insoluble sulfide formation. The result is a greatly enhanced flux of metals to the bottom waters. (Baker-IVI)
W85-02473

NONEQUILIBRIUM AND EQUILIBRIUM SORPTION WITH A LINEAR SORPTION ISOTHERM DURING MASS TRANSPORT THROUGH AN INFINITE POROUS MEDIUM: SOME ANALYTICAL SOLUTIONS,
California Univ., Berkeley. Lawrence Berkeley Lab.
For primary bibliographic entry see Field 2F.
W85-02488

DETERMINATION OF THE TROPHIC STATE OF LAKE TRASIMENO BY INDIRECT ANALYSIS OF NITROGEN AND PHOSPHORUS (DETERMINAZIONE DELLO STATO TROFICO DEL LAGO TRASIMENO ATTRAVERSO LA VALUTAZIONE INDIRETTA DELL'AZOTO E DEL FOSFORO),
Perugia Univ. (Italy). Ist. di Idrobiologia e Pescicultura.
For primary bibliographic entry see Field 5C.
W85-02497

TOTAL PHOSPHORUS LOAD TO LAKE MONATE (NORTHERN ITALY, VARESE) (STIMA DEL CARICO DI FOSFORO TOTALE AL LAGO DI MONATE (PROVINCIA DI VARESE, ITALIA SETTENTRIONALE)),
Commission of the European Communities, Ispra (Italy).
D. Annoni, and O. Ravera.
Rivista di Idrobiologia, Vol. 20, No. 3, p 699-708, 1981. 3 Fig, 4 Tab, 12 Ref.

Descriptors: *Phosphorus, *Lake Monate, *Italy, Water pollution sources, Eutrophication, Mesotrophic lakes.

Total phosphorus load entering Lake Monate, Italy was calculated considering the distance between the sources of phosphorus (e.g. inhabitants, tourists, hotels, restaurants) and the lake. According to Vollenweider's model fed with the data obtained, Lake Monate at present is mesotrophic, whereas the data collected from 1969-1971 indicate that the same lake was oligotrophic. Some hypotheses concerning the increase of trophy of the lake are discussed. (Author's abstract)
W85-02501

CHEMICAL AND PHYSICAL CHARACTERISTICS OF THE WATERS OF THE ADIGE RIVER AND ITS GREATEST TRIBUTARIES, RUNNING THROUGH THE VERONA'S AREA (INDAGINE PRELIMINARE SULLE CARATTERISTICHE FISICHE E CHIMICHE DEL TRATTO VERONESE DELL'ADIGE E DEI SUOI AFFLUENTI A REGIME PERENNE),
Padua Univ. (Italy). Ist. di Biologia Animale.
B. Duzzin.
Rivista di Idrobiologia, Vol. 20, No. 3, p 709-730, 1981. 4 Fig, 3 Tab, 15 Ref.

Descriptors: *Adige River, Chiampo *Verona, *Italy, *Water pollution, Rive Anoxic conditions, Fate of pollutants.

Samples have been taken from fourteen st the period comprised between July 1980 a 1981. The results show the gradual wors conditions of the river waters upstream of the high pollution levels in the immediate ty after the city, a considerable lowering tion in the following tract owing to artifici waters flowing into the river. A remarkabl vation from the data is that the Adige river puration capacity in the last tract (30 km) to be completely lacking. The flow cond essential to determine the general character the river water quality. Among the Adige ies the Chiampo river is the most pollute waters completely anoxic conditions hav sometimes observed. (Author's abstract)
W85-02502

PRELIMINARY ESTIMATE OF NUT RUN-OFF INTO TWO LAKES IN THE ZYNSKO-WLODAWSKIE LAKE DIS THROUGHOUT A YEAR,
Akademia Rolnicza, Lublin (Poland). Inst. Science and Agricultural Chemistry.
H. Smal, and M. Misztal.
Acta Hydrobiologica, Vol. 24, No. 3, p 1 1982. 1 Fig, 4 Tab, 8 Ref.

Descriptors: *Runoff, *Nitrates, *Water po sources, *Poland, *Lakes, *Leczynsko-Wl kie Lake, Agricultural chemicals, Nutrients.

The investigation of nutrient run-off to bodies is of great interest in view of the p sive deterioration of water quality due to po poisoning, and eutrophication. Such an inv tion was started in the Leczynsko-Wlod Lake District where agriculture in the regi been intensified and a rapid development ha noted in tourism. During the year of stu concentration of elements and their forms in greatly varied in the different sectors of th Piaseczno catchment. In the catchment of Bialka greater differences appeared in the c sodium and magnesium ions. The highest c tration of nitrates was found in the ground of the agricultural sector of Lake Piaseczno ment. (Baker-IVI)
W85-02508

STREAM ECOSYSTEMS IN MOUN GRASSLAND (WEST CARPATHIANS CHEMICAL COMPOSITION OF WATER,
Polish Academy of Sciences, Krakow. Zakla logii Wod.
For primary bibliographic entry see Field 2K
W85-02514

STREAM ECOSYSTEMS IN MOUN GRASSLAND (WEST CARPATHIANS) HEAVY METALS,
Polish Academy of Sciences, Krakow. Zakla logii Wod.
M. Reczynska-Dutka.
Acta Hydrobiologica, Vol. 24, No. 4, p 33 1982. 2 Tab, 16 Ref.

Descriptors: *Water pollution sources, *Lan *Heavy metals, *West Carpathians, *Poland tilizers, Grazing, Zinc, Air pollution.

The level of heavy metals was determined i water of the Biala Woda and Kamionka st against the background of the natural conditi their basins and the pastoral management o territory. The level of heavy metals approxi that characteristic for natural waters. How intensified use of the basins for sheep grazin mineral fertilization was manifested by a creased zinc content in the water. The variati the concentrations of some metals may als connected with pollution introduced by mea atmospheric precipitation. (Baker-IVI)
W85-02515

REAM ECOSYSTEMS IN MOUNTAIN ASSLAND (WEST CARPATHIANS); 5. BAC-RIA,
ish Academy of Sciences, Krakow. Zaklad Bio-ii Wod.
Starzecka, and K. Trela.
ta Hydrobiologica, Vol. 24, No. 4, p 343-355, 2. 4 Fig, 10 Ref.

scriptors: *Bacteria, *Water quality, *Land use, est Carpathians, *Poland, Water pollution rces, Seasonal variation, Pastures.

acteriological characterization was made of the dwaters of the Grajcarek stream (the streams rna Woda, Biala Woda, Kamionka and Graj-ek) The effect of traditional and intense pastoral tems on water purity and seasonal changes in numbers of bacteria were determined. The st uniform number of total heterotrophic bacte-was found in the water of the midforest stream rna Woda. In other streams the number of erotrophs increased distinctly in the summer early autumn periods. A tendency to increas-pollution is noted in more intensely used areas. ker-IVI)
5-02516

REAM ECOSYSTEMS IN MOUNTAIN ASSLAND (WEST CARPATHIANS); 6. SES-E ALGAE COMMUNITIES,
ish Academy of Sciences, Krakow. Zaklad Bio-ii Wod.
Kawecka.
ta Hydrobiologica, Vol. 24, No. 4, p 357-365, 2. 2 Tab, 13 Ref.

scriptors: *Grasslands, *Algal growth, *Popula-n dynamics, *Land use, *West Carpathians, land, Grazing, Fertilization, Farming.

e structure of algal communities developing in mountain streams flowing through grassland s investigated and their growth during the year s observed. While there were similarities be-een the algal communities in control streams in a oded drainage area and in streams situated in regions of pastures with traditional and inten-e fertilization, the size of the populations of ne of the species present was significantly differ-. The index of diatom biomass reached the hest values in the stream flowing across the ions of pastures used for traditional sheep graz-, and the lowest ones in the area of the experi-ntal pastures undergoing intensive fertilization. ker-IVI)
5-02517

REAM ECOSYSTEMS IN MOUNTAIN ASSLAND (WEST CARPATHIANS); 9. OLI-OCHAETA,
ish Academy of Sciences, Krakow. Zaklad Bio-ii Wod.
Dumnicka.
ta Hydrobiologica, Vol. 24, No. 4, p 391-398, 2. 1 Fig, 1 Tab, 13 Ref.

scriptors: *Land use, *Grasslands, *West Car-hians, *Poland, *Oligochaetes, Annelids, Graz-, Minerals, Population dynamics, Eutrophica-n.

e composition of oligochaetes communities in untain streams of the upper Grajcarek catch-nt basin was investigated in areas of different ensity of pastoral land use. Moreover, the com-ison of the composition and structure of Oligo-aeta communities in the investigated streams was de with those in other mountain streams. enty-two species belonging to 5 families were nd in the streams. In the Biala Woda stream the aracteristic communities of mountain streams re noted. The species of the genus Nais pre-minated while Enchytraeidae were also fairly merous. Apart from species typical for mountain eams, those typical for lowland or slightly pol-ed waters were also encountered in the Ka-onka stream, suggesting the eutrophication of water due to pasturing. (Baker-IVI)
35-02520

STREAM ECOSYSTEMS IN MOUNTAIN GRASSLAND (WEST CARPATHIANS); 12. GENERAL CONCLUSION,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
A. Kownacki.
Acta Hydrobiologica, Vol. 24, No. 4, p 413-422, 1982. 1 Fig, 11 Ref.

Descriptors: *Land use, *Streams, *Grazing, *West Carpathians, *Poland, Forests, Pastures, Nutrients, Benthic environment, Ecosystems.

The effect on stream ecosystems of pastoral economy in West Carpathran mountainous areas was investigated. Signs of any transformation of the biocenosis under the influence of this use of the land were sought, including hydrological investigations, hydrochemical, bacteriological, algological, and faunistic changes. The investigations were carried out at three stations: BW1, the control, not affected by pasturing, established in the upper sector of the Biala Woda stream at an altitude of 690 m was located at the outskirts of a large forest complex. BW2 was located in the Biala Woda stream at 640 m in an area of traditional pastures. K2 was located in the Kamionka stream at 690 m in the areas of experimental pastures. The aim was to determine whether stations lying at similar altitudes in the same ecological zone would reflect differences caused solely by the character of land use surrounding them. The first signs of impairment of self-regulation mechanisms in these ecosystems were noted. Differences were reported in the number of individual groups of organisms and in the structure of biocenoses, and disturbances in the seasonal fluctuations of numbers and structures of the communities were found. The changes in natural stream biocenoses were caused not only by increasing the amount of nutrients washed out from the meadows, but also by such physical factors as differences in water discharge, insulation and temperature. (Baker-IVI)
W85-02521

QUANTITATIVE INVESTIGATIONS ON ODONATA, HFTEROPTERA AND COLEOPTERA IN A DRAINAGE CHANNEL NEAR THE VILLAGE OF TUREW (POZNAN REGION),
Polish Academy of Sciences, Poznan. Dept. of Agrobiology and Forestry.
S. Mielewczyk.
Acta Hydrobiologica, Vol. 25/26, No. 1, p 89-100, 1983/1984. 2 Fig, 3 Tab, 14 Ref.

Descriptors: *Drainage canals, *Land use, *Insects, *Turew, *Poland, Population dynamics, Water quality, Meadows, Forests, Aquatic fauna.

Within the framework of complex investigations a quantitative study was made of the fauna in a drainage channel near Turew, which is typical of the agricultural lands of the Poznan region. The investigation attempted to evaluate the energy flow and cycling of matter in various ecosystems of the agricultural landscape. The dominant structure and changes in the density and biomass of Odonata, Heteroptera, and Coleoptera in the vegetative season from May to September are described for two sectors of the channel, one flowing through meadows and the other through woods, across the agricultural land. In the meadow sector the fauna of these insects was qualitatively and quantitatively richer than in the wooded area. (Baker-IVI)
W85-02523

EFFECT OF DISCHARGE RATE ON BIOTIC AND ABIOTIC CHEMICAL FLUX IN AN ACIDIFIED STREAM,
Ontario Ministry of the Environment, Toronto.
R. J. Hall, and G. E. Likens.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 8, p 1132-1138, August, 1984. 4 Tab, 51 Ref.

Descriptors: *Acidification, *Water pollution effects, *Flow discharge, Path of pollutants, Norris Brook, New Hampshire, Aluminum, Calcium, Magnesium, Potassium, Sodium, Nitrates, Organic carbon, Fluctuations, Invertebrates, Storms.

Acidity of Norris Brook, a mountain stream in the Hubbard Brook Experimental Forest, New Hampshire, was manipulated to estimate the effects on biotic and abiotic chemical flux during high (spring) and low (summer) discharge periods. Sulfuric acid was added to maintain the pH near 4.0 from April to September 1977. Al, Ca, Mg, and K were mobilized into streamwater with concentrations progessively increasing downstream, as a result of increased H(+) concentration. Concentrations of Na and NO3 were not affected by the acidification. Dissolved organic carbon concentrations decreased downstream during periods of high discharge but did not change significantly during low flow. During storms, Al, Ca, Mg, and K increased in concentration below the acid addition as well as in the reference reach of the stream. Net flux of dissolved Al in streamwater was significant during both high- and low-discharge periods. Net flux of Al in invertebrate biomass was significantly increased only during high flow but was insignificant when compared with the amount in the dissolved form. Net flux of N was significant only in biomass of invertebrates at high discharge. Significance of flux on N in biota was totally overshadowed by transport (flux) of dissolved N (as NO3 and NH4) during storms. (Author's abstract)
W85-02534

ULTRASTRUCTURAL LOCALIZATION OF METALS IN SPECIMENS OF LITTORINA LITTOREA COLLECTED FROM CLEAN AND POLLUTED SITES,
Reading Univ. (England). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W85-02543

MUTAGENIC ACTIVITY OF RUNOFF AND LEACHATE WATER FROM HAZARDOUS WASTE LAND TREATMENT,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
K. W. Brown, and K. C. Donnelly.
Environmental Pollution (Series A), Vol. 35, No. 3, p 229-246, 1984. 2 Fig, 6 Tab, 25 Ref. EPA grant R.805474010.

Descriptors: *Mutagens, *Hazardous wastes, *Land disposal, *Leachates, Sludge, Runoff, Water pollution sources, Oil industry, Industrial wastes, Bioassay.

The mutagenic potential of runoff and leachate water from petroleum sludge-amended soils was determined using the Salmonella microsome assay and the Bacillus subtilis DNA repair assay. The runoff and leachate samples were collected from four different soils amended with an API-separator sludge from either a petroleum refinery or a petrochemical plant. While mutagenic activity was detected in limited number of runoff and leachate samples, greater amounts of mutagenic activity were detected in the runoff water. The majority of samples which were toxic to Salmonella at low dose levels induced increased lethal damage to DNA repair-deficient strains of B. subtilis. Generally, the mutagenic activity of leachate water and the runoff water from two of the three soils decreased with time following waste application. The activity in the third soil did not decrease over the 3 years of observation. The amounts of activity released from the soil in the leachate and runoff water were small compared with other environmetal exposures, indicating that while land treatment may allow some release to the environment, the impact is likely to be small. The results also indicate that microbial bioassays may prove to be a useful tool environmental monitoring of land treatment facilities. (Author's abstract)
W85-02588

ROLE OF RESISTANCE TO STARVATION IN BACTERIAL SURVIVAL IN SEWAGE AND LAKE WATER,
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
J. L. Sinclair, and M. Alexander.
Applied and Environmental Microbiology, Vol. 48, No. 2, p 410-415, August, 1984. 4 Fig, 1 Tab, 17 Ref. EPA R807688020.

Descriptors: *Bacteria, *Starvation, *Wastewater, *Lake water, Nutrients, Competition, Bacterial survival.

A study was conducted to determine the significance of starvation resistance to the ability of a species to survive in sewage and lake water. Tests were conducted for periods of up to 14 days. Rhizobium meliloti and one fluorescent and one nonfluorescent strain of Pseudomonas were resistant to starvation because their population sizes did not fall appreciably in buffer and sterile lake water, and the first two maintained high numbers after being added to sterile sewage. Cell densities of these bacterial species dropped slowly in nonsterile sewage, and more cells these three organism than of the other test organisms remained in nonsterile lake water. Rhizobium leguminosarum was moderately resistant to starvation because its numbers fell slowly in buffer and sterile lake water did not change appreciably in sterile sewage. The abundance of Micrococcus flavus added to buffer and sterile lake water did not change, but the density of M. flavus declined in nonsterile lake water. The abundance of R. leguminosarum fell in nonsterile lake water and nonsterile sewage. Streptococcus faecalis, Staphylococcus aureus, an asporogenous strain of Bacillus subtilis, and Streptococcus sp. were susceptible to starvation because their populations were markedly reduced in buffer. Populations of the last three species declined rapidly in nonsterile samples of lake water and sewage. S. faecalis declined rapidly when added to nonsterile lake water and sewage and sterile lake water but not when added to sterile sewage, the persistence in the last instance probably being associated with the availability of organic nutrients. In a comparison of random isolates from nutrient-poor and nutrient-rich habitats, the percentage of survival of 17 of 19 bacteria from lake water was found to be greater than that of all 11 isolates from human skin and mouth. It is suggested that starvation-susceptible bacteria will not persist in environments that are nutrient poor or in which they fail to compete for organic nutrients and that starvation resistance is a necessary but not sufficient condition for persistence in environments that are nutrient poor or that support intense interspecific competition. (Author's abstract)
W85-02600

INFLUENCE OF WATER TEMPERATURE, SALINITY, AND PH ON SURVIVAL AND GROWTH OF TOXIGENIC VIBRIO CHOLERAE SEROVAR O1 ASSOCIATED WITH LIVE COPEPODS IN LABORATORY MICROCOSMS,
Maryland Univ., College Park. Dept. of Microbiology.
A. Huq, P. A. West, E. B. Small, M. I. Huq, and R. R. Colwell.
Applied and Environmental Microbiology, Vol. 48, No. 2, p 420-424, August, 1984. 6 Fig, 1 Tab, 17 Ref. WHO grant C6/181/70, PHS grant 5R22 A14242, NSF grant DEB-82-08418.

Descriptors: *Vibrio, *Water temperature, *Salinity, *Hydrogen ion concentration, *Copepods, Pathogenic bacteria, Cholera, Epidemiology, Estuarine environment.

The influence of water temperature, salinity, and pH on the multiplication of toxigenic Vibrio cholerae serovar O1 cells and their attachment to live planktonic crustaceans, i.e., copepods, was investigated by using laboratory microcosms. By increasing water temperatures up to 30 C, a pronounced effect on the multiplication of V. cholerae was demonstrated, as was attachment of the cells to live copepods. These were measured by culturable counts on agar plates and direct observation by scanning electron microscopy, respectively. Of the three salinities examined (5, 10, and 15%), maximum growth of V. cholerae and attachment to copepods occurred at 15%. An alkaline pH (8.5) was optimal both for attachment and multiplication of V. cholerae, as compared with pH 6.5 and 7.5. It is concluded that conditions affecting attachment of V. cholerae serovar O1 to live copepods observed under laboratory conditions may also occur in the natural estuarine environment and, thereby, are significant in the epidemiology of cholera. (Author's abstract)
W85-02601

R-PLASMID TRANSFER IN SALMONELLA SPP. ISOLATED FROM WASTEWATER AND SEWAGE-CONTAMINATED SURFACE WATERS,
Valencia Univ. (Spain). Dept. of Microbiology.
E. Alcaide, and E. Garay.
Applied and Environmental Microbiology, Vol. 48, No. 2, p 435-438, August, 1984. 3 Tab, 21 Ref.

Descriptors: *Bacteria, *Wastewater, *Salmonella, *R-plasmids, *Surface waters, Water pollution sources, Microbiological studies, Wastewater treatment, Albufera Lake, Spain, Antibiotic resistance.

A total of 865 Salmonella strains recovered from a wastewater treatment plant and from a hypereutrophic coastal lagoon (Albufera Lake, near Valencia, Spain) for antibiotic resistance by using NR10 medium and incubation at 43 C. Minimal inhibitory concentrations (MICs) and the ability to transfer resistance to a laboratory strain of Escherichia coli K-12 (nalidixic acid resistant) have also been investigated. Of the strains, 12.7% were resistant to one or more of the compounds tested. The MIC ranged between 25 and 1700 micro g/ml. The highest MIC generally corresponded to strains showing multiple resistance. Of the antibiotics tested, only one, streptomycin, was not transferable. Kanamycin was rarely transferred. Single and multiple P determinants were transferable in 30% of the strains. The incidence of resistance to antibiotics in the environmental Salmonella strains recovered in this study agrees with similar studies carried out in river waters. (Baker-IVI)
W85-02604

SOME CONSIDERATIONS ON ADEQUATE CONSTRUCTION OF BOX MODEL AND ITS APPLICATION,
National Inst. for Environmental Studies, Tsukuba (Japan).
K. Muraoka, and T. Fukushima.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 136-148, July, 1984. 6 Fig, 4 Tab, 7 Ref.

Descriptors: *Mathematical models, *Water quality, *Box models, Model studies, Lakes.

Water quality prediction is often necessary for the control of lakes. Of the prediction models for water quality which have been proposed, the box model is supposed to have a special functionality by reason of its simple procedure of calculation and its macroscopic presentation of water quality circumstances in spite of little input data. The simplest box model is a one box model where a whole lake is replaced by only one box. The method of adequate construction of a box model for the primary understandings of lake environment and its future aspects is considered. For actual application of this model a limitation in the usage will occur. At present stage the model is available for only the shallow lake in which one dimensional analysis is adaptable. Moreover, in order to set up the exchange flow, horizontally two-dimensional numerical analysis on lake current under arbitrary weather conditions is necessary, but recently it is not so difficult to pursue such a numerical computation. (Baker-IVI)
W85-02613

DYNAMICS OF DESORPTION OF MERCURY ABSORBED ON POORLY CRYSTALLINE OXIDES OF MANGANESE, IRON, ALUMINIUM, AND SILICON,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
J. S. Rogers, P. M. Huang, U. T. Hammer, and W. K. Liaw.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 283-288, July, 1984. 1 Fig, 4 Tab, 18 Ref. Natural Sciences and Engineering Research Council of Canada grants A3248 G1296 and G0515.

Descriptors: *Fate of pollutants, *Mercury, *sediments, *Desorption, Sediments, Alum Iron, Manganese, Silicon, Oxides.

Most mercury which enters freshwater syste taken up by bottom sediments. Because the f tion of methylmercury depends on soluble m ry concentrations, release of mercury from sediments may be one of the main factors infl ing the methylation and subsequent bioamp tion of mercury in the food chain. The deso of mercury adsorbed on poorly crystalline A Mn and Si oxides was investigated to aid in u standing the role of highly reactive oxides i release and cycling of mercury in freshwater ments. The rate of desorption of Hg adsorbe these oxides was very slow and significantly v with the nature of oxides and appeared t controlled by diffusion. The cation exchang pacity, point of zero charge, surface area, an total mercury adsorbed was not significantly c lated with mercury desorption. The data ackn edge the very substantial variations in the bi strengths between mercury and the surfaces o oxides of these metals. (Baker-IVI)
W85-02627

MEASUREMENT OF OPERATIONALLY FINED LEAD FRACTIONS IN SEDIME FROM SEVERAL LAKES,
Trent Univ., Peterborough (Ontario).
R. D. Evans, and C. J. Parliament.
Verhandlung Internationale Vereinigung Limn gie, Vol. 22, No. 1, p 345-350, July, 1984. 3 F Tab, 18 Ref.

Descriptors: *Lead, *Lake sediments, *Ont Chemical reactions, Trace metals, Sedim Hardness, Calcium, Fate of pollutants.

The differences between lakes in the lead extra by MgCl2 and the reasons for those differe were investigated. Sediments were collected f 12 lakes in southern Ontario. Five chemical ex tions were used on the sediments: MgCl2 ex tion, NaOAc extraction, H2O2 extraction, w acid extraction, and strong acid extraction. procedure was not a sequential extraction. The lakes with the hardest waters exhibit little o lead in the MgCl2 extractable fraction while t with soft water show very high percentages MgCl2 extractable lead. More lead was extrac in all sediments by the NaOAc extraction than the MgCl2. The percentage extracted by NaOA quite constant across the range of lakes stud The H2O2 extracted lead was the largest frac in all sediments. An obvious relation is noted tween the amount of lead extracted and the h ness of the lake water. A good relationship found between the amount of lead extracted MgCl2 and the amount of calcium in the epi nion. This relationship suggests that the obser results are a consequence of natural conditi within the lake. Through studies such as this tests can be designed to study the behavior of both in the water column and after burial in sediments. (Baker-IVI)
W85-02632

SEDIMENT GEOCHEMISTRY IN A EUTR PHIC LAKE COLONIZED BY THE SU MERSED MACROPHYTE MYRIOPHYLLU SPICATUM,
Institut National de la Recherche Scientifiq Sainte-Foy (Quebec).
For primary bibliographic entry see Field 2H.
W85-02633

ALUMINUM SPECIATION IN SURFA WATERS ON THE CANADIAN PRE-CAMBR AN SHIELD,
Institut National de la Recherche Scientifiq Sainte-Foy (Quebec).
For primary bibliographic entry see Field 2K.
W85-02634

PHYTOPLANKTON STANDING STOCK, SIZ DISTRIBUTION, SPECIES COMPOSITIO AND PRODUCTIVITY ALONG A TROPH

ADIENT IN GREEN BY, LAKE MICHI-
N,
rence Univ., Appleton, WI. Dept. of Biology.
primary bibliographic entry see Field 2H.
5-02640

ACE METAL COMPOSITION OF AND AC-
MULATION RATES OF SEDIMENTS IN
E UPPER GULF OF THAILAND,
laway Inst. of Oceanography, Savannah, GA.
.. Windom, S. Silpipat, A. Chanpongsang, R.
Smith, Jr., and M. Hungspreugs.
Marine, Coastal and Shelf Science, Vol. 19, No.
133-142, August, 1984. 5 Fig, 2 Tab, 7 Ref.
grant INT81-16705.

criptors: *Sediments, *Gulf of Thailand,
ace metals, *Chao Phraya, *Mae Klong, *Ta
n, *Bang Pakong, Iron, Bays, Metals, Manga-
, Aluminum, Fate of pollutants.

iment cores and grab samples were collected in
Upper Gulf of Thailand to determine sedimen-
on rates and to determine if metal concentra-
s reflect anthropogenic inputs. Accumulation
s of sediments in the Upper Gulf measured
g the Pb-210 method, appear to vary from
ut 4 to 11 mm/year. Sediment budgets suggest
little of the sediment delivered to the Upper
f by the major rivers is ultimately transported
he Lower Gulf. Sediment discharge by the
o Phraya River, the largest of the four rivers
tying into the Upper Gulf, is about 3400000
ric tons per year. The Gulf annually receives
ut 7000000 metric tons. Sediment transported
the Chao Phraya, Mae Klong, Ta Chin and
g Pakong Rivers are for the most part deposit-
in the northern part of the Upper Gulf of
iland. Metal concentrations in Upper Gulf sedi-
ts appear to be dominantly controlled by natu-
inputs, except for iron and manganese. (Baker-
)
5-02654

OYANT CONTAMINANT PLUMES IN
OUNDWATER,
za Engineering Co., Chicago, IL.
W. Paschke, and J. A. Hoopes.
ter Resources Research, Vol. 20, No. 9, P 1183-
2, September, 1984. 5 Fig, 1 Tab, 13 Ref.

criptors: *Buoyant pollutants, *Plumes,
oundwater pollution, *Mathematical models,
d disposal, Path of pollutants, Groundwater
vement.

oyant contaminant groundwater plumes occur
en liquid wastes which have densities different
n groundwater are released from various land
osal activities (e.g., landfills, infiltration la-
ns, injection wells). By using mass and momen-
conservation equations, an analytical model
plume characteristics and behavior (namely,
ectory, concentration, and boundary) is devel-
d for steady flow in a homogeneous, isotropic
ifer. The model predicts that plume behavior
characteristics are different close to the source
n those far from the source. Solutions of the
del yield dimensionless relations for the plume
racteristics and behavior in each region in
ns of length and concentration scales represent-
the combined effects of the source buoyancy
and size and the ambient groundwater flow
dispersion. Experimental results, from a series
ests in a homogeneous, isotropic sand medium
h a salt water discharge, are in reasonable
eement with model predictions. The model re-
s have application to field problems under simi-
conditions. (Author's abstract)
5-02660

SPERSION OF TRACE SOLUTES IN FLOW-
G GROUNDWATER,
sconsin Univ.-Madison. Dept. of Chemical En-
eering.
A. Hatton, and E. N. Lightfoot.
ter Resources Research, Vol. 20, No. 9, p 1253-
9, September, 1984. 5 Fig, 19 Ref, 1 Append.

Descriptors: *Solute transport, *Groundwater movement, *Dispersion, Stratified aquifers, Convective velocity, Mathematical models.

Generalized Taylor dispersion theory is used to identify the dispersion characteristics of simple stratified aquifers. The parameters routinely estimated from field tests are shown to be influenced in a nontrivial way by the inhomogeneity of the aquifer as well as by the initial distribution of solute and by the sampling techniques used in their determination; both the dispersion coefficient and apparent convective velocity can exhibit important transients. These factors are sufficient to explain the well-known scale effect for the idealized system analyzed. Furthermore, sampling procedures may require addition of a reaction term to the contracted diffusion equations normally used for analysis of field data if the model is to represent faithfully the dispersion processes occurring within the aquifer. (Author's abstract)
W85-02667

GEOSTATISTICAL APPROACH TO SOLUTE TRANSPORT IN HETEROGENEOUS FIELDS AND ITS APPLICATIONS TO SALINITY MANAGEMENT,
Agricultural Research Organization, Bet-Dagan (Israel). Div. of Soil Physics.
D. Russo.
Water Resources Research, Vol. 20, No. 9, p 1260-1270, September, 1984. 11 Fig, 1 Tab, 26 Ref.

Descriptors: *Salinity management, *Solute transport, *Leaching, *Saline soils, Permeability coefficient, Soil water, Mathematical models, Simulation, Pressure potential, Application rate.

In heterogeneous fields in which the soil water properties and the initial salinity vary under a deterministic water application rate uniform throughout the field, the salinity during leaching might also differ from place to place. A geostatistical approach was used to investigate the spatial variability of three soil properties: the saturated hydraulic conductivity Ks, the soil characteristic alpha = d log (K)/d(psi) (K being the soil hydraulic conductivity and psi being the pressure potential), and the dispersivity lambda, as well as the initial salinity EC sub 0, by using actual measured field data. These properties were used as input parameters of a simplified water and salt flow model, which in turn was coupled with the conditional simulation method to analyze the salinity profile and its spatial distribution during leaching in a 187-ha plot of land. Analysis of the results showed that 107 hours of continuous leaching (6527 cu m/ha) were required to obtain an average salinity of EC* = 5 dS/m for the field layer between the soil surface and the 40-cm depth. By considering the leaching of the different sites in the field, rather than that of the entire field, it was shown that, theoretically, the amount of water for leaching required to obtain EC* = 5 dS/m uniformly throughout the field can be reduced to 4038 cu m/ha (a reduction of 38%). Practically, since the field had to be subdivided into small subplots and because of engineering design requirements for the water supply system, the amount of water for leaching required to obtain the above-mentioned value of EC* for the entire field (519 cu m/ha) could be reduced by only 20%. (Author's abstract)
W85-02668

MODELING ORGANIC CONTAMINANT PARTITIONING IN GROUND-WATER SYSTEMS,
Michigan Univ., Ann Arbor.
C. T. Miller, and W. J. Weber, Jr.
Ground Water, Vol. 22, No. 5, p 584-592, September-October, 1984. 6 Fig, 37 Ref.

Descriptors: *Groundwater pollution, *Fate of pollutants, *Path of pollutants, Mathematical models, Partition coefficients, Solute transport, Sorption, Kinetics, Mass transport, Organic compounds.

Effective management of a ground-water system requires description and prediction of the transport and fate of contaminants in that system. This can be facilitated by using mathematical models which accurately represent the physical phenomena operative in the system. One of the most significant phenomena impacting the transport of many organic pollutants is partitioning between the solid (soil) and aqueous (ground-water) phases. The tendency of a contaminant to partition may be roughly approximated from measurements of such constitutive properties as the octanol:water partition coefficient of the contaminant and organic carbon content of the soil. Such rough approximations provide a basis for cursory appraisal, but are inadequate for quantitative system descriptions, particularly where nonlinear equilibrium sorption, kinetically dependent partitioning, or irreversible and/or hysteretic phase distribution phenomena are operative. Accurate simulation of solute transport frequently requires the incorporation of kinetic parameters and/or a nonlinear isotherm relationship to define transport phenomena in the fundamental equations governing mass transport. Laboratory measurements may be utilized to assess sorptive factors of importance, kinetic properties of an organic solute and a soil system, and equilibrium partitioning relationships. Such measurements can be utilized to provide more accurate modeling of contaminant transport. (Author's abstract)
W85-02692

MIGRATION OF CHLOROPHENOLIC COMPOUNDS AT THE CHEMICAL WASTE DISPOSAL SITE AT ALKALI LAKE, OREGON - 1. SITE DESCRIPTION AND GROUND-WATER FLOW,
Oregon Graduate Center, Beaverton.
J. F. Pankow, R. L. Johnson, J. E. Houck, S. M. Brillante, and W. J. Bryan.
Ground Water, Vol. 22, No. 5, p 593-601, September-October, 1984. 10 Fig, 24 Ref. EPA grant 808272.

Descriptors: *Alkali Lake, *Oregon, *Groundwater movement, *Hydrogeology Waste disposal, Chlorophenols, Industrial wastes, Playas, Springs, Water pollution sources.

The hydrogeology of the chemical waste disposal site in the closed basin at Alkali Lake, Oregon has been examined. Interest in the site is due to the burial (November 1976) of 25,000 drums of herbicide manufacturing residues in unlined trenches on the playa of the basin. Included in the wastes were large amounts of chlorophenols and polymeric chlorophenoxyphenols. The flow of the alkaline (pH about 10) ground water in the site area is driven by: (1) springs which create a mound east of the site; and (2) the sump effect of 'West Alkali Lake,' a topographic low to the west of the site. Porosity, bulk mass densities, and grain-size distributions were determined. At one piezometer, the depth to ground water ranged between 0.9 m and 2.2 m. With the bottoms of the trenches in which the chemicals were buried between 0.60 and 0.75 m below the level of the ground surface, the bottom portions of the trenches may, at least occasionally, be in direct contact with the ground water. (Author's abstract)
W85-02693

5C. Effects Of Pollution

RECOVERY OF DAMAGES BY STATES FOR FISH AND WILDLIFE LOSSES CAUSED BY POLLUTION,
F. Halter, and J. T. Thomas.
Ecology Law Quarterly, Vol. 10, No. 1, p 5-35, 1982. 124 Ref.

Descriptors: *Oil spills, *Cleanup, *Legal aspects, *Fish, *Wildlife, Legislation, Common law, Evaluation, Economic aspects, Chesapeake Bay, Bays.

In February of 1976 a tank barge carrying about 19,700 barrels of oil sank while in tow up the Chesapeake Bay. Much of the oil escaped into the Bay off Smith Point, just below the mouth of the Potomac River. Several months later the owner, Steuart Transportation Company, filed a complaint seeking exoneration from or limitation of liability for the damages caused by the spill. Both the United States and the Commonwealth of Virginia

filed claims. The several bases for state recovery actions are analyzed and investigation is made of various methods for establishing the monetary value of the fish and wildlife destroyed. While legal remedies are available through legislation and, in many cases, through state common law as well, the problem of determining the value of fish and wildlife has been a major factor in discouraging recoveries. Methods for valuing these resources are available. Some, like replacement cost, are well established. Newer methods for more difficult valuation problems are just developing and have not yet received much application. Specific authorizing legislation will facilitate state recovery efforts by establishing a sound legal basis and providing a framework for the development and use of a variety of valuation methods. The growing number of state actions and the statutory mandate of Superfund should lead to rapid progress in this area. (Baker-IVI)
W85-02181

TOXICITY OF COPPER TO THE ADULT AND EARLY LIFE STAGES OF THE FRESHWATER CLAM, CORBICULA MANILENSIS,
Lawrence Livermore National Lab., CA.
F. L. Harrison, J. P. Knezovich, and D. W. Rice, Jr.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 1, p 85-92, January, 1984. 3 Fig, 4 Tab, 41 Ref. DOE contract W-7405-ENG-48.

Descriptors: *Clams, *Copper, *Toxicity, *Growth stages, Heavy metals, Bioassay, Mortality, Bioaccumulation, Water pollution effects.

The copper sensitivity of adult and larval stages of the freshwater clam Corbicula manilensis was evaluated. In addition, copper concentrations were determined in adult clams exposed for 4 to 10 weeks to copper in a high-volume, flow-through bioassay. All bioassay systems utilized water that was low in total hardness and alkalinity. The response of the clams to copper depended on life stage. Copper sensitivity of larvae decreased markedly in successive developmental stages; 24 hr LC50 of veliger and juvenile larvae were 28 and 600 micro g Cu/L, respectively. The mortality of trochophore larvae exposed to 10 micro g Cu/L for one hr was 91.5%. The sensitivity to copper decreased with increased amounts of larval shell deposition. Adult clams were resistant to copper; the 96 hr LC50 was greater than 2,600 micro g Cu/L. By comparison, the incipient lethal concentration (ILC, was lowless than 10 micro g Cu/L. Adult clams accumulated more copper as concentrations in the water increased. Evidence was obtained for copper loss near or at death. Labile and total copper, as well as the copper-complexing capacity, in the bioassay water were determined; the majority of copper was present at labile species. Toxicity was related to the quantities of labile copper in the water. (Author's abstract)
W85-02193

INTRASPECIFIC VARIATION IN COPPER SUSCEPTIBILITY OF THE BLUEGILL SUNFISH,
Maryland Univ., Solomons. Chesapeake Biological Lab.
C. Tsai, and K. Chang.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 1, p 93-99, January, 1984. 4 Fig, 1 Tab, 18 Ref.

Descriptors: *Bluegills, *Copper, *Toxicity, Sex, Age, Size, Heavy metals, Bioassay.

The bluegill, Lepomis mocrochirus, is one of the most common species of freshwater fish in North America and is commonly used as a test species in toxicity tests of pollutants. Since intraspecific variables such as size, sex, and age might affect test results, the objective of this study was to determine the effects of these variables on the susceptibility of the bluegill to toxicants by using copper as a test chemical. For the same unit of effective concentration adjusted with size factor, the survival times of age-0 males, age-0 females, age-1 males and age-1 females were, respectively, 2.77, 2.88, 4.20 and 6.30 times that of the juveniles; susceptibility to the toxic effect of copper decreased from small to large, young to old, and male to female. Bluegills of 30-50 mm standard length (about 3 g) at age-0 are the best size for toxicity tests. (Moore-IVI)
W85-02194

TOXICITY, ACCUMULATION, AND ELIMINATION OF POLYCYCLIC AROMATIC SULFUR HETEROCYCLES IN DAPHNIA MAGNA,
Brigham Young Univ., Provo, UT. Dept. of Zoology.
D. A. Eastmond, G. M. Booth, and M. L. Lee.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 1, p 105-111, January, 1984. 8 Fig, 1 Tab, 36 Ref.

Descriptors: *Daphnia, *Toxicity, *Bioaccumulation, *Polycyclic aromatic sulfur heterocycles, Aromatic compounds, Hydrocarbons, Polycyclic aromatic hydrocarbons, Biological magnification, Industrial wastes.

Full-scale commercial synfuel plants would produce effluents containing polycyclic aromatic sulfur heterocycles (PASH), a portion of which would be released to the freshwater environment. The environmental effects of the PASH are largely unknown. A series of PASH were compared to their sterically and structurally similar polycyclic aromatic hydrocarbons (PAH) for toxicity, bioconcentration, and elimination in Daphnia magna. The PASH were generally more toxic than their analogous PAH. Benzo(b)thiophene and benzo(b)naphtho(2,1-d)-thiophene (BNT) were bioconcentrated to a greater extent than naphthalene and chrysene, respectively. Dibenzothiophene and phenanthrene exhibited similar uptake curves. No clear trend was observed for elimination differences between PASH and PAH, with those of BNT and chrysene being equal and those of bensol(b)thiophene and phenanthrene being slower than naphthalene and dibenzothiophene, respectively. (Moore-IVI)
W85-02195

INFLUENCE OF TETRACHLOROETHYLENE ON THE BIOTA OF AQUATIC SYSTEMS: TOXICITY TO PHYTO- AND ZOOPLANKTON SPECIES IN COMPARTMENTS OF A NATURAL POND,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Okologische Chemie.
J. P. Lay, W. Schauerte, W. Klein, and F. Korte.
Archives of Enironmental Contamination and Toxicology, Vol. 13, No. 2, p 135-142, March, 1984. 7 Fig, 2 Tab, 19 Ref. Commission of the European Communities contract 187-77-1 ENV D.

Descriptors: *Tetrachloroethylene, *Toxicity, *Phytoplankton, *Zooplankton, Solvents, Chlorinated hydrocarbons, Daphnia, Aquatic life.

This study was designed to determine the effects of tetrachloroethylene on the phyto- and zooplankton community at initial concentrations of 1.2 and 0.44 mg/L in separated compartments of an experimental pond. Measurements in the surrounding water were made simultaneously to detect possible effects of compartmentalization. Residues as low as 0.1 mg/L could be analyzed 5 days (low dose) and 38 days (high dose) post application. In all applied biotopes, a lethal effect on the Daphnia population was detected. The phytoplankton community showed an increase of relative abundance and a decrease in species diversity. Studies of the frequency distribution of six selected phytoplankton species demonstrated the total elimination of at least four species from the treated compartments. In spite of different dosing, only weak differences could be found in toxic effects between the low and high dosed compartments. No significant chemical-induced effect was observed on the physico-chemical properties of the treated water. (Author's abstract)
W85-02196

TOXICOLOGICAL RESPONSE OF THE ANABAENA FLOS-AQUA (CYANOPHY TO CADMIUM,
Herbert H. Lehman Coll., Bronx, NY. D Biological Sciences
J. W Rachlin, T E. Jensen, and B Warken
Archive of Environmental Contaminatio Toxicology, Vol. 13, No. 2, p 143-151, 1984. 9 Fig, 6 Tab, 44 Ref EPA grant R-

Descriptors: *Phytotoxicity, *Anabaena, * um, Algae, Water pollution effects, Heavy Cellular compartmentalization, Intracellula ture.

The toxicological response of the cyanop alga Anabaena flos-aquae to cadmium was gated by three integrated approaches: 1) the mination of the incipient lethal concentra the metal, 2) study of metal incorporatio cellular compartmentalization using X-ray dispersive analysis, and 3) the quantifica intracellular structural changes, after meta sure, using morphometic analysis. After 9 exposure, the incipient lethal concentratio calculated to be 0.118 +/- 0.04 micro M ca At concentrations three orders of mag higher than the incipient lethal concentratio mium was incorporated into both cellular plasm and the cell's polyphosphate bodies. um also caused the polyphosphate bodies Mg and Ca, resulting in ionic changes in t mental composition of these cellular incl The utilization of stereological techniques fo tron microscopic morphometric analysis lished that all concentrations of cadmium caused significant reductions in the surface the cell's thylakoids. Cadmium induced cha the numbers and relative volume of the cell pied by polyhedral bodies, polyphosphate lipid inclusions, cyanophycin granules, me limited crystalline inclusions, and changes volume of the cell wall layers were also doc ed. The physiological significance of these fi are discussed in terms of the toxic action of um and the cellular mechanisms for detoxifi of cations once they enter the cell. (Autho stract)
W85-02197

HISTOPATHOLOGICAL, HEMATOLOG CONDITION-FACTOR, AND ORGAN WE CHANGES ASSOCIATED WITH SELE ACCUMULATION IN FISH FROM BE LAKE, NORTH CAROLINA,
Texas Univ. at Austin. Dept. of Pharmac E. M. B. Sorensen, P. M. Cumbie, T. L. Baue S. Bell, and C. W. Harlan.
Archives of Environmental Contamination Toxicology, Vol. 13, No. 2, p 153-162, M 1984. 8 Fig, 3 Tab, 31 Ref.

Descriptors: *Selenium, *Sunfish, *To *Belews Lake, *North Carolina, Bioaccumul Hepatopancreas, *Histopathology, Blood, Water pollution effects.

Green sunfish (Lepomis cyanellus) were coll from two study sites in Belews Lake, North C na, for assessment of correlations between se biological parameters and bioaccumulation of nium. The fish had elevated concentrations of nium in the hepatopancreas (liver) and exhi histopathological and other manifestations of nium poisoning. Condition-factors of Belews fish were significantly correlated with sele concentrations in hepatopancreas and sk muscle, indicative of capillary permea changes and resultant edema, supported by occurrence of significantly increased hepat creas-weight-to-body-weight ratios in the having the higher tissue selenium levels. Gi mellae were noticeably swollen and vacuol Hematocrits of the selinium-contaminated were significantly lower than those of the r ence fish. The hepatopancreas exhibited lym cyte infiltration, vacuolation of parenchymal l tocytes around the central veins, and incre numbers of Kupffer cells. The mesonephros e ited focal intra-capillary proliferative glomeru phritis. Hearts showed swollen, inflammatory filled pericardial spaces, diagnosed as pos

nia-induced pericarditis. Ovaries in fish with higher liver selenium levels exhibited numerous otic and ruptured egg follicles. These conditi-s were observed in the Belews Lake Site 2 fish, did not occur in reference green sunfish, nor they occur consistently in fish from the less-aminated Belews Lake Site 1. (Author's ab-:t)
W85-02198

LTIPLE BIOASSAYS TO ASSESS THE ICITY OF A SANITARY LANDFILL CHATE,
sachusetts Univ., Amherst. Dept. of Civil En-ering.
primary bibliographic entry see Field 5A.
W85-02202

ICITY OF SEWAGE SLUDGE TO RHE-XYNIUS ABRONIUS, A MARINE BENTHIC PHIPOD,
vallis Environmental Research Lab., OR.
. Swartz, D. W. Schults, G. R. Ditsworth, and A. DeBen.
hives of Environmental Contamination and icology, Vol. 13, No. 2, p 207-216, March, 1. 2 Fig, 5 Tab, 42 Ref.

criptors: *Sludge, *Toxicity, *Amphipods, atile solids, Marine sediments, Water pollution cts, Sludge disposal.

tive toxicity of sewage sludges from six treat-t plants was determined by the LC50 of ge-sediment mixtures to the infaunal marine hipod, Rhepoxynius abronius. LC50s were sured as the increase in the percent total vola-solids (TVS) of the mixture due to the addition ludge required to kill 50% of the amphipods ng a 10-day exposure. LC50s ranged from % TVS addition for sludge from the small, estic community of Waldport, Oregon to < % TVS addition for metropolitan, more indus-ized source in Los Angeles, California. The city of the sludge-sediment mixtures is attrib-primarily to chemical contamination rather organic enrichment. Rank correlations be-n toxicity and specific chemicals were usually statistically significant, indicating that different binations of stresses involving multiple or un-sured factors were probably responsible for rved effects. Integrative measures of contami-n (oil/grease concentration; consensus rank-of contamination based on 15 parameters) were ificantly correlated with R. abronius survival ating that the more toxic sludges had a higher all level of contamination. (Author's abstract)
W85-02203

AKE AND PHYTOTOXICITY OF SOIL-BED ATRAZINE FOR THE SUBMERGED QUATIC PLANT, POTAMOGETON PERFO-TUS L.,
yland Univ., Cambridge. Horn Point Environ-tal Labs.
W. Jones, and P. S. Estes.
hives of Environmental Contamination and icology, Vol. 13, No, 2, p 237-241, March, . 3 Fig, 1 Tab, 19 Ref. EPA grant 3248010.

criptors: *Atrazine, *Herbicides, *Phytotoxi-*Submerged plants, Photosynthesis, Soil ad-tion, Macrophytes, Pesticide residues, Water tion effects.

icide runoff into estuarine aquatic environ-ts may have an impact on submerged macro-e vegetation. Triazine herbicides such as atri-are relatively mobile in the soil and move agricultural fields into aquatic systems. The itioning of atrazine between the dissolved e and the soil-sorbed phase in the runoff com-nt may be of key importance to the availabil-f the herbicide for uptake by submerged ma-hytes. The photosynthetic inhibitory effect of zine-sorbed soil placed on the leaf surfaces of mogeton perfoliatus was investigated under ratory conditions. Leaves simultaneously ex-d to atrazine both in solution and sorbed to soil exhibited a similar uptake of atrazine and associated photosynthetic reduction as did leaves exposed to the same concentration of atrazine in solution only. A small quantity of atrazine (0.19 micro g/gdw leaf) was found in leaves treated with atrazine-sorbed soil at 120 micro g/kg whereas a significantly larger amount (3.57 micro g/gdw leaf) was present in leaves treated with dissolved atrazine at a concentration of 100 micro g/L. Atrazine sorbed to soil on leaf surfaces is less available for uptake by aquatic plants than atrazine in solution. The physical presence of the soil on the leaves and the resultant reduction of light may be of greater physiological concern. (Moore-IVI)
W85-02205

BACTERIA AND CADMIUM INTERACTIONS IN NATURAL AND LABORATORY MODEL AQUATIC SYSTEMS,
Ohio State Univ., Columbus. Dept. of Microbiology.
J. A. Titus, and R. M. Pfister.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 3, p 271-277, May, 1984. 4 Fig, 3 Tab, 27 Ref. OWRT contract B-079-OHIO.

Descriptors: *Cadmium, *Bacteria, *Ottwa River, *Ohio, Heavy metals, River sediments, Aquatic environment, Water pollution effects, Bacillus, Pseudomonas.

Cadmium-resistant bacterial populations were examined in sediments of the Ottwa River, near Lima, Ohio, at a site that had elevated levels of Cd, Cr, Cu, Ni, Zn, and Fe. The percentage of the bacterial population that was resistant to cadmium was higher at the metal-contaminated site than at a less contaminated site downstream. Bacillus was the most abundant genus of the total river sediment population recovered and Pseudomonas was the most abundant Cd-resistant genus recovered. Types and distribution of bacterial populations in 40 liter laboratory model aquatic systems were examined over a ten-week period during the continuous addition of 10 mg Cd(+2) per day. The Cd level in the water column rose rapidly through the first two weeks and reached a maxium of 3 micro g Cd/ml. Sediment Cd levels rose most rapidly after 5 weeks and reached a concentration of 270 micro g Cd/g after 10 weeks. The bacteria in the water column responded to the Cd treatments with increased Cd resistance more quickly and to a greater degree than the bacteria in the sediment. The types of Cd-resistant bacteria isolated in the model systems were similar to Cd-resistant bacteria isolated from sediments of the Ottwa River. (Author's abstract)
W85-02206

PERSISTENCE AND EFFECTS OF CHEMICALS IN SMALL ENCLOSURES IN PONDS,
Shell Research Ltd., Sittingbourne (England). Sittingbourne Research Centre.
R. R. Stephenson, and D. F. Kane.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 3, p 313-326, May, 1984. 14 Fig, 3 Tab, 23 Ref.

Descriptors: *Water pollution effects, *Toxicity, *Enclosures, *Ponds, Aquatic plants, Aquatic animals, Persistence, Fate of pollutants, Insecticides, Herbicides, Methyl parathion, Linuron, Zooplankton, Invertebrates.

The use of small (1 cu m) enclosures for providing data on the persistence and effects of chemicals in freshwater was investigated. The enclosures included an intact water column with its associated flora and fauna and provided water/air and water/sediment interfaces when placed in small ponds. The enclosures provided a means of examining a variety of toxic effects of two chemicals, an insecticide (methyl parathion) and a herbicide (linuron), under relatively natural conditions in a replicated experiment which lasted six weeks. Toxic effects on zooplankton, macroinvertebrates, and the flora of the enclosures were observed and compared with the results of laboratory toxicity tests and bioassays of water samples collected from the enclosures. The persistence of the two chemicals in the water in the enclosures was followed by chemical analysis and bioassay. Experiments in enclosures could play a role in providing data to be used in the assessment of the hazard posed by chemicals: particularly in cases where the laboratory data in acute toxicity, to single species or simple associates of species, and knowledge of simple physical constants are inadequate to allow assessment of the hazard. (Author's abstract)
W85-02207

COPPER COMPLEXATION AND TOXICITY TO FRESHWATER ZOOPLANKTON,
Canada Centre for Inland Waters, Burlington (Ontario).
U. Borgmann, and K. M. Ralph.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 4, p 403-409, July, 1984. 5 Fig, 1 Tab, 19 Ref.

Descriptors: *Copper, *Toxicity, *Zooplankton, *Complexation, Copepods, Rotifers, Tris, Bioassay, Growth.

The effect of copper on the growth rate of cyclopoid copepods and survival of rotifers was determined in natural water with and without addition of the complexing agent Tris. Free copper concentrations were estimated, both by cupric ion electrode and from the bioassay data, making use of the known complexing ability of Tris and the increase in total copper tolerated after Tris addition. Growth rates of copepods were directly related to free copper concentrations indicating that the copper-Tris complex was not toxic to these animals. Rotifer survival was similar at equivalent free copper concentrations in water with and without 1 mmole/L Tris, but addition of 3 mmole/L Tris resulted in slightly lower free copper at equivalently toxic total copper concentrations. Free copper concentrations calculated from bioassay data compared well with electrode measurements in all cases except when calculated using the 3 mmole/L Tris data for rotifers, when free copper concentrations were slightly overestimated. (Author's abstract)
W85-02211

EFFECTS OF LAKE ACIDIFICATION ON RATES OF ORGANIC MATTER DECOMPOSITION IN SEDIMENTS,
Winnipeg Univ. (Manitoba). Dept. of Biology.
C. A. Kelly, J. W. M. Rudd, A. Furutani, and D. W. Schindler.
Limnology and Oceanography, Vol. 29, No. 4, p 687-694, July, 1984. 4 Fig, 2 Tab, 20 Ref.

Descriptors: *Acidification, *Decomposition, *Organic matter, *Lake sediments, Acid lakes, Hydrogen ion concentration, Microorganisms, Atmospheric deposition, Epilimnion.

Decomposition was monitored in Lake 223, a Canadian Shield lake within the Experimental Lakes Area, as the lake was being experimentally acidified by additions of sulfuric acid. Summer hypolimnetic and whole-lake under-ice measurements in the acidified lake suggested that rates of in situ decomposition in sediments (measured as methane and inorganic carbon release) were unaffected over an epilimnetic pH range of 6.7-5.1. This was apparently because microbial process kept the pH at 6.0 or above just a few millimeters below the sediment surface even after lake water had been acidified for 8 years. In laboratory studies where the pH of mixed, fresh lake sediment was controlled at reduced levels, decomposition rates of carbon that had been made in the sediments for several months were unaffected at pH values as low as 4.0. Decomposition rates of newly sedimented material began to decrease at pH 5.25-5.0. Decomposition processes were less affected during the acidification of Lake 223 than were higher life forms. The kinds of pH and decomposition phenomena seen in Lake 223 may be expected in other lakes receiving acid precipitation, but rates of atmospheric inputs of acid are lower than the experimental rate of acidification. (Moore-IVI)
W85-02218

INSECTICIDE TOXICITY TO MACROBRACHIUM LAMARREI (H. MILNE EDWARDS) (DECAPODA, PALAEMONIDAE),
Gorakhpur Univ. (India). Dept. of Zoology.
G. S. Shukla, and Omkar.
Crustaceana, Vol. 46, No. 3, p 283-287, May, 1984. 1 Tab, 19 Ref.

Descriptors: *Water pollution effects, *Insecticides, *Aquatic animals, Organochlorines, Organophosphates, Endosulfan, Methyldemeton, Carbaryl, Organocarbamates, Organic compounds.

Three commonly used insecticides were tested for their short-term toxicity to a freshwater prawn, Macrobrachium lamarrei, which is a valuable source of food for fishes and humans and is abundantly available in local water sources. The animals were restless in the test solutions of each insecticide, earlier at higher concentrations than in lower ones. The first indication of insecticide poisoning was irritability, followed by impaired locomotion, restriction of appendage movement and finally death occurred. Symptoms of poisoning were somewhat similar for all insecticides. The organochlorine insecticide endosulfan was highly toxic, 568.5 times more toxic than the organophosphate methyldemeton, which is least toxic to this species and the carbamate carbaryl is intermediate in toxicity. In 0.002, 0.5 and 0.0175 mg/l solutions of endosulfan, methyldemeton, and carbaryl, respectively, no mortality occurred in 96 hr while in 0.0075, 6.0 and 0.065 mg/l solutions of endosulfan, methyldemeton and carbaryl, respectively, 10% mortality occurred within 24 hr. (Baker-IVI)
W85-02235

EFFECTS OF WATER POLLUTION ON PLANT SPECIES COMPOSITION ALONG THE AMAL RIVER, ISRAEL,
Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.
M. Agami.
Archiv fur Hydrobiologie, Vol. 100, No. 4, p 445-454, July, 1984. 2 Fig, 2 Tab, 9 Ref.

Descriptors: *Vegetation, *Water pollution effects, *Amal River, *Harod River, *Israel, Water quality, Dissolved oxygen, Chemical oxygen demand, Biochemical oxygen demand, Suspended solids, Ammonia, Nitrates, Salinity, Detergents.

The effect of increasing pollution levels in the Amal river system on the vegetation in that system was evaluated. Water quality measurements taken in the Amal and Harod Rivers included determinations of nitrate, ammonium, total dispersed solids, biochemical oxygen demand, chemical oxygen demand, detergent, dissolved oxygen and calcium. Section 1 of the study area (a 700 m section of Amal river from its source to a point 200 m before the dam) had water which remained pure throughout the year. Water in Section 2 of the study area (a 1000 m section of Amal River from the first sewage dump to the beginning of an irrigation canal) was only slightly polluted indicating that the dilution of the sewage by the water was very large (1:219). Section 3 (a section of Harod River which receives some 20,000 cu m/day of urban and industrial sewage) was heavily polluted. The level of dissolved oxygen was only about 31% of air equilibrium and detergents and ammonium were always present with ranges of 1.7 to 2.4 ppm and 3.71 to 12.35 ppm, respectively. Only one third of the species of vegetation which exist in the unpolluted sections manage to live also in the polluted ones. The flora of the Amal River system is generally poor. The Amal River is also of relatively high salinity compared to the Yarkon and Alexander Rivers which contain 47 and 81 species respectively compared to the 22 species of vegetation found in the Amal River. In the clean sections of this study site submerged, floating and emergent species are present. In the polluted section all plants have disappeared from the water body with only bank vegetation remaining. (Baker-IVI)
W85-02239

PHYTOPLANKTON LIMITATION BY PHOSPHORUS AND ZOOPLANKTON GRAZING IN AN ACIDIC ADIRONDACK LAKE,
Syracuse Univ., NY. Dept. of Civil Engineering.
R. Singer, G. L. Evans, and N. C. Pratt.
Journal of Freshwater Ecology, Vol. 2, No. 5, p 423-434, August, 1984. 46 Ref.

Descriptors: *Phytoplankton, *Zooplankton, *Phosphorus, *Acid lakes, *New York, Mountain lakes, Acidity, Algal growth, Predation, Water pollution effects.

Lakes which are believed to have been acidified by atmospheric deposition of anthropogenic substances are known for their unusually high water clarity and low nutrient concentrations. Some evidence indicates that alterations in predator/prey relationships, an indirect effect of acidification, bring about the increase in water clarity. Enclosures were used to study the effects of phosphorus addition and zooplankton removal on the phytoplankton of an acidic lake in the Adirondak Mountains of New York. Fertilized enclosures had significantly lower alkalinities and contained significantly more dissolved oxygen after the incubation period than did unfertilized enclosures. The P concentration remained at or near the limit of detection in the unfertilized enclosures. The phytoplankton population bloomed after the addition of 80 micro g/liter of phosphate as KH_2PO_4. The response was measured by cell counts of the dominant phytoplankton, Chlamydomonas, and by changes in chlorophyll a concentration. About half the number of algal cells were present after the two week incubation when zooplankton were not removed, indicating that zooplankton herbivory can influence, but not totally control, the algal production. (Baker-IVI)
W85-02243

EFFECT OF MINERAL ACIDS AND ALUMINUM FROM COAL LEACHATE ON SUBSTRATE PERIPHYTON COMPOSITION AND PRODUCTIVITY,
Massachusetts Univ., Amherst. Dept. of Environmental Sciences.
B. Tease, and R. A. Coler.
Journal of Freshwater Ecology, Vol. 2, No. 5, p 459-467, August, 1984. 3 Fig, 2 Tab, 22 Ref.

Descriptors: *Leachates, *Acid mine drainage, *Massachusetts, *Taylor Brook, *Swamps, Water pollution effects, Periphyton, Population dynamics, Primary productivity.

Taylor Brook drains agricultural and grazing land surrounding Hawley swamp in North Amherst, Massachusetts. It is a second order stream, with an average flow of less than 4 cfs in the study area, and a total length of 5 km. Riparian vegetation occurs mainly as aspens. Silt and sand, together with stretches of gravel, make up the stream bed. The test site is within a pasture, 1 km below a coal leachate seepage problem and 10 m above the confluence of a first order tributary. Shifts in pH from 6.8 to 4.4 and in aluminum from 0.03 to 3.8 ppm were noted in the stream. Tubular substrates, colonized by the indigenous periphyton of a clean water tributary were transferred to the contaminated stream and monitored for structural and functional perturbations. Net productivity, measured by oxygen evolution, was reduced to zero after 10 days exposure to the polluted stream. All diatom and cyanobacteria motility ceased. Low pH alone proved sufficient to eliminate net productivity, but it did not restrict algal movement. (Baker-IVI)
W85-02246

EFFECT OF SODIUM NAPHTHENATE ON SURVIVAL AND SOME PHYSIOLOGICAL-BIOCHEMICAL PARAMETERS OF SOME FISHES,
Kaspiiskii Nauchno-Issledovatel'skii Inst. Rybnogo Kozyaistava, Makhachkala (USSR).
B. K. Dokholyan, and A. K. Magomedov.
Journal of Ichthyology, Vol. 23, No. 6, p 125-132, 1983. 6 Fig, 6 Tab, 6 Ref.

Descriptors: *Water pollution effects, *Organic compounds, *Fish, *Toxicity, Naphthenic acid, Sodium naphthenate, Salmon, Roach, Kutum, Sturgeon, Goby.

The toxicity of the alkaline salt of naphth
for some Caspian fish species was determ
findings confirm the differential sensitiv
ferent species to the various toxic reage
ontogeny. The concentrations not affe
versely the life processes of fish species
ed are: 0.57 mg/l for young kutum; 0.332
young chum salmon, 4.8 mg/l for young
mg/l for adult roach; 6.3 mg/l for stur
9.0 mg/l for Caspian round goby. In spi
tive resistance estimated on the basis of
the case of sturgeon, roach and round go
icant changes in the blood components a
metabolism were observed in these fish
lower toxicant concentrations. On the ba
matological and biochemical parameters,
less concentrations of sodium naphthe
these species were only 0.5 and 1.0 mg/
tively. Sodium naphthenate is similar in its
crude oil on the basis of its action on phys
biochemical parameters in fish. The maxi
missible concentration of sodium naphth
the fish species studied has been fixed at
Considering that other hydrobionts we
more sensitive than fishes, the maximum
ble content of sodium naphthenate in s
should be considered 0.15 mg/l. (Baker-IV
W85-02280

AGRICULTURE AND STREAM WATER ITY: A BIOLOGICAL EVALUATION O SION CONTROL PRACTICES,
North Carolina Dept. of Natural Resou
Community Development, Raleigh.
D. R. Lenat.
Environmental Management, Vol. 8, No. 4 344, July, 1984. 10 Tab, 31 Ref.

Descriptors: *North Carolina, *Water
*Erosion control, *Ecological effects, *Ag
al runoff, Benthos, Aquatic insects, Sedime
Water pollution effects, Caddisflies,
Stoneflies.

Agricultural runoff affects many streams i
Carolina. However, there is little info
about either its effect on stream biota or an
tial mitigation by erosion control practices
study, benthic macroinvertebrates were sam
three different geographic areas of North C
comparing control watersheds with well-m
and poorly managed watersheds. Agri
streams were characterized by lower taxa r
(especially for intolerant groups) and s
These effects were most evident at the
managed sites. Sedimentation was the a
major problem, but some changes at agri
sites implied water quality problems. The
most intolerant of agricultural runoff were
meroptera, Plecoptera and Trichoptera. T
species were usually filter-feeders or algal g
suggesting a modification of the food web b
tion of particulate organic matter and nu
This study clearly indicates that agricultural
can severely impact stream biota. Howeve
impact can be greatly mitigated by current
ommended erosion control practices. (Autho
stract)
W85-02296

RECREATIONAL IMPACTS ON COLO RIVER BEACHES IN GLEN CANYON, A NA,
Museum of Northern Arizona, Inc., Fla
Dept. of Biology.
S. W. Carothers, and R. A. Johnson.
Environmental Management, Vol. 8, No. 4, 358, July, 1984. 4 Tab, 9 Ref. National Park ice contract CX82100022.

Descriptors: *Glen Canyon, *Colorado
*Arizona, *Beaches, *Recreation wastes,
ronmental impact, Parks, Recreation fac
Camp sites, Management planning.

Recreational impact was measured on eight b
es in Glen Canyon Recreation Area and 15 be
in Grand Canyon National Park using perma
located transects and plots. Recreational i
indices included densities of human trash and
coal and a measure of sand discoloration d

bal. Significant increases in the indices oc-
l on several Glen Canyon beaches over a
month period. Sand discoloration became
cantly higher over all Glen Canyon beaches
the same time period. All indices were
cantly higher in Glen Canyon than on similar
Canyon beaches. These differences are
bly due to differences in: (a) level of impacts
ed by the respective management regimes
) in the number of user days among the two
al Park Service administrative units. Man-
nt alternatives are presented for reversing
esent trends of recreational impact on Glen
n beaches. (Author's abstract)
02298

INE DISPOSAL OF MINE TAILING,
ria Univ. (British Columbia). Dept. of Biol-

Littlepage, D. V. Ellis, and J. McInerney.
e Pollution Bulletin, Vol. 15, No. 7, p 242-
984. 12 Ref.

iptors: *Mine wastes, *Marine environment,
e disposal, Mercury, Lead, Cadmium, Ra-
clides, Environmental effects, Environmental
t assessment.

otential impacts of a mine-mill discharging to
arine ecosystem can be grouped into a three-
artment conceptual model. The first compart-
includes the chemical composition and chem-
ehavior of the tailing slurry, the second, the
al behavior of the submerged tailing flow,
e third, changes in the receiving ecosystem.
deration of the type of potential impacts
l form the starting point for predicting and
ng environmental alteration. Primary im-
arise from suspended and settling particulate
ial and soluble components of the discharge.
dary impacts may include reduced primary
ction, alteration including depletion of the
community and incorporation of metals into
od chain. Variable oceanographic conditions
e areas may make control of a tailing stream
ilt and surveys must be undertaken to deter-
if currents are present which may intersect
nding tailing flows or resuspend settled tail-
reatest concern is with toxic metals, cadmi-
nd lead; with metals known to biomagnify,
ury; and with radionuclides. The ecosystem
onent of the environmental impact assessment
l emphasize assessing the relative complexity
ecosystem, the fisheries present, their socio-
mic importance as resources, and the nature
eir dependence on ecosystem processes.
r-IVI)
02324

CT OF SEWAGE EFFLUENT ON THE
ULATION DENSITY AND SIZE OF THE
M PARVILUCINA TENUISCULPTA,
rsity of Southern California, Los Angeles.
of Biological Sciences.
brikant.
e Pollution Bulletin, Vol. 15, No. 7, p 249-
uly, 1984. 5 Fig, 15 Ref.

iptors: *Nitrogen compounds, *Water pollu-
ffects, *Clams, *Wastewater outfall, Outfall
's, Bioindicators, Population dynamics.

population density and size of Parvilucina
culpta in relation to the distance the clams
located from a municipal wastewater outfall
investigated. The contribution of organic en-
ent to the changes in the population and size
e clams was calculated as measured by sedi-
organic nitrogen concentration. Definite re-
es and changes in size and density were noted
the distance gradient from the Whites Point
ll. Average clam size increased as sediment
ic nitrogen concentration increased, but pop-
n density increased until organic nitrogen
ntration reached a critical level when popu-
density decreased dramatically. These ef-
were explained in terms of increased available
ion in the form of sediment organic nitrogen
tants which enhanced both population and
idual size growth. At this critical level, how-
population density decreased due to the tox-
icity of the released compounds. Parvilucina tenuisculpta may be a good bioindicator of organic enrichment pollution. (Baker-IVI)
W85-02325

STUDY OF PERIPHYTON IN A POLLUTED SECTION OF A VAROISE RIVER, THE ARGENS. SPATIAL EVOLUTION OF THE ALGAL POPULATION DURING A PERIOD OF INTENSE POLLUTION (ETUDE DU PERIPHYTON D'UN SECTEUR POLLUE D'UNE RIVIERE VAROISE, L'ARGENS. EVOLUTION SPATIALE DU PEUPLEMENT ALGAL EN PERIODE D'INTENSE POLLUTION),
Aix-Marseille-3 Univ. (France). Lab. de Biologie Animale et Ecologie.
N. Galvin-Chabriere, and A. Cazaubon.
Annales de Limnologie, Vol. 19, No. 3, p 169-178, 1983. 6 Fig, 20 Ref.

Descriptors: *Varoise River, *Argens, *France, *Periphyton, *Species composition, Physicochemical properties, Aquatic productivity, Water pollution effects, Euglenophyta, Chlorophyta, Cyanophyta, Diatoms.

The objectives of this study were to follow changes in a water body that was subjected to organic pollution from urban and industrial effluents. The evolution of the pollution load as well as its impact on the chief abiotic and biotic parts of the aquatic ecosystem were studied by taking monthly readings of physical-chemical variables and samples of periphyton. Changes in algal production, and the composition and structure of the periphyton were followed in a 10 km stretch by using artifical substrata that were renewed every 12 days. In the study zone, there was a progressive change from an algal population of low diversity (chiefly Euglenophyceae, Chlorophyceae and Cyanophyceae) in the polluted environment, to a diverse population dominated by diatoms in the section downstream. This investigation shows that algal populations integrate the environmental conditions and show through their composition and structure the variations in water quality, thus reflecting the spatial changes in hydrochemical conditions. (Author's abstract)
W85-02327

SYSTEM THEORY FORMULATION OF SITE-SPECIFIC WATER QUALITY STANDARDS AND PROTOCOLS,
Georgia Univ., Athens. Dept. of Zoology.
B. C. Patten.
Ecological Modeiling, Vol. 23, No. 14, p 313-340, July, 1984. 6 Ref.

Descriptors: *Water quality standards, *Site specific standards, *Habitat variability, Decision making, Aquatic habitats, Standards, Toxicology, Systems analysis, Ecological effects, Water pollution effects.

The water bodies and wetlands of the United States host hundreds of ecological communities composed of thousands of interacting species, each with its own tolerances and preferences for physical and chemical factors of water quality. Habitat variability makes site-specific considerations a necessity in the specification of water quality standards. The U.S. Environmental Protection Agency (EPA) has recognized this in its development of procedures for site-specific modification of national standards. These procedures involve translation of laboratory toxicology data into field situations where such data are often poor predictors of biotoxicity. As formulated by the EPA, the site-specific problem was poorly specified. The legally defined objective of both National and Site-Specific Guidelines is to maintain the physical, chemical, and biological integrity of the environment. This can be framed in terms of general dynamical (state space) systems defined by a state transition function and a response (output) function. Development of site-specific environmental protection protocols must first involve finding a set of diagnostic variables whose maintenance within specifiable limits (standards) is both necessary and sufficient to protect all variables of a subject ecosystem. Standards for these variables must be determined through toxicity testing. Problems associated with determination of standards include: (a) spatiotemporal variability, (b) system linearity-nonlinearity, (c) system stationarity-nonstationarity, and (d) monitoring for baseline information, impact detection, compliance montoring, establishment of causality, and prediction. Further efforts to develop a more practically oriented theory within the general systems framework provided would be well advised; the present theory can serve to generally guide future methodological development. (Collier-IVI)
W85-02340

USE OF ELECTROPHORESIS AND IMMUNOELECTROPHORESIS IN TAXONOMIC AND POLLUTION STUDIES,
National Inst. of Oceanography, Panaji (India).
M. R. Menezes, and S. Z. Qasim.
Proceedings of the Indian Academy of Science (Animal Science), Vol. 93, No. 3, p 179-198, April, 1984. 6 Fig, 6 Tab, 50 Ref.

Descriptors: *Electrophoresis, *Tilapia, *Immunoelectrophoresis, *Water pollution effects, *Sublethal effects, Mercury, Immune system, Stress, Fish, Bioassay.

Stress conditions in fish may cause significant changes in the proteins of blood serum, hemoglobin, and eye lens proteins. Such changes might reflect an altered antibody synthesis, protein biosynthesis, cellular leakage, or perhaps other events resulting directly or indirectly from the stress. Long-term and short-term effects of inorganic mercury (mercuric chloride) on the electrophoresis patterns of a freshwater fish, Tilapia mossambica, were investigated under controlled conditions. Collateral studies included the uptake of mercury by the fish. The electrophoretic patterns of the serum and hemoglobin showed changes in response to low concentrations of mercury; these changes in number, mobility, and intensity of the fractions became evident in the serum proteins at a 0.04 ppm mercury exposure level. At this concentration, feeding behavior and swimming activity were altered and mercury concentrations in the blood increased. There was a general increase in the intensity of the low mobility serum protein fractions - a pattern similar to that found in the mammalian species under stress. Similar changes were also seen in the serum proteins of the fish exposed to relatively higher concentrations of mercury which were just below the lethal level. There is evidence that the low mobility proteins in the fish serum function as antibodies; this would indicate that the increased levels of these proteins in the exposed fish is due to a rapid and vigorous immune system response. Such indicators of stress responses would be useful for testing whether or not an effluent or a body of water containing a mixture of chemicals will collectively have a stressful effect on fish; the response would reflect the summation of effects, including synergistic effects, of pollutants. (Collier-IVI)
W85-02343

CHEMICAL POLLUTANTS IN SEDIMENTS AND DISEASES OF BOTTOM-DWELLING FISH IN PUGET SOUND, WASHINGTON,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
D. C. Malins, B. B. McCain, D. W. Brown, S.-L. Chan, and M. S. Myers.
Environmental Science and Technology, Vol. 18, No. 9, p 705-713, 1984. 5 Fig, 4 Tab, 65 Ref.

Descriptors: *Puget Sound, *Washington, *Fish diseases, *Sediments, *Water pollution effects, Sole, Toxicicty, Organic compounds.

A 4-year multidisciplinary study was conducted on relationships between pollutants and diseases of fish in Puget Sound, WA. In this study, high concentrations of a large number of anthropogenic chemicals were found in certain Puget Sound sediments. For example, over 900 individual organic compounds were detected in sediment from one urban bay (Commencement Bay), and evidence was obtained for the presence of numerous additional compounds. Many of the chemicals accumu-

lated in bottom-dwelling fish, and high levels of certain toxic chemicals in the urban bays were linked to serious disease (e.g., liver carcinomas) of English sole (Parophrys vetulus) and other demersal fish species. Application of the approach used would reveal comparable serious pollution-related health problems in marine biota in other urban coastal areas of the world. (Author's abstract)
W85-02347

ECOTOXICOLOGICAL ASSAYS WITH ALGAE: WEIBULL DOSE-RESPONSE CURVES,
Wisconsin Univ.-Milwaukee. Dept. of Civil Engineering.
E. R. Christensen, and N. Nyholm.
Environmental Science and Technology, Vol. 18, No. 9, p 713-718, 1984. 3 Fig, 4 Tab, 19 Ref. NSF grant CEE8103650.

Descriptors: *Toxicology, *Algae, *Weibull dose-response curves, *Weibull model, *Bioassay, Selenastrum, Scenedesmus, Potassium dichromate, Dichlorophenol, Dose-response curve, Model studies, Logit models, Probit models.

A newly proposed Weibull model was compared to the probit and logit models for the growth rate of algae as a function of the concentration of metallic and organic toxicants. Four batch assays with Selenastrum capricornutum exposed to potassium dichromate and copper and with Scenedesmus suspicatus affected by 3,5-di-chlorophenol and potassium dichromate were carried out. Literature data for four other experiments were also examined. The data fitting was based on linear transformations of the three models using proper weighting. The Weibull model was at least as appropiate as the probit and logit models. The effective concentrations giving 10 and 90% growth rate reduction, EC10 and EC90, were generally lowest for the Weibull model. The slopes (0.5 to 3-5) in the Weibull and logit transformations may be interpreted as the number of toxicant molecules reacting per active receptor of the organism. (Author's abstract)
W85-02348

ROLE OF FISH DISTRIBUTION ON ESTIMATES OF STANDING CROP IN A COOLING RESERVOIR,
Fish and Wildlife Service, Clemson, SC. Southeast Reservoir Investigations.
D. H. Barwick.
North American Journal of Fisheries Management, Vol. 4, No. 3, p 308-313, 1984. 2 Fig, 1 Tab, 15 Ref.

Descriptors: *Fish management, *Cooling reservoirs, *Keowee Reservoir, *South Carolina, Cooling water discharge, Water pollution effects, Stratification, Reservoir fisheries, Fish migration, Water temperature, Dissolved oxygen.

Estimates of fish standing crop from coves in Keowee Reservoir, South Carolina, were obtained in May and August for 3 consecutive years. Estimates were significantly higher in May than in August for most of the major species of fish collected, suggesting that considerable numbers of fish had migrated from the coves by August. This change in fish distribution may have resulted from the operation of a 2,580-megawatt nuclear power plant which altered reservoir stratification. Because fish distribution is sensitive to conditions of reservoir stratification, and because power plants often alter reservoir stratification, annual cove sampling in August may not be sufficient to produce comparable estimates of fish standing crop on which to assess the impact of power plant operations on fish populations. Comparable estimates of fish standing crop can probably be obtained from cooling reservoirs by collecting annual samples at similar water temperatures and concentrations of dissolved oxygen. (Author's abstract)
W85-02374

AGE AND GROWTH OF LARGEMOUTH BASS IN A THERMALLY ALTERED RESERVOIR, AS DETERMINED FROM OTOLITHS,
Illinois Natural History Survey, Champaign.
L. G. Perry, and J. A. Tranquilli.
North American Journal of Fisheries Management, Vol. 4, No. 3, p 321-330, 1984. 6 Fig, 3 Tab, 33 Ref.

Descriptors: *Coffeen Lake, *Illinois, *Bass, *Thermal pollution, *Otoliths, *Reservoirs, *Growth, Water pollution effects, Fish physiology, Water temperature.

Comparative growth rates of largemouth bass (Micropterus salmoides) from heated and ambient areas of Coffeen Lake, Illinois, were estimated by back calculation of lengths at annuli using transverse sections of otoliths and by recovery of marked fish after one growing season. Calculated lengths at otolith annuli were judged to be representative of the population growth, indicating that this technique was a reliable approach to obtaining growth information on largemouth bass from thermally affected environments. Growth of the Coffeen Lake population was more rapid than most other midwest populations. Fish recaptured in heated areas generally exhibited greater annual growth increments than those recaptured in ambient areas. Young largemouth bass (ages 1-4) from heated areas had significantly greater ($P < 0.05$) mean lengths than those from ambient areas according to back-calculated estimates. This was attributed to a longer growing season and earlier hatching time in thermally affected areas. (Author's abstract)
W85-02376

PHARMACOKINETIC MODEL FOR THE UPTAKE AND DISPOSITION OF DI-2-ETHYLHEXYL PHTHALATE IN SHEEPSHEAD MINNOW CYPRINODON VARIEGATUS,
Washington State Univ., Pullman. Coll. of Pharmacy.
A. H. Karara, and W. L. Hayton.
Aquatic Toxicology, Vol. 5, No. 3, p 181-195, 1984. 5 Fig, 2 Tab, 34 Ref. NIH grant ES01995.

Descriptors: *Phthalates, *Pharmacokinetics, *Sheepshead minnows, Plasticizers, Toxicology, Bioconcentration, Fate of pollutants, Water pollution effects, Metabolism, Fish physiology.

Sheepshead minnow Cyprinodon variegatus were placed individually in a 2 L solution that contained 60 nano g (C-14)di-2-ethylhexyl phthalate (DEHP)/ml at 23 degrees C. After various periods of exposure, fish and water were analyzed for unchanged DEHP and total metabolites. A two-compartment pharmacokinetic model was developed to characterize the uptake and disposition of DEHP. In the model, DEHP reversibly entered a relatively small compartment where it predominantly underwent metabolism. A small fraction of the absorbed DEHP moved into the second relatively large storage compartment. After depletion of the external solution of DEHP, the rate of metabolism slowed, due to the slow return of DEHP from the storage compartment to the metabolic compartment. The magnitude of the absorption clearance was similar to the gill blood flow, and indicated that the uptake of DEHP was blood flow rate limited. The metabolic clearance of DEHP was much larger (29-fold) than the absorption clearance and it therefore appeared that metabolism prevented the accumulation of DEHP to a level that in the absence of metabolism would have been much higher. The model-predicted bioconcentration factor and depuration half-life of DEHP were 637 and 38 days, respectively. (Author's abstract)
W85-02377

STRUCTURE AND FUNCTION OF COPPER-STRESSED AQUATIC MICROCOSMS,
Environmental Research Lab.-Duluth, Monticello, MN. Monticello Ecological Research Station.
S. F. Hedtke.
Aquatic Toxicology, Vol. 5, No. 3, p 227-244, 1984. 4 Fig, 6 Tab, 14 Ref.

Descriptors: *Copper, *Ecological effects, *Sediment, *Ecosystems, Water pollution effects, Primary production, Organic carbon, Toxicity, Adaptation.

Laboratory aquatic microcosms were es
using natural pond sediment and the o
contained therein. After a 30-day deve
time, microcosms were exposed on a flow
basis to six concentrations of copper with
cates of each concentration. Measures o
fixation, material cycling, and biological
were measured periodically over a 32-wk
Exposure to copper at 9.3 micro g/l an
resulted in a change in the structure and
of the test systems while 4.0 micro g/l
cause an effect relative to controls. Syste
micro g/l were structurally similar to con
at reduced levels of primary production, o
organic carbon production, and ma
growth. Substantial structural changes occ
> or = 30 micro g/l as these systems incr
shifted from autotrophic to heterotrophic
Little evidence of adaptation to the copp
occurred during the test period. (Author's
W85-02378

**EFFECT OF CHRONIC EXPOSURE T
AND TO GUTHION ON THE CR
SWIMMING SPEED AND BRAIN AC
CHOLINESTERASE ACTIVITY OF CY
DON VARIEGATUS,**
Environmental Protection Agency, Gulf
FL. Gulf Breeze Environmental Researc
G. M. Cripe, L. R. Goodman, and D. J. Ha
Aquatic Toxicology, Vol. 5, No. 3, p
1984. 1 Fig, 3 Tab, 27 Ref.

Descriptors: *EPN, *Guthion, *She
minnow, *Pesticide toxicity, *Organopho
pesticides, Acetylcholinesterase, Fish be
Fish physiology, Pesticides, Water pollu
fects.

Swimming performance of the estuarine
head minnow, Cyprinodon variegatus, wa
ured in a stamina tunnel at the end of lif
toxicity tests with the organophosphate pe
EPN (265 days) and Guthion (219 days). Ef
acetylcholinesterase (AChE) inhibition we
determined. These measures were compa
survival, growth and reproduction data obt
the life-cycle toxicity test. Significant eff
swimming stamina were detected in fish exp
2.2 micro g EPN/L (57% that of control fi
in fish exposed to 4.1 micro g EPN/L (4
controls). Survival and growth were reduce
in 7.9 micro g EPN/L. Swimming perfo
was not affected by Guthion concentration
0.5 micro g/L, a concentration affecting rep
tion. AChE was significantly inhibited by al
concentrations of EPN, 0.25 to 7.9 micro g/
Guthion, 0.06 to 0.50 micro g/L. Swimming
na may be an important endpoint to includ
measurements of effects on survival, grow
reproduction in chronic toxicity tests with fi
the relation of AChE inhibition to these end
is uncertain. (Author's abstract)
W85-02379

**TOXICITY AND BIOACCUMULATION
CADMIUM AND COPPER AS AFFECTE
HUMIC ACID,**
Miami Univ., Oxford, OH. Dept. of Zoology
R. W. Winner.
Aquatic Toxicology, Vol. 5, No. 3, p 26
1984. 2 Fig, 3 Tab, 18 Ref.

Descriptors: *Humic acids, *Cadmium, *C
*Toxicity, *Bioaccumulation, Synergistic e
Daphnia, Water quality criteria, Trace m
Crustaceans, Bioavailability, Water pollutio
fects.

The most recent U.S. EPA water quality c
for cadmium and copper acknowledge that
rally occurring organics will alter toxicity, b
data on the effects of such organics on
toxicity were available for incorporation int
criteria. The affect of humic acids on bioaccu
tion of metals is also poorly documented i
literature. The toxicity of Cd and Cu to dap
was evaluated over a 42-day exposure peri
three humic acid (HA) concentrations. The
tion of humic acid to test water decreased
acute and chronic toxicity of Cu but increase

e and chronic toxicity of Cd. However, there no effect of HA on the bioaccumulation of er metal. HA most likely decreased the bioavai- ity of Cu due to the strong affinity of HA for metal; the bioavailability of Cd was actually eased as indicated by the impact of HA on Cd city due to the weak affinity of HA for Cd and ability for Ca to displace Cd. At the highest centration, the presence of humic acid actually lted in an increase in mean brood sizes of Cu- sed animals and prevented a reduction in n brood sizes of Cd-exposed animals. Bioaccu- ation may reflect the physiological condition of organism more so than the environmental con- ns under which exposure occurs. (Collier-IVI) -02380

ECTS OF ENVIRONMENTAL CHANGES THE FISHERIES AND FISH STOCKS IN ARCHIPELAGO SEA AND THE FINNISH T OF THE GULF OCH BOTHNIA,
inki Univ. (Finland). Dept. of Limnology.
-Hilden, R. Hudd, and H. Lehtonen.
a Fennica, Vol. 12, p 47-58, 1982. 9 Fig, 3 Tab, ef.

criptors: *Water pollution effects, *Environ- tal effects, *Gulf of Bothnia, *Finland, *Fish- , Dam effects, Drainage, Wastewater pollu- Hydrology, Rivers, Spawning, Water quality.

han activities have affected the fish stocks and ries in the Archipelago Sea and the Finnish of the Gulf of Bothnia. Industrial, domestic agricultural wastes pollute the coastal areas. ervoirs with low buffering capacity have rs with very low pH levels. Hydroelectric s on the rivers draining to the gulf, land drain- and lumbering have affected the hydrology water quality of the rivers. The environmental nges caused by man have reduced the possibili- f expansion of fisheries by damaging the coast- sheries. The greatest damage to the fisheries occurred along the Ostrobothnian coast and been caused by damage to spawning and nurs- areas. To avoid further deleterious effects im- iate measures should be taken to protect fish cs and fishing areas. Where possible, former ming areas, especially in rivers, should be re- d. (Moore-IVI) -02388

UCTURE AND DYNAMICS OF ZOO- NKTON COMMUNITIES, ALLIGATOR ERS REGION, N.T., AUSTRALIA,
Australia Ltd., Sydney.
primary bibliographic entry see Field 2H. -02405

ICITY OF ARSENATE AND DDT TO THE DOCERAN BOSMINA LONGIROSTRIS,
onal Marine Fisheries Service, Ann Arbor, Great Lakes Fishery Lab.
.. M. Passino, and A. J. Novak.
tin of Environmental Contamination and cology, Vol. 33, No. 3, p 325-329, September, . 2 Tab, 12 Ref.

riptors: *Toxicity, *Arsenic, *Zooplankton, indicators, Water pollution effects, Great s, Water quality control, Monitoring, DDT, nnia.

e toxicity to Bosmina longirostris of arsenate DDT, which are representative inorganic and nic contaminants of the Great Lakes, was ht along with the relative sensitivity of B. irostris and Daphnia pulex to these contami- s. The mean 96 hr EC50 for B. longirostris was mg arsenate/L and the 48 hr EC50 for D. was 49.6 mg arsenate/L. For B. longirostris lifference in 48 hr EC50 values of DDT in the diluent waters was highly significant. In addi- to greater sensitivity of B. longirostris in re- tituted hard water, the results were more re- ucible. The difference between 48hr EC50 es for B. longirostris and D. pulex is also ly significant, indicating that the sensitivity of nina exceeds that of D. pulex. Based on the ts obtained and the semiautomatic rearing, counting and testing methods used it is concluded that Bosmina longirostris is a suitable zooplankton species for toxicological evaluation of contaminants. (Baker-IVI)
W85-02415

TRICLOPYR TRIETHYLAMINE SALT TOXICITY TO LIFE STAGES OF THE FATHEAD MINNOW (PIMEPHALES PROMELAS RAFINESQUE),
Dow Chemical Co., Midland, MI. Environmental Sciences Research Lab.
M. A. Mayes, D. C. Dill, K. M. Bodner, and C. G. Mendoza.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 3, p 339-347, September, 1984. 3 Tab, 12 Ref.

Descriptors: *Water pollution effects, *Fish, *Toxicity, *Organic compounds, *Herbicides, Agricultural chemicals, Triclopyr, GARLON, Fathead minnows, Immature growth stage.

The study included a 96 hr static acute test, a 192 hr flow-through acute test and a 31 day embryo-larval test. The static acute LC50 and 95% confidence interval (CI) was determined to be 245 (224-269) mg/L; the flow through 96 and 192 hr LC50 values with 95% CI were 120 (104-140) mg/L and 101 (88.5-116) mg/L, respectively. Larval survival varied in the embryo larval tests nonsystematically except at the 114 mg/L level where survival dropped precipitously and was significantly different from the controls. Triclopyr TEA salt appears to be relatively non-toxic to fathead minnows. The concentration of the compound which is toxic to the fathead minnow is well above expected environmental concentrations. Comparison of the acute and embryo-larval toxicity data indicate triclopyr TEA salt has little cummulative or chronic effect on the fathead minnow. (Baker-IVI)
W85-02417

TRACE METAL CONCENTRATIONS IN FISH FROM THE SOUTH ESK RIVER, NORTHEASTERN TASMANIA, AUSTRALIA,
Canberra Coll. of Advanced Education, Belconnen (Australia).
R. H. Norris, and P. S. Lake.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 3, p 348-354, 1984. 3 Tab, 17 Ref.

Descriptors: *Trace metals, *Fish, *South Esk River, *Tasmania, *Australia, *Bioindicators, Copper, Lead, Cadmium, Zinc, Monitoring, Water pollution sources, Mine wastes, Eels, Perch, Tench.

The value of determining metal concentrations in freshwater fish to serve as an indicator of metal pollution was investigated. The South Esk River, the site of the study, is located in northeastern Tasmania and is polluted by cadmium, zinc, lead and copper from Storys Creek and Rossarden mines. Samples were collected at ten sites, 4 above the metal inflow point and 6 below it. A total of 178 fish belonging to five species were collected. Concentrations for all metals in all species were highest in the liver, intermediate in the gills and lowest in the muscle. The short finned eels, Anguilla australis, had significant concentrations of all the metals analyzed at sites both upstream and downstream of the trace metal inflow to the South Esk River. Concentrations of Zn, Cd and Cu in the water clearly indicated elevated levels downstream of site 3. In terms of distribution, the pygmy perch appears to have been the most sensitive to trace metal contamination occurring at uncontaminated upstream sites and at the least contaminated downstream sites. Tench were the least sensitive. The largest tench collected from site 4 had both pectoral fins missing and deformed pelvic and tail fins. The study suggests that waterbody contamination by copper and zinc may not be reflected in concentrations of these metals in fish but that contamination by cadmium may be reflected by cadmium concentration in resident fish. (Baker-IVI)
W85-02418

EFFECT OF SUSPENDED BENTONITE CLAY ON THE ACUTE TOXICITY OF GLYPHOSATE TO DAPHNIA PULEX AND LEMNA MINOR,
Columbia National Fisheries Research Lab., Yankton, SD. Field Research Station.
W. A. Hartman, and D. B. Martin.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 3, p 355-361, September, 1984. 1 Fig, 1 Tab, 14 Ref.

Descriptors: *Pesticides, *Toxicity, *Aquatic life, Water pollution effects, Glyphosate, Organic compounds, Bentonite.

In the Basic Static Test the calculated 48 hr EC50 for Daphnia pulex at 15 C was 3.2 mg/L with suspended sediment and 7.9 mg/L without suspended sediment. Mortality was negligible at about 0.75 mg/L with or without suspended sediment. As concentrations of giyphosate increased, daphnid mortality increased significantly in the presence of suspended sediment. Experiments simulating a single dose of glyphosate to D. pulex populations showed that suspended sediment increased the short term toxicity of glyphosate at all concentrations. In pretreatment cultures, total standing crop of daphnids ranged from 52 to 56/L. One week after the cultures were treated, total population numbers were significantly reduced at all glyphosate concentrations, both with and without suspended sediment. Total standing crops were reduced less in the otherwise equivalent glyphosate solution that lacked suspended sediment. The reduction in all glyphosate treatments was primarily a result of selective toxicity to immature organisms. In the acute toxicity tests conducted with Lemna minor, glyphosate with suspended sediment was clearly less toxic than comparable concentrations of glyphosate alone. Suspended sediment influences the acute toxicity of glyphosate to the organisms tested. (Baker-IVI)
W85-02419

OXYGEN CONSUMPTION BY THE CRAYFISH ORCONECTES PROPINQUUS (GIRARD) EXPOSED TO AQUASHADE,
Indiana Univ.-Purdue Univ. at Indianapolis. Dept. of Biology.
D. F. Spencer.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 3, p 373-378, September, 1984. 3 Fig, 2 Tab, 9 Ref.

Descriptors: *Herbicides, *Dyes, *Toxicity, *Crayfish, Aquashade, Oxygen consumption, Organic compounds, Aquatic plants.

Individual crayfish were placed into 300 ml glass BOD bottles. Tapwater or tapwater treated with 5, 10, or 15 ppm Aquashade was used to fill the bottles. Oxygen consumption rates for individual crayfish exposed to Aquashade were not significantly different from those measured for control organisms. Based on the data presented, Aquashade applied at the recommended rate of 1 ppm should not significantly alter oxygen uptake rates of crayfish. While the dyes used in Aquashade have been judged to be safe based on feeding tests with rats, mice, and dogs, this is the first published report which suggests that Aquashade does not adversely affect common aquatic invertebrates. (Baker-IVI)
W85-02420

TOXICITY OF FENITROTHION TO FATHEAD MINNOWS (PIMEPHALES PROMELAS) AND ALTERNATIVE EXPOSURE DURATION STUDIES WITH FENITROTHION AND ENDOSULFAN,
Environmental Research Lab.-Duluth, MN.
C. F. Kleiner, R. L. Anderson, and D. K. Tanner.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 5, p 573-578, September, 1984. 3 Tab, 19 Ref.

Descriptors: *Pesticides, *Toxicity, *Fish, Organic compounds, Minnows, Water pollution effects, Fenitrothion, Endosulfan.

The toxic effects of fenitrothion to fathead minnows was investigated along with the effects of

short-term exposures of fenitrothion and endosulfan on this species. Survival of fathead minnows was significantly reduced at 0.86 and 0.74 mg/L during two 14 day embryo-larvae studies. In a 30 day embryo-larvae study, growth was not adversely affected at 0.13 mg/L. Significant differences occurred at 0.30 mg/L. Growth differences were more significant than survival. A 96 hr acute value for endosulfan was 1.32 micro g/L which agrees with published values. No delayed mortality was noted in this study. (Baker-IVI)
W85-02421

FATE OF FENITROTHION IN SEVERAL DEVELOPMENTAL STAGES OF THE KILLIFISH (ORYZIAS LATIPES),
Sumitomo Chemical Co. Ltd., Takarazuka (Japan). Research Center.
Y. Takimoto, M. Ohshima, H. Yamada, and J. Miyamoto.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 5, p 579-587, September, 1984. 4 Fig, 3 Tab, 18 Ref.

Descriptors: *Insecticide, *Toxicity, *Killifish, *Fenitrothion, Organic compounds, Bioaccumulation, Agricultural chemicals, Water pollution effects, Growth stages, Fish.

Short term exposure of 0.1 ppm nominal concentration of fenitrothion to five different developmental stages of killifish was carried out by a flow-through system to measure the bioaccumulation potential at each stage and also the transference to eggs from parent animals of decomposition products as well as the parent compound. Thereafter the organisms were transfered to fresh water to measure the biodegradability and excretion potential of the compounds produced during the exposure period. Fenitrothion was rapidly absorbed at each stage of the killifish, with concentrations in organisms reaching equilibrium after 1 to 3 days of exposure except for the juvenile stage which shows a gradual increase in concentration. The maximum bioaccumulation ratios of the parent compound ranged from 88 to 540-fold relative to the water concentration. Demethylfenitrothion and 3-methyl-4-nitrophenyl-beta-glucuronide are produced at all stages except the embryo, and the highest content of the former compound is produced at the yolk sac fry stage. Once placed in fresh water, the fenitrothion concentrations decreased rapidly with a variation of the half life of the parent compound from 0.27 day (yolk sac fry) to 1.42 days (embryo). Primary distribution of the compounds is in the internal organs, with concentration occurring in the mature eggs present in the female body as well. (Baker-IVI)
W85-02422

ACUTE AND CHRONIC TOXICITIES OF ARSENIC(III) TO FATHEAD MINNOWS, FLAGFISH, DAPHNIDS, AND AN AMPHIPOD,
A. R. Lima, C. Curtis, D. E. Hammermeister, T. P. Markee, and C. E. Northcott.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 5, p 595-601, September, 1984. 5 Tab, 21 Ref.

Descriptors: *Fish, *Toxicity, *Arsenic, *Water pollution effects, Industrial wastes, Fathead minnows, Flagfish, Daphnia, Mortality.

Acute exposure of fathead minnows to As resulted in some deaths at the two highest exposure concentrations (52,100 and 99,700 micro g/L) within two hr of initial exposure. No fish survived 96 hr exposures greater than 25,000 micro g/L. All fish survived exposures of less than 5,060 micro g/L. Only one fish survived 96 hr exposure to concentrations greater than 25,900 micro g/L. Acute exposure of amphipods to As resulted in some immobilization at the two highest exposures (2,400 and 5,250 micro g/L) within 19 hr of initial exposure. All test organisms became affected at concentrations greater than 1,340 micro g/L after 96 hr of exposure and only one organism was immobilized at concentrations less than 583 micro g/L. Unfed daphnids exposed to As responded quickly with most of the effects occurring within 24 hr of initial exposure. No organisms survived exposure to concentrations greater than 4,190 micro g/L. After 48 hr of exposure to As, only a single organism was distressed at concentrations less than 2,220 micro g/L, and this was not caused by As exposure. Chronic exposures of 28 to 31 days duration were made for fathead minnows, flagfish and daphnids. The chronic limit ranges based on the most sensitive measured parameters of body length and wet weight were 2,130 to 4,300 micro g/L for flathead minnows, and 2,130 to 4,120 micro g/L for flagfish. Daphnids had chronic limits of 633 to 1 320 micro g/L based on survival and the measured parameters of reproduction and body length. Calculation of an acute test/chronic test ratio for fathead minnows, flagfish, and daphnids resulted in a range of values from 1.64 to 4.80. (Baker-IVI)
W85-02423

ROLE OF BENTHIC FILMS IN THE OXYGEN BALANCE IN AN EAST DEVON RIVER,
Exeter Univ. (England). Dept. of Chemical Engineering.
J. D. Boyle, and J. A. Scott.
Water Research, Vol. 18, No. 9, p 1089-1099, 1984. 10 Fig, 8 Tab, 11 Ref.

Descriptors: *Biochemical oxygen demand, *Rivers, *Benthic environment *Films, *Devon, *England, Respiration, Oxygen balance, Pulp and paper industry, Industrial wastes, Decomposition.

A method for the direct assessment of the rates of the main processes involved in the oxygen balance of a shallow (0.6 m) Devon river is described and an oxygen balance over a stretch of the stream is demonstrated. The river receives effluent from a papermill. Benthic respiration dominates the oxygen balance in the stretch most affected by the effluent and increases the effective biochemical oxygen demand decomposition rate by a factor of up to 12. Values of decomposition rates of 3.5 to 4.5/day have been measured in the stream. Although increasing river flow rate is likely to increase the dilution of bacteria suspended in the stream and therefore to decrease the oxygen uptake in a given parcel of water, the same number of bacteria may pass a given point during a given time interval independent of flow rate. The effect of different depths of water can also be considered. If it is assumed that the bacterial concentration support in a film is independent of river depth, then the effect of the respiration of the film-bacteria on the rate of decline of oxygen concentration in the water above them will be inversely proportional to depth. Benthic (film) processes are of most significance in shallow rivers, and in rivers where a given area of river bottom can maintain a high surface area of film. (Baker-IVI)
W85-02426

GROWTH INHIBITION OF PLANKTONIC ALGAE DUE TO SURFACTANTS USED IN WASHING AGENTS,
National Inst. for Environmental Studies, Tsukuba (Japan). Lab. of Freshwater Environment.
A. N. Yamane, M. Okada, and R. Sudo.
Water Research, Vol. 18, No. 9, p 1101-1105, 1984. 3 Fig, 3 Tab, 20 Ref.

Descriptors: *Surfactants, *Detergents, *Algal growth, *Water pollution effects, Soap, Selenastrum, Nitzschia, Microcystis, Domestic wastes, Soaps.

The inhibitory effects on freshwater plankton algae of synthetic surfactants and soaps that are widely used in laundry detergents as raw materials were investigated. Five types of anionic surfactants including a soap and three types of nonionic surfactants were tested. A green alga Selenastrum capricornutum, a blue-green alga Microcystis aeruginosa and a diatom Nitzschia fonticola were chosen as test organisms. Surfactants used included sodium alkylbenzenesulfonate (LAS), sodium alkyl sulfate (AS), sodium polyoxyethylene alkyl ether sulfate (AES), sodium alphaolefinsulfonate (AOS) and soap. Also used were three surfactants of the polyoxyethylene alkyl ether type, EO:4, EO:9, and EO:13 and two surfactants of the polyoxyethylene alkylphenyl ether (APE) type, Emulgen 909 and Emulgen 910. The EC50 value of LAS a for S. capricornutum fell between 50 and The values of EC50 for polyoxyethyl ether (AE) ranged from 2 to 10 mg/l. APE and sugar esters ranged from 20-50 from 8 to 12 mg/l, respectively. APE lower toxicity than AE in this study. values for AS, AES, and AOS fell betw mg/l. Those for LAS and soap were be and 100 mg/l and between 10 and 50 mg/ tively. The most sensitive algae for a spe factant was not always the most sensitiv other surfactants. The effects of surfa algae must be regarded as being species (Baker-IVI)
W85-02427

AQUATIC CONTAMINATION AND EC CAL RISK. AN ATTEMPT TO A CONC FRAMEWORK,
National Swedish Environment Protectio Uppsala (Sweden). Water Quality Lab.
L. Hakanson.
Water Research, Vol. 18, No. 9, p 1107-11 5 Fig, 6 Tab, 20 Ref.

Descriptors: *Water pollution effects, studies, *Toxicity, *Sediments, Mercury Contamination, Ecotoxicology.

A conceptual model is presented concer causal relationships determining the rel between dose and response of toxic subs aquatic environments. Mercury is used a element. Special emphasis is placed on mental factors which regulate the potenti of the contaminant and stresses the impor sedimentology in ecotoxicology. Ecologic dose and sensitivity are included. In orde pare a potential ecological risk index fo practical environmental control work, t must be based on tested and comparativ pensive standard methods. Specifics which accounted for in the index include biolog tact area, biological contact time, and effects. The residual term is also a signifi damental concept and it describes the fact impossible in ecological contexts to reach plete understanding of a relationship. (Ba W85-02428

FLUORIDE CONTENT OF DRINKING AND THE MENARCHEAL AGE,
Jozsef Attila Univ., Szeged (Hungary). Anthropology.
Gy. Farkas, A. Fazekas, and E. Szekeres.
Acta Biologica (Nova Series), Vol. 29, N 159-167, 1983. 5 Tab, 37 Ref.

Descriptors: *Drinking water, *Fluo *Public health, *Hungary, Humans, F Water treatment.

In case the long standing consumption of fluoride content optimal for the viewpoint prevention would harmfully influence the physiological processes of the human orga study was carried out on the somatic mat school-aged children from two Hungarian ments where the fluoride concentration drinking water showed significant variation mg/l vs. 0.17 mg/l). Inquires were made o ing the time of the first menstruation in the 337 girls in Kunszentmarton and 467 girls kunmajsa. Even though there is more than difference in the fluoride content of water, there are no essential changes obse the age at puberty of the girls. This supp presumption that the optimal intake of fluo caries prevention does not show any effect puberty age. (Baker-IVI)
W85-02475

ARTIFICIAL SUBSTRATES WHICH RE NUTRIENTS: EFFECTS ON PERIPH AND INVERTEBRATE SUCCESSION,
Central Michigan Univ., Mount Pleasant. Biology.
G. W. Fairchild, and R. L. Lowe.
Hydrobiologia, Vol. 114, No. 1, p 29-37 1984. 4 Fig, 56 Ref.

scriptors: *Nutrients, *Periphyton, *Invertetes, Phosphate, Nitrate, Chlorophyll, Succesn, Artificial substrate, Algae, Midges, Mollusks, stacea.

rient diffusing substrates for periphyton were le from clay flower pots, sealed with plastic ri dishes, and filied with 2% agar and specified rients. When placed in water, the nutrients vly diffuse through the agar and clay walls of pots, becoming available to organisms colonizthe outer surface. Forty-eight pots, 16 contain-0.1 M KH2PO4, 16 with 0.1 M NaNO3 and 16 h no added nutrients were placed af 0.5 m th in Douglas Lake, Michigan. Four pots of n nutrient treatment were sampled for algal phyton and invertebrates after 7, 14, 25, and 36 s. A total of 72 algal species were enumerated. st true phytoplankton reached the pots rapidly, experienced little benthic growth. Invertees which colonized the pots were present in sediments and upon nearby vegetation, and val on the pots probably involved primarily strate-associated movement or weak swimming r short distances. Chironomids, chydorid Claera, and gastropods dominated the invertebrate a found on the pots. The study provided little lence of competitive effects exerted by the inant species upon other taxa. (Baker-IVI)
5-02479

FECTS OF LOW-PH STRESS ON THE MOROLOGY AND ACTIVITY OF BACTERIA OM LAKES RECEIVING ACID PRECIPITAON,
onal Water Research Inst., Burlington (Ontar-

. Rao, D. Paolini, and G. G. Leppard.
lrobiologia, Vol. 114, No. 2, p 115-121, July, 4 Fig, 2 Tab, 12 Ref.

criptors: *Acidity, *Bacteria, *Acid lakes, id rain, Water pollution effects, Morphology, ndicators, McFarlane Lake, Silver Lake, On-

d and laboratory studies on the effects of lowstress are reported here for lacustrine bacteria. ment cores examined were collected from acid ssed Silver Lake and non-acid stressed McFar- Lake near Sudbury, Ontario. Bacterial popula- stressed in laboratory ecosystems were affectn their cytological characteristics, their cell ities and their physiological activity. The test complexity in terms of their diversity, cell cture and development of extracellular product und at pH 5.0. Among the extracellular materiassociated with the cell surface, fibrils and ules were particularly abundant with a charactic type of granule often found on cells of ed populations at the interface between the cell and the aquatic milieu as a cell bound materin addition, low pH stress appears to have a ked effect on the bacterial morphology per se or the selection of dominant cell types. It is ceivable that the pH stress-related cell surface ges reported may reflect a basis for the selecof low pH-resistant microbes whose survival is ndent on physiological adjustments including xtremely low metabolism. The morphological rences in cells under extreme environmental s may be significant as stress indicators if ed to cell surface exchange and/or membrane neability properties associated with nutrient sport or transport of toxic substances in acidilakes. (Baker-IVI)
5-02482

NG-TERM CHANGES OF THE SUBRGED MACROPHYTES IN EUTROPHIC E MIKOLAJSKIE (NORTH POLAND),
saw Univ. (Poland). Dept. of Hydrobiology.
Pzimek, and A. Kowalczewski.
atic Botany, Vol. 19, p. 1-11, 1984. 4 Fig, 4 24 Ref.

criptors: *Macrophytes, *Eutrophication, ke Mikolajskie, *Poland, Distribution, Frecy, Littoral zone, Aquatic plants, Depth, Bios.

On the basis of quantitative observations of submerged macrophytes over the past 17 years, it has been found that their distribution, frequency and presence in Lake Mikolajskie are all affected by eutrophication. The area occupied by the submerged macrophytes in the lake was about 44 ha in 1971. In the 9 year period to 1980, this decreased by about 14 ha (30%). In 1971 the macrophytes drew down to a depth of 5.5 m, reached their highest frequency at a depth of 2.0 m, and were found only sporadically at 4.5-5.5 m. In 1980 they occurred only to a depth of 3.5 m. The highest (21%) frequency depth had decreased to 1.5 m and was only slightly higher than those determined for 0.5 and 2.0 m depths. Comparison of the two sets of data shows a 5-fold rise in macrophyte frequency at a depth of 0.5 m, similar values at depths of 1.0 and 1.5 m, and a small but consistent decrease of frequency values below 2.0 m in 1980 as compared with 1971. The maximum value did not change much, being 30% in 1971 and 21% in 1980. The aquatic macrophyte species present in the lake did not change significantly during this period of time. There were considerable changes in the frequency of occurrence of certain taxa. The contribution of particular taxa to the total biomass changed considerably. The greatest decrease was observed for the percentage contributions of Characeae and Ceratophyllum demersum (18%) and the greatest increase was for Potamogeton pectinatus (0.3% in 1971 to 19.0% in 1980). The biomass of all macrophytes at each depth decreased. (Baker-IVI)
W85-02483

DETERMINATION OF THE TROPHIC STATE OF LAKE TRASIMENO BY INDIRECT ANALYSIS OF NITROGEN AND PHOSPHORUS (DETERMINAZIONE DELLO STATO TROFICO DEL LAGO TRASIMENO ATTRAVERSO LA VALUTAZIONE INDIRETTA DELL'AZOTO E DEL FOSFORO),
Perugia Univ. (Italy). Ist. di Idrobiologia e Pescicultura.
M. Mearelli, M. Lorenzoni, and F. Ruffini.
Rivista di Idrobiologia, Vol. 20, No. 3, p 571-587, 1981. 2 Fig, 3 Tab, 15 Ref.

Descriptors: *Nitrogen, *Phosphorus, *Lake Trasimeno, *Italy, *Eutrophication, Agricultural wastes, Domestic wastewater, Water pollution control, Water pollution sources.

Indirect analysis of nitrogen and phosphorus loading relative to the lake Trasimeno basin, was carried out in an attempt to define its present trophic state. Loading was estimated and evaluated using two models of Vollenweider. The results obtained showed that the greatest fraction of nitrogen is discharged by agricultural activity, while that of phosphorus is due to input of domestic waste. On the basis of this results, various hypotheses for intervention have been prospected which aim at reducing the present state of eutrophication. (Author's abstract)
W85-02497

EFFECTS OF COPPER POLLUTION ON ICTALURUS NEBULOSUS (EFFETTI DELL'INQUINAMENTO DA RAME SU ICTALURUS NEBULOSUS),
Modena Univ. (Italy). Ist. di Anatomia Comparata.
I. Benedetti, L. Benedetti, A. M. Bolognani Fantin, M. Marini, and E. Ottaviani.
Rivista di Idrobiologia, Vol. 20, No. 3, p 611-620, 1981. 6 Fig, 2 Tab, 17 Ref.

Descriptors: *Copper, *Fish, *Toxicity, *Water pollution effects, Heavy metals, Liver, Integument, Intestine, Food habits.

The copper concentration in tissues of specimens of Ictalurus nebulosus, fished from a canal in which the deposits and vegetation showed a high content of this metal, above the standard value, especially in the liver and in the gut. The high copper content found in the gut of this teleost is due to its feeding habits and to the presence of this metal in the environment. The copper is absorbed with the food through the intestinal walls without damaging them and accumulates in the liver. The increase of copper in the liver produces cytoplasmic vacuolization in the hepatocytes and a noticeable depletion of the proteins; in some areas picnotic nuclei are evident. The integument shows a remarkable decrease of the mucous and club cells and degenerative patterns in the principal cells. The hypothesis that the damage to the integument is a consequence of hepatic injury is put forward. (Author's abstract)
W85-02498

HYDROBIOLOGICAL RESEARCH ON TWO SMALL BRACKISH LAKES IN PORTONOVO; I: LAKE PROFONDO (RICERCHE IDROBIOLOGICHE SU DUE LAGHETTI DI PORTONOVO; PARTE I: LAGO PROFONDO),
Perugia Univ. (Italy). Ist. di Idrobiologia e Pescicultura.
L. Mantilacci.
Rivista di Idrobiologia, Vol. 20, No. 3, p 621-643, 1981. 2 Fig, 4 Tab, 18 Ref.

Descriptors: *Saline lakes, *Portonovo, *Italy, *Water pollution effects, Environmental effects, Plankton, Eutrophication, Coastal areas, Land development, Lake shores.

Hydrobiological research was carried out during the years 1980, 1981, 1982, on 11 samples in a salt lake in Portonovo (Ancona, Italy), in order to ascertain the enviromental situation following alterations to the coastline which is being built up as seaside resorts. Two sampling points were chosen: Station 1 and Station 2; the first situated in the center of the lake and the second along the lake shore or neritic zone. Research consisted in physical-chemical observations and qualitative-quantitative analysis of the plankton population; a saprobic index of the lake was calculated. The results obtained show a rather critical environmental situation. (Author's abstract)
W85-02499

HYDROBIOLOGICAL RESEARCH ON TWO SMALL BRACKISH LAKES IN PORTONOVO; II: LAKE GRANDE (RICERCHE IDROBIOLOGICHE SU DUE LAGHETTI DI PORTONOVO; PARTE II: LAGO GRANDE),
Perugia Univ. (Italy). Ist. di Idrobiologia e Pescicultura.
L. Mantilacci.
Rivista di Idrobiologia, Vol. 20, No. 3, p 645-659, 1981. 1 Fig, 5 Tab, 18 Ref.

Descriptors: *Lake Grande, *Italy, *Brackish lakes, *Water pollution effects, Plankton, Environmental effects, Eutrophication.

Research was carried out on Lake Grande, a brackish ecosystem situated in Portonovo (Ancona, Italy), in order to bring to light any possible modifications to the environment following large-scale intervention by man. Seasonal sampling was taken during 1981-1982 and both physical-chemical data and plankton were collected. Furthermore, a qualitative evaluation of the lake waters was carried out on the basis of information gleaned from each species, according to the system of Sladecek (Archiv. Hydrob., 7, 1-218, 1973) and an attempt was made to quantify the saprobity of the lake with the calculation of a 'Saprobic index' according to the model of Pantle and Buck (Gass und Wasserfach., 96, 604, 1955) corrected by Descy (Utilisation des algues benthiques comme indicateurs biologique de la qualite des eaux courantes. La pollution des eaux continentales. Incidence sur les biocenoses aquatiques. Gauthier-Villars E., Bordas, 1976). The results obtained show a somewhat degraded environment. (Author's abstract)
W85-02500

CONCENTRATIONS OF CADMIUM AND LEAD IN THE BODY OF SOME MACROBENTHOS SPECIES FROM FIVE STREAMS OF SOUTHERN POLAND,
Jagiellonian Univ., Krakow (Poland). Dept. of Hydrobiology.
K. Jop, and K. Wojtan.
Acta Hydrobiologica, Vol. 24, No. 3, p 197-210, 1982. 4 Fig, 4 Tab, 21 Ref.

Descriptors: *Water pollution effects, *Heavy metals, *Invertebrates, *Poland, Cadmium, Lead, Bioaccumulation, Calcium.

Concentrations of lead and cadmium in the body of some abundant macroinvertebrates from the three taxonomic groups were investigated and compared with concentrations of these elements in water and sediments in some streams contaminated by the pollution in Southern Poland. Investigations were carried out in the catchment basin of the Drwinka stream in the vicinity of Kracow and the catchment basin of the Biala Przemsza River flowing across the Kracow-Czestochowa Jura. Concentrations of metals decreased with increasing age in all species studied. The relationships of metal concentrations in aquatic invertebrates were not consistent with the degree of contamination in streams. Calcium concentration of stream waters appeared to affect body metal concentration. (Baker-IVI)
W85-02509

EFFECTS OF EXPLORATION OF THE 'ZARABIE' BATH ON THE WATER QUALITY OF THE RIVER RABA (SOUTH POLAND),
Instytut Ksztaltowania Srodowiska, Krakow (Poland).
K. Stachowicz, and M. Czernoch.
Acta Hydrobiologica, Vol. 24, No. 3, p 211-222, 1982. 4 Fig, 3 Tab, 10 Ref.

Descriptors: *Water quality, *Swimming, *River Raba, *Poland, *Bacteria, *Public health, Zarabie Territory, Drinking water, Water pollution sources, Recreation, Physicochemical properties.

The extent to which bathing at Zarabie affects the quality of the waters of the River Raba was investigated. The problem is important in that River Raba is a source of drinking water for the town of Myslenice and the city of Kracow. The River Raba, which flows across the recreational area of Zarabie, is dammed up by a weir. The best bathing conditions are just below the weir where there is usually the greatest crowd of bathers every Sunday. When the number of bathers below the weir was about 20, no significant changes in water quality were found in the 14 environmental parameters analyzed. When there were more than 30 bathers in the water, negative changes in the bacteriological indices were recorded and at a still greater number, changes were noted in the physicochemical parameters as well. Seston analyses showed a three times increase in the number of organisms during intensive bathing periods. The range of the negative effect of bathing on water quality was noted for a distance of 2.5 km along the river. (Baker-IVI)
W85-02510

EFFECT OF SUSPENDED MATERIALS ON ZOOPLANKTON, 2. LABORATORY INVESTIGATIONS OF DAPHNIA HYALINA LEYDIG,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
R. Zurek.
Acta Hydrobiologia, Vol. 24, No. 3, p 233-251, 1982. 11 Fig, 3 Tab, 24 Ref.

Descriptors: *Suspended load, *Zooplankton, *Water pollution effects, *Daphnia, *Population dynamics, Behavior, Turbidity, Bottom sediments, Algae, Clay, Suspended solids.

Experiments were carried out for the purpose of elucidating some aspects of relations between planktonic animals and suspensions. Daphnia hyalina populations were cultivated in three kinds of turbid medium: suspension of bottom sediments, bentonite and red loam with a high content of clay minerals. Two concentrations of green alga were combined with the turbid mediums. Ingested mineral suspension caused the increase in specific gravity and, as a result, in the velocity of sinking. The frequency of antenna beats increased by 13%. In concentrations greater than and equal to 100 mg/cu dm of suspensoids the respiration of D. hyalina was 10.6 to 32.4% higher, in dependence on Daphnia length. The influence of suspension depended both on the kind of suspension and the time of exposure. (Baker-IVI)
W85-02511

STREAM ECOSYSTEMS IN MOUNTAIN GRASSLAND (WEST CARPATHIANS); 5. BACTERIA,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
For primary bibliographic entry see Field 5B.
W85-02516

STREAM ECOSYSTEMS IN MOUNTAIN GRASSLAND (WEST CARPATHIANS); 6. SESSILE ALGAE COMMUNITIES,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
For primary bibliographic entry see Field 5B.
W85-02517

STREAM ECOSYSTEMS IN MOUNTAIN GRASSLAND (WEST CARPATHIANS); 9. OLIGOCHAETA,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
For primary bibliographic entry see Field 5B.
W85-02520

STREAM ECOSYSTEMS IN MOUNTAIN GRASSLAND (WEST CARPATHIANS); 12. GENERAL CONCLUSION,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
For primary bibliographic entry see Field 5B.
W85-02521

EPIPELIC ALGAE IN MARGINAL PARTS OF THE PRZECZYCE RESERVOIR AND OF NEIGHBOURING SECTORS OF THE RIVER CZARNA PRZEMSZA (UPPER SILESIA); 1. ALGAE IN CONSTANTLY SUBMERGED ZONE,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
For primary bibliographic entry see Field 2H.
W85-02522

QUANTITATIVE INVESTIGATIONS ON ODONATA, HETEROPTERA AND COLEOPTERA IN A DRAINAGE CHANNEL NEAR THE VILLAGE OF TUREW (POZNAN REGION),
Polish Academy of Sciences, Poznan. Dept. of Agrobiology and Forestry.
For primary bibliographic entry see Field 5B.
W85-02523

EFFECT OF SEWAGE REMOVAL ON LAKE WATER QUALITY (FUSCHLSEE, SALZBURG, AUSTRIA),
Paracelsus-Forschungsinstitut, Salzburg (Austria).
J. Haslauer, Jr., O. Moog, and M. Pum.
Archiv fur Hydrobiologie, Vol. 101, No. 1/2, p 113-134, 1984. 7 Fig, 10 Tab, 55 Ref.

Descriptors: *Water pollution effects, *Wastewater disposal, *Lake Fuschl, *Austria, Eutrophication, Oligotrophication, Phosphorus, Nutrients, Dissolved oxgyen, Crustacean, Stagnation, Seasonal variation.

Lake Fuschl, a formerly oligotrophic lake, has shown characteristics of cultural eutrophication since 1966. Beginning in 1971, Oscillatoria rubescens blooms appeared annually and the hypolimnetic oxygen content decreased steadily. From 1972 to 1982 the nutrient supply of domestic waste water to Lake Fuschl was reduced ultimately to 77% after a sewage collection system with a tertiary treatment plant outside of the catchment area began operation. Distinct signs of reoligotrophication have been noted in the lake. The average total phosphorus concentration sank from 56 to 14 mg/cu m and the mean Secchi-depth increased from 4.7 to 7.4 m. Since 1980 oxygen was detected again on the lake bottom at the end of summer stagnation. The chlorophyll-a concentration exhibited a reduction from 5.2 to 1.4 mg/cu m, and the mean clutch size of the dominant planktonic crustacean, Eudiaptomus graciis, sank from 9.7 to 6.9. Loading calculations indicated that the sewage removal caused a total phosphorus load lower tha permissable loading of earlier studies. (Bake
W85-02525

DEVELOPMENT OF OXYGEN CONDIT IN LAKE ZURICH FROM 1936 TO (ENTWICKLUNG DER SAUERSTOFF HALTNISSE IM ZURICH-OBERSEE UN ZURICH-UNTERSEE VON 1936 BIS 1982),
Zurich Univ., Kilchberg (Switzerland). Hyd logical-Limnological Station.
For primary bibliographic entry see Field 2H
W85-02529

EFFECT OF WOOD WASTE DUMPING ORGANIC MATTER IN SEAWATER AND FICIAL SEDIMENTS OF ALBERNI IN BRITISH COLUMBIA,
ISK Environmental Research, Saanichton (B Columbia).
K. Iseki, R. W. Macdonald, and C. S. Wong.
Journal of the Oceanographical Society of J Vol. 40, p 213-220, 1984. 6 Fig, 22 Ref.

Descriptors: *Organic matter, *Wood, wastes, *Seawater, *Sediments, *Alberni *British Columbia, Water pollution effects, P ulates, Dissolved solids, Organic carbon, banks.

Distribution of particulate organic carbon (and dissolved organic carbon (DOC) in seav and chemical composition of surficial sedi were studied in relation to pulpmill effluen dumping of dredge spoil containing wood deb Alberni Inlet, British Columbia, Canada. The mum concentration of POC (377-584 micro g was observed at the surface around the dun area (5-7 km seaward of the inlet's head), a the location immediately adjacent to the dum POC was elevated throughout the water co (50 m). While POC tended to decrease i surface layer for a distance of about 25 km d inlet, measureable effects of POC in the d water did not extend beyond 600 m from the site. The dump site was conspicuous by the maximum in C:N ratio (46.3). In contrast, was observed to be highest (4.25 mg C/l) a head of the inlet where pulpmill effluent was discharged and a secondary maximum was about 10 km down-inlet from the dump site. data suggest that a considerable proportion dredge spoil sinks rapidly near the dump probably within several hundred meters. Son the spoil, perhaps low density wood debris travel considerably further with the surface where by leaching it may contribute to extent to the surface DOC before sinking deeper water. (Author's abstract)
W85-02533

ECOLOGICAL EFFECTS OF ACID DEP TION UPON PEATLANDS: A NEGLEC FIELD IN 'ACID-RAIN' RESEARCH,
Minnesota Univ., Minneapolis. Dept. of Ecc and Behavioral Biology.
E. Gorham, S. E. Bayley, and D. W. Schindle
Canadian Journal of Fisheries and Aquatic ences, Vol. 41, No. 8, p 1256-1268, August, 19 Fig, 2 Tab, 135 Ref.

Descriptors: *Peatlands, *Acid rain, *Water p tion effects, Wetlands, Research priorities, Fens, Acidification, Drainage, Streams, L Biogeochemistry.

Certain types of peatlands are probably hi susceptible to anthropogenic acidification, yet little research is being done on the vulnerabili bogs and fens to acid deposition. The need for research and for studies of the role of acidific - natural and anthropogenic in determining n ent availability, metal mobilization, and biogeo mical cycling by fauna and microflora has documented. Possible effects of hydrolo changes, and of drainage from acid peatland lakes and streams, are noted. An outline is pro ed of possible responses of plants and anima acidification; these should be investigated at cies, community, and ecosystem levels. Studi

lands as possible sources of the gaseous precur- of acid deposition are needed. Different ap- ches to examining the responses of peatlands cid deposition include geographical surveys, erimental studies, short-term, long-term, and oecological investigations, and analysis of bio- hemical mass-balances. Finally, the need for sive studies of peatlands in relation to sur- ding uplands and to the streams and lakes that ive their drainage is emphasized. (Author's ract)
5-02536

MARKS ON THE STRUCTURE OF ZOO- NKTONIC POPULATIONS IN THE VAGE DISCHARGE ZONE OF MAR- LLE-CORTIOU (REMARQUES SUR LA UCTURATION DES POPULATIONS ZOO- NCTONIQUES DANS LA ZONE DE L'E- SSAIRE DE MARSEILLE-CORTIOU),
oume Marine Station and Oceanography tre, Marseille (France).
Patriti.
ine Biology, Vol. 82, No. 2, p 157-166, August, . 12 Fig, 14 Ref.

criptors: *Zooplankton, *Wastewater pollu- *Marseille, *France, Population dynamics, cies diversity, Effluents, Seasonal variation, d, Waves.

impact of a polluted water-layer on zooplank- c populations was studied in the sewage dis- ge zone at Marseille-Cortiou throughout 1977 a modification of specific diversity was ob- ed: diversity was instable near the outfall, but eased slightly and became more stable further y in non-polluted stations. The population position did not seem to change. Species rank ed slightly and the number of species increased increasing distance from the outfall. Specific ninance' remained relatively unchanged, and ntially consisted of only 5 species: Clausoca- s acuicornis, Evadne spinifera, Oithona helgo- ica, Temora stylifera and Centropages typicus. population structure, as illustrated by 'Fron- diagrams, was higher during or just preceding er. Population organization was the same close r far away from the outfall, although the total ulation counts and number of species were ler at the most polluted stations. The taxons biting the largest decreases in density were: nausids, nauplii, larvae of various brachyurans gastropods, fish eggs, the pteropod Cavolinia xa, the copepod Calanus minor and several yceidae. The greatest disturbance of the popu- n structure at all stations was observed during summer. The composition of the zooplanktonic ulation seems to depend much more on season- ctors than on the level of pollution. It was not ible to distinguish a cluster of species which e sufficiently dominant to be considered as y characteristic; perhaps the rather high expo- of the sewage site to winds and waves pre- s the formation of a local facies. (Author's ract)
5-02537

CUMULATION OF CADMIUM FROM CON- MINATED WATER AND SEDIMENT BY E SHRIMP CALLIANASSA AUSTRALIEN-

tralian Atomic Energy Commission, Suther- . Lucas Heights Research Labs.
Ahsanullah, M. C. Mobley, and D. S. Negilski.
ine Biology, Vol. 82, No. 3, p 191-197, August, . 4 Tab, 23 Ref.

criptors: *Cadmium, *Shrimp, *Water pollu- effects, *Sediment contamination, Heavy als, Toxicity, Marine environment.

burrowing marine shrimp Callianassa austra- sis (Dana) was collected from an uncontaminat- area in Western Port, Victoria, Australia in 7. The shrimp were exposed to cadmium-con- inated water and sediment for 8 wk. The con- rations ranged from 0.5 to 63 micro g Cd/l for er and 0.5 to 63 micro g Cd/g for sediment. shrimp accumulated cadmium from water at a commensurate with increases in the concentra- tion of cadmium in water and the duration of the experiment. Although the cadmium concentration in the sediments was 1000 times higher than that in water, it had no effect on cadmium uptake by the shrimp. The concentration factors decreased with increasing concentration of cadmium in water but increased as the duration of exposure increased. The shrimp dry weight decreased with increasing concentration of cadmium in water and duration of exposure. As was the case with cadmium uptake by the shrimp, these two factors acted interactively on the shrimp dry weight, but the third factor, concentration of cadmium in sediment, had no effect. (Author's abstract)
W85-02538

EFFECTS OF METALS ON NITROGEN FIXATION AND DENITRIFICATION IN SLURRIES OF ANOXIC SALTMARSH SEDIMENT,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
J. Slater, and D. G. Capone.
Marine Ecology Progress Series, Vol. 18, No. 1-2, p 89-95, June, 1984. 4 Fig, 2 Tab, 42 Ref. EPA grant R-809475-01-0, Hudson River Foundation grant 14-83B-12, NSF grant OCE-82-00157, NOAA grant NA-80-RAD-0057.

Descriptors: *Metals, *Nitrogen fixation, *Denitrification, *Sediments, *Salt marshes, *Anoxic conditions, Mercury, Lead, Cadmium, Zinc, Copper, Chromium, Molybdenum, Water pollution effects.

The effect of metals on nitrogen fixation, as measured by acetylene reduction, and on denitrification, as determined by nitrous oxide accumulation in the presence of acetylene (acetylene blockage), was examined in short-term experiments with saltmarsh sediments. At concentrations of 1000 ppm (weight metal : weight dry sediment), $HgCl_2$, $PbCl_2$, $CdCl_2$, $ZnSO_4$, $CuCl_2$, $K_2Cr_2O_7$, K_2CrO_4, and Na_2MoO_4 decreased acetylene reduction throughout the experiments by more than 30%. $FeCl_3$ decreased it to a lesser extent, while $NiCl_2$ greatly stimulated nitrogenase activity. Initial rate of nitrous oxide production was inhibited by $HgCl_2$, $PbCl_2$, $NiCl_2$, $K_2Cr_2O_7$, K_2CrO_4, $ZnSO_4$, $CuCl_2$, $FeCl_3$, and $CdCl_2$, but maximum production was stimulated substantially by $PbCl_2$, $K_2Cr_2O_7$, and K_2CrO_4, and somewhat by Na_2MoO_4, $ZnSO_4$, and $CuCl_2$. In contrast, $NiCl_2$ depressed both initial and maximum nitrous oxide production. Lower levels of Ni and Hg (10 and 100 ppm) caused effects that were intermediate between 1000 ppm and controls. Metal pollution could considerably alter nitrogen dynamics in marine sediments, at least in the short term; and could have repercussions on water-column productivity. (Author's abstract)
W85-02539

BEHAVIOR OF TRACE METALS IN MYTILUS EDULIS DURING A RECIPROCAL TRANSPLANT FIELD EXPERIMENT,
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
G. Roesijadi, J. S. Young, A. S. Drum, and J. M. Gurtisen.
Marine Ecology Progress Series, Vol. 18, No. 1-2, p 155-170, June, 1984. 12 Fig, 4 Tab, 36 Ref. NOAA grant NA81RAD00019.

Descriptors: *Mussels, *Trace metals, *Bioindicators, *Sequim Bay, *Tacoma, *Washington, Bioaccumulation, Copper, Zinc, Cadmium, Mercury, Silver, Heavy metals, Seawater, Water pollution effects.

Marine mussels Mytilus edulis were transplanted reciprocally from relatively pristine Sequim Bay to a metal-contaminated site at Tacoma (both Washington State) and vice versa. Temporal patterns of trace metal accumulation by the mussels, metal incorporation into subcellular compartments (low molecular weight, metal-binding proteins, lysosome-like vesicles) and condition index (a measure of animal health) were studied in a field experiment. Analysis of seawater from the Tacoma site showed elevated concentrations in all the metals examined in this study; i.e. copper, zinc, cadmium, mercury, and silver. Values fluctuated with time; peak concentrations were 105 ppb copper, 113 ppb zinc, 5.4 ppb cadmium, 0.0189 ppb mercury, and 0.13 ppb silver. These values were 255x, 188x, 103x, 47x and 138x the respective metal concentrations in Sequim Bay. With the exception of cadmium, the tissues of indigenous mussels at the Tacoma site reflected the high seawater metal concentrations. Mussels transferred from Sequim to Tacoma accumulated metals rapidly and approached or exceeded the metal concentrations in Tacoma mussels. General patterns were complicated by fluctuations in metal concentrations. Loss of metals following reciprocal transfer was relatively rapid in copper and silver values which were close to background levels after 4 wk and slower with zinc and mercury (24 wk or longer to background). Patterns of accumulation and loss and organs for concentration were specific for individual metals. Gills and digestive gland, for example, varied in their abilities to concentrate different metals and were often more sensitive indicators of metal bioconcentration than the whole organism. Gills were also examined for copper, cadmium and zinc on low-molecular-weight metal-binding proteins, high-molecular-weight proteins ($< 70{,}000$ Mr), and pelleted fraction. A highly significant correlation ($r = 0.87$, $p < 0.01$) existed between copper in whole tissues and copper associated with the 3 fractions identified above. Changes in copper in the subcellular compartments paralleled changes in the whole tissues in this study. X-ray microanalysis provided evidence for the localization of zinc as being primarily in the kidneys and was useful for examining the metal composition of organs which could not be easily excised and analyzed using other procedures. Measurement of condition index indicated that Tacoma mussels were stressed by the field conditions; condition index was reduced in both transplanted and indigenous groups of mussels at Tacoma. The time at which the reduction was sustained over time coincided with the time at which the trace metals in Tacoma seawater had risen to extremely high concentrations. (Author's abstract)
W85-02540

BENTHOS OF A COASTAL POWER STATION THERMAL DISCHARGE CANAL,
Central Electricity Generating Board, Fawley (England). Marine Biological Unit.
R. N. Bamber, and J. F. Spencer.
Journal of the Marine Biological Association of the U.K., Vol. 64, No. 3, p 603-623, August, 1984. 11 Fig, 3 Tab, 39 Ref, 2 Append.

Descriptors: *Thermal pollution, *Kingsnorth Power Station, *River Medway, *Kent, *England, *Benthos, *Ecological effects, Temperature effects, Salinity, Water temperature, Sediment, Thermal stress, Water pollution effects, Population density, Estuarine environment.

Kingsnorth Power Station, on the River Medway Estuary, Kent, discharges cooling water into a canal comprising a 4 km creek system. A comprehensive investigation of the sublittoral benthic fauna of the discharge system was undertaken from January 1979 to September 1981. The benthic macrofauna was sampled monthly at five stations along the system and a sixth in the River Medway adjacent to the creek mouth (DC4); salinity, seabed temperature, sediment particle size, sediment redox potential, residual chlorine and meiofaunal numbers were measured. The macrofauna is significantly suppressed at sites along the discharge canal, representing a community with half the number of species as at station DC4, comprising dense populations of a few dominant opportunistic species tolerant of thermal stress (e.g. Tubificoides, Cauleriella), and not those characteristic of organic pollution stress communities. The latter are regular summer immigrants in the creek, but persist only in low numbers if at all in the winter (e.g. Polydora ciliata). This suppression is the result of an approximately 10 degrees C temperature front between the heated discharge water and ambient estuarine water, passing over the sea bed with the ebbing and flooding tide four times each day. The residual gradient of mean temperature along the discharge canal causes some changes in the dominance of those species not eliminated by the temperature front. These temperature effects are expected to be

localized, mainly in the area of sea-bed impingement of the discharge water; they are predicted to occur at any thermal discharge in tidal waters where the heated effluent contacts the sea bed. (Author's abstract)
W85-02542

ULTRASTRUCTURAL LOCALIZATION OF METALS IN SPECIMENS OF LITTORINA LITTOREA COLLECTED FROM CLEAN AND POLLUTED SITES,
Reading Univ. (England). Dept. of Zoology.
A. Z. Mason, K. Simkiss, and K. P. Ryan.
Journal of the Marine Biological Association of the U.K., Vol. 64, No. 3, p 699-720, August, 1984. 6 Fig, 2 Tab, 34 Ref. Natural Environment Research Council grant GR3/3063A.

Descriptors: *Periwinkle, *Metals, *Biochemical pathways, *Path of pollutants, Benthos, Toxicology, Gastropods, Menai Straight, Wales, Restronguet Creek, Fal Estuary, Cornwall, England.

Specimens of the periwinkle, Littorina littorea (L.), were collected from a relatively unpolluted site on the Menai Straight, N. Wales, or from the heavily polluted site at Restronguet Creek on the Fal Estuary, Cornwall. The ultrastructural organization of various metal-containing cells of the specimens were analyzed to provide information on the specificity and identity of the biochemical pathways involved in manipulating the metals. These cells occur in the connective tissue, digestive gland, kidney, stomach and ctenidia. The majority of the metals were bound to intracellular ligands. The diversity of ligands includes differences in both composition of the ligands and their availability to pollutant metals. The ligands are usually compartmentalized within membrane-delineated structures. The basophil cells and connective tissue calcium cells appear to contain oxygen donor ligands which mainly bind class A metals (e.g. Ca, Mg, K, Mn). The pore cells and ctenidium contain sulphur donor ligands which mainly bind copper. Ligands of unknown composition occur in the nephrocytes and stomach epithelial cells. The ligands in the basophil cells and the nephrocytes appear to bind a wide range of metals and may therefore serve a detoxification function. Ligands in the connective tissue calcium cells and pore cells are very specific in their binding characteristics, and this presumably reflects some particular metabolic pathway within these cells. Ligands associated with the stomach and ctenidial epithelia appear to be responsible for preventing the penetration of metals through these layers. The effects of ligand specificity, induction and turnover rates will lead to variation in the results obtained in the use of an organism such as L. littorea as a monitoring system for metal pollution. (Collier-IVI)
W85-02543

PHYTOPLANKTON DISTRIBUTION IN THE COASTAL AREA SUBJECT TO THE IMPACT WITH THE TIBER RIVER OUTFALL,
Istituto di Ricerca sulle Acque, Rome (Italy).
A. Puddu, and R. Arfi.
Internationale Revue der Gesamten Hydrobiologie, Vol. 69, No. 4, p 541-552, 1984. 4 Fig, 3 Tab, 36 Ref.

Descriptors: *Phytoplankton, *Coastal areas, *Tiber River, *Italy, *Water pollution effects, Marine enviroments, Spatial distribution, Diatoms, Nutrients.

The Tiber, which is the second-ranking river in Italy in terms of flow and basin area, carries a substantial pollutant load at its outfall. Municipal effluents from Rome are chiefly responsible for this situation. Due to its river plume effects, estuary-like condititions exist at the Tiber outfall. The taxonomic composition and geographical distribution of phytoplankton in the coastal zone surrounding the River Tiber mouth were investigated in twelve surveys from April 1978 to September 1979. Ninety phytoplankton species were identified from 168 samples. Populations were dominated by diatoms, which accounted for more than 95% of total phytoplankton. Among these, small sized and strongly euryhaline organisms like Rhizosolenia delicatula, R. fragilissima and Leptocylindrus danicus were the dominant species throughout the observation period. The direct impact on the coastal environment of Tiber River water and its considerable nutrient load were seen as providing a permanent potential for the development of less structured phytoplankton communities within which there is a prevalence of clearly opportunistic members. Heterogeneity of local hydrological conditions and fluctuations in the river's impact, lead to a virtually constant instability in the neritic environment near the Tiber River outfall. (Moore-IVI)
W85-02569

MUTAGENIC ACTIVITY OF RUNOFF AND LEACHATE WATER FROM HAZARDOUS WASTE LAND TREATMENT,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
For primary bibliographic entry see Field 5B.
W85-02588

IMMUNE RESPONSE IN RAINBOW TROUT SALMO GAIRDNERI AFTER LONG-TERM TREATMENT WITH LOW LEVELS OF CR, CD AND CU,
Milan Univ. (Italy). Sezione di Ecologia.
G. Viale, and D. Calamari.
Environmental Pollution (Series A), Vol. 35, No. 3, p 247-257, 1984. 1 Fig, 3 Tab, 25 Ref.

Descriptors: *Trout, *Immunity, *Chromium, *Cadmium, *Copper, Water quality standards, Heavy metals, Toxicity.

Metals have been demonstrated to affect the immune system of mammals and fish. The immune response was studied in rainbow trout Salmo gairdneri in order to validate the proposed water quality criteria for chromium, cadmium and copper. The kinetics of antibody production against human red blood cells were followed during a 4-month experiment in fish exposed to 50 and 200 micro g Cr/liter, 1.0 and 10 micro g Cd/liter and 30 and 100 micro g Cu/liter. Cadmium slightly reduced the humoral immune response at both concentrations tested while chromium and copper were ineffective. These findings are discussed in the framework of the validation of the proposed water quality criteria for chromium, cadmium and copper. (Author's abstract)
W85-02589

WASTEWATER TREATMENT WITH AQUATIC PLANTS: ECOTYPIC DIFFERENTIATION OF TYPHA DOMINGENSIS SEEDLINGS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Centre for Irrigation Research.
For primary bibliographic entry see Field 5D.
W85-02590

ACIDIFICATION OF WATER AND EXTRAHEPATIC BIOTRANSFORMATION IN FISH,
Kuopio Univ. (Finland). Dept. of Physiology.
M. Laitinen, E. Hietanen, M. Nieminen, and P. Pasanen.
Environmental Pollution (Series A), Vol. 35, No. 3, p 271-278, 1984. 6 Fig, 19 Ref.

Descriptors: *Fish, *Enzymes, *Acidification, *Biotransformation, Hydrogen ion concentration, Whitefish, Kidney, Duodenum, Metabolism.

Biotransformation reactions catalyze the metabolism of foreign compounds, as well as that of endogenous substrates, for instance, the hormones. If the capacity of biotransformation reactions is modified, the whole physiology of the fish will change. The effects of decreased aquatic pH on the extrahepatic biotransformation reactions were studied in whitefish (Coregonus peled). The tissues studied were the kidney and duodenal mucosa, which are known to have biotransformation activity. Fish were exposed to water of pH 3 for 8 h and extrahepatic biotransformation was monitored by measuring renal and duodenal activities of ethoxycoumarin O-deethylase, epoxide hydrase, aryl hydrocarbon hydroxylase and UDP-glucuronosyltransferase at 18 C and 25 C. In the kidn
activities of ethoxycoumarin O-deethylase a
oxide hydrase were increased with acidic
while the opposite was true with aryl hydro
hydroxylase. In acidic water ethoxycouma
deethylase also showed a tendency to incr
duodenal mucosa. These results indicate th
renal and duodenal metabolism of foreign
pounds is modified with acidification of
(Moore-IVI)
W85-02591

EFFECTS OF CADMIUM ON AQUATIC PHOMYCETES,
Basel Univ. (Switzerland). Botanisches Inst.
T. H. Abel, and F. Barlocher.
Applied and Environmental Microbiology 48, No. 2, p 245-251, August, 1984. 4 Fig, 4 T Ref.

Descriptors: *Cadmium, *Aquatic fungi, * ness, Water pollution effects, Sporulation, growth, Calcium, Phytotoxicity.

The effects of cadmium on aquatic hyphom were studied in stream waters of different ch characteristics, and factors responsible for di sensitivities to cadmium were identified leaves were exposed in a hard-water stream soft-water stream for 2 months. In the labo fungal sporulation on the leaves in stream enriched with cadmium (as CdCl2) was stud measurable effect was found when the ca concentration exceeded 0.1 ppm (0.1 mg Concentrations higher than 100 ppm inhibit nidium production completely. This toxic ef cadmium was species dependent and much in soft water than in hard water. Growth ments with Alatospora acuminata, Clava aquatica, Flagellospora curvula, Heliscus lu ensis, and Tetracladium marchalianum show same pattern of cadmium sensitivity as that s the sporulation experiments. Mycelial growt less sensitive to cadmium than was fungal sp tion. High concentrations of competing c (e.g., calcium and zinc) or potential ligands reduce cadmium toxicity. The lower sensitiv fungi sporulating in hard water was almost c ly due to its higher Ca content. Calcium presumably compete with Cd for binding s enzymes or other proteins. They may redu irreversible damage due to Cd-protein compl Although the content of organic ligands higher in the soft-water fungi, concentrations too low to have any effect at high Cd conc tions. (Moore-IVI)
W85-02592

EVIDENCE FOR THE ROLE OF COPPE THE INJURY PROCESS OF COLIFORM TERIA IN DRINKING WATER,
Montana State Univ., Bozeman. Dept. of Mi ology.
For primary bibliographic entry see Field 5F.
W85-02594

PHOSPHORUS RESIDENCE TIME IN R TION TO TROPHIC CONDITIONS IN LA
Canada Centre for Inland Waters, Burlington tario).
For primary bibliographic entry see Field 2H.
W85-02616

IMPORTANCE OF INTERNAL PHOSPHO LOAD TO THE EUTROPHICATION LAKES WITH ANOXIC HYPOLIMNIA,
McGill Univ., Montreal (Quebec). Dept. of ogy.
G. Nurnberg, and R. H. Peters.
Verhandlung Internationale Vereinigung Lim gie, Vol. 22, No. 1, p 190-194, July, 1984. 8 Ref.

Descriptors: *Eutrophication, *Phosphorus, cling nutrients, *Lakes, *Hypolimnion, Iron, mal stratification, Epilimnion, Anoxic condi Plankton.

Experimental studies and literature data were ered on eight lakes in Canada with anoxic

limnia. The iron concentration in these waters ranged from 0 to 7 mg/l and the iron was almost completely in the ferrous state. Therefore oxygen was excluded during all sampling. Phosphorus appears to accumulate in anoxic hypolimnia of culturally eutrophied lakes at a mean rate of 12 to 16 mm/sq m/day as determined from core tubes containing sediment and water and in situ estimates. This release produces steep P gradients in the anoxic hypolimnia during stratified periods. The proportion of total hypolimnetic P which is potentially available provided it comes into contact with P deficient plankton, was determined as soluble reactive phosphorus to give a maximium estimate and by bioassays to give a more appropriate estimate. Results suggest that under optimal conditions epilimnetic plankton can use approximately 70% of entrained hypolimnetic total phosphorus when concentrations in the hypolimnion exceed 100 micro g/l total P. How much of hypolimnetic P actually contributes to eutrophication will depend on the capacity of the plankton to take up the hypolimnetic P after thermocline erosion. While this is difficult to assess, the study suggests that high internal P loads increase eutrophication in lakes. (Baker-IVI)
W85-02618

PHOSPHORUS RELEASE PATTERNS FROM SEDIMENTS OF A MEROMICTIC MESOTROPHIC LAKE (PIBURGER SEE, AUSTRIA),
Innsbruck Univ. (Austria). Dept. of Limnology.
R. Psenner.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 219-228, July 1984. 5 Fig, 35 Ref.

Descriptors: *Phosphorus, *Lake sediments, *Piburger See, *Austria, *Meromictic lakes, *Mesotrophic lakes, Trophic levels, Temperature effects, Eutrophication, Oxygen, Phosphates.

Piburger See is a mesotrophic softwater lake with an area of 13.4 ha and a maximum depth of 24.6 m. The lake is situated in the Eastern Alps near Oetz, Austria. The catchment area is formed by siliceous rocks; 75% of the lake bottom consists of soft, noncalcareous organic rich sediment. Piburger See is meromictic and has suffered from cultural eutrophication since the early sixties. This study has revealed that different release patterns for phosphorus occur within the same lake at different depths depending on temperature and oxygen supply, both of which were experimentally modified. Release rates measured in laboratory experiments with undisturbed sediment cores proved well coordinated with the interstitial water concentration of soluble reactive phosphorus and/or the concentration gradient across the interface. The diffusion controlled phosphate flux accounted only for 1/10 to 1/50 of the release rate determined in lab studies. Beside the effect of iron bound and apatite phosphorus, the NaOH-P fraction is the most important for the release and uptake mechanisms. NaOH-P constitutes a phosphorus reservoir capable of rapid interactions with the dissolved phosphate pool over the whole range of lake depth, independently of redox conditions. (Baker-IVI)
W85-02619

NITROGEN LOADING: INFLUENCE ON DISSOLVED INORGANIC CARBON IN NATURAL WATERS,
Hidrobioloski Zavod, Ochrida (Yugoslavia).
T. Naumoski, and J. T. Lehman.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 244-249, July, 1984. 3 Fig, 1 Tab, 18 Ref.

Descriptors: *Lakes, *Nitrogen, *Acid rain, Third Sister Lake, *Michigan, Nitrates, Chemical reactions, Algae, Inorganic carbon, Natural waters, Kettle lakes, Phytoplankton.

Experiments were conducted in Third Sister Lake, a 16 m deep kettle lake in southern Michigan 5 km west of Ann Arbor. Enclosures of clear plastic were filled with water from 3 m and were enriched with nutrients while being filled. Treatments consisted of sodium phosphate with ferric chloride and sodium nitrate, nitric acid, or ammonium chloride to replicate enclosures. Given equimolar additions of ammonia or nitrate, the ammonia is more swiftly converted to new phytoplankton biomass measured as chlorophyll. There was some indication that alkalinity changes occur accompanying phosphate uptake. The relevance of the study to the global problem of acid rain is noted. Because uptake of nitrate by phytoplankton causes an increase in alkalinity, all of the strong acid added to two of the enclosures as nitric acid would have been neutralized if the algae removed all the nitrate. In lakes were nitrate loading derives from acid rain the processes described here lead to biological neutralization of some of the acid and to diminution of its effects. (Baker-IVI)
W85-02623

MODELING CHEMICAL WATER QUALITY IN RESERVOIRS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
M. J. Zimmerman.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 254-260, July, 1984. 2 Fig, 14 Ref.

Descriptors: *Water quality control, *Reservoirs, *Model studies, *Eutrophication, Water quality management, Chlorophyll a, Simulation, Hydrodynamics.

Various water quality modeling approaches are discussed as they pertain to reservoirs. The insensitivity of these models to data variability as well as to violations of their own assumptions are emphasized. Within the context of their intended purposes and constraints, all the techniques seem capable of producing reasonably good characterizations or simulations of the systems considered. Loading and empirical regression models yield good predictions of chlorophyll a concentrations which may indicate the necessity of controlling nutrient inputs. Equilibrium calculations provide detailed descriptions of biogeochemical events associated with eutrophication and, thus, can aid in assessing some of the more diverse ramifications of water quality management. Ecosystem level models are particularly valuable for their ability to simulate operational conditions of reservoirs. They account for time-dependent behavior and the effects of hydrodynamics on physical, chemical, and biological aspects of water quality. At the coarsest level of resolution lie the loading and regression models. Next are the one-dimensional ecosystem compartment models which incorporate up to date hydrodynamic simulation capability. At the finest level are chemical equilibrium calculations which can provide highly detailed descriptions of system chemistry. No one modeling approach is best for all possible applications. (Baker-IVI)
W85-02624

SUMMARY OF US OECD EUTROPHICATION STUDY. RESULTS AND THEIR APPLICATION TO WATER QUALITY MANAGEMENT,
Texas Tech Univ., Lubbock. Dept. of Civil Engineering.
G. F. Lee, and R. A. Jones.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 261-267. July, 1984. 2 Fig, 12 Ref.

Descriptors: *Water quality control, *Eutrophication, *Water quality management, Nutrients, Phosphorus, Organic compounds, Fertilizers, Reservoirs, Dissolved oxygen.

A Cooperative Program on Eutrophication was initiated in the early 1970's under the auspices of the Organization for Economic Cooperation and Development (OECD). The program was to quantify relationships between nutrient loads to water bodies and their eutrophication related water quality responses. The project included a five year study of about 200 lakes and impoundments in Australia, Japan and 16 countries in Western Europe and North America. The results of the study conducted in the United States are reported. The primary factor that motivated the initiation of the study was the development of a management tool that could be widely used to predict the impact of altering P loads to waterbodies on the waterbodies' eutrophication-related water quality. Specific problems of concern range from domestic water supply water quality, low dissolved oxygen below hydropower releases from reservoirs, agricultural irrigation water quality, and impaired recreational use of waterbodies. The modeling approach is a powerful tool for eutrophication-related water quality evaluation/management. (Baker-IVI)
W85-02625

EMPIRICAL MODELS FOR PREDICTION OF ALGAL BLOOMS AND COLLAPSES, WINTER OXYGEN DEPLETION AND A FREEZE-OUT EFFECT IN LAKES: SUMMARY AND VERIFICATION,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W85-02631

EFFECTS OF PHOSPHORUS FERTILIZATION ON PHYTOPLANKTON BIOMASS AND PHOSPHORUS RETENTION IN SUBARCTIC QUEBEC LAKES,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W85-02635

EFFECTS OF AN IN SITU ARTIFICIAL ACIDIFICATION ON THE LACUSTRINE PHYTOPLANKTON AND ZOOPLANKTON (EFFETS D'UNE ACIDIFICATION ARTIFICIELLE IN SITU SUR LE PHYTOPLANCTON ET LE ZOOPLANCTON LACUSTRE),
Ecole Polytechnique, Montreal (Quebec). Section du Genie de l'Environnement.
C. E. Delisle, L. Roy, P. Bilodeau, and P. Andre.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, p 383-387, July, 1984. 2 Fig, 10 Ref.

Descriptors: *Acidification, *Phytoplankton, *Zooplankton, *Lake Kempt, *Quebec, Lakes, Heavy metals, Acid rain, Water pollution effects, Hydrogen ion concentration, Species composition, Biomass, Primary productivity.

Because of interest in the effects of acid rain on planktonic communities, artificial acidification experiments were carried out in enclosures in Lake Kempt. Lake Kempt is located about 200 km north of Montreal. It is free of local sources of pollution, but is in a zone considered to be very sensitive to acidification, in part because of its location downwind of industrial centers, and in part because the geological formation is dominated by gneiss granite. The transparent plastic enclosures are 2 m in diameter and in depth. The pH in the enclosures was modified to 4.0, 5.0, and 5.5 by the addition of sulfuric acid. The liberation of heavy metals from sediments was affected by acidification. Zooplankton communities were affected by the acidification: dominance of Bosmina and a reduction in the number of species are characteristic of acid environments. The number of phytoplankton taxa is reduced: between 30 and 50 taxa were found in the control enclosures; only 20 were found at pH 4.0. Biomass, measured as chlorophyll a, did not vary significantly. At pH 4.0, there is a clear increase in productivity. (Moore-IVI)
W85-02636

PLANKTON OF AN ACID-STRESSED LAKE (KEJIMKUJIK NATIONAL PARK, NOVA SCOTIA, CANADA); PART 1, DESIGN AND WATER CHEMISTRY RESULTS OF AN ENCLOSURE EXPERIMENT,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W85-02637

GROWTH RESPONSES OF RIVER AND LAKE PHYTOPLANKTON POPULATIONS IN LAKE MICHIGAN WATER,
Michigan Univ., Ann Arbor. Great Lakes Research Div.

For primary bibliographic entry see Field 2H.
W85-02638

LONG-TERM PHYTOPLANKTON CHANGES IN LAKE MICHIGAN: CULTURAL EUTROPHICATION OR BIOTIC SHIFTS,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
For primary bibliographic entry see Field 2H.
W85-02639

BENTHIC AND EPIBENTHIC (MICROCRUSTACEANS, MACROBENTHOS) COMMUNITY STRUCTURE IN THE VICINITY OF A POWER PLANT, SOUTHEASTERN LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
M. S. Evans.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 488-494, July 1984. 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Powerplants, *Thermal pollution, *Lake Michigan, *Benthos, *Epibenthos, Nuclear powerplants, Heated water, Effluents.

The effects of operating the Donald C. Cook Nuclear Plant on epibenthic and benthic communities in the adjacent aquatic communities were investigated. Twenty-six sampling stations were investigated. A moderate effect was noted on epibenthic and benthic communities. Macrobenthic taxa abundances were only slightly different (amphipods, chironomids) or the same (oligochaetes) in plume or control regions. The affected area was relatively small and located within a few hundred meters of the intake and discharge structures. Condenser passed water is discharged at a high velocity through subsurface discharge jets resulting in a rapid loss of temperature and the formation of a floating plume. It is probably only within a few tens of meters of the discharge jets where plume temperatures are more than 2 C above ambient and where the sediment is scoured by the high current velocities that epibenthic and benthic community structure is strongly altered by plant operation. (Baker-IVI)
W85-02641

MT. ST. HELENS ASH IN LAKES IN THE LOWER GRAND COULEE, WASHINGTON STATE,
Washington Univ., Seattle. Dept. of Zoology.
W. T. Edmondson, and A. H. Litt.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 510-512, July, 1984. 1 Fig, 10 Ref.

Descriptors: *Volcanic ash, *Aquatic life, *Mt. St. Helens, *Soap Lake, *Lake Lenore, *Washington, Midges, Benthos, Amphipods, Daphnia, Crustaceans, Alkaline lakes, Volcanoes.

The eruption of Mt. St. Helens in May of 1980 caused the deposit of volcanic ash into two alkaline lakes in central Washington state, Soap Lake and Lake Lenore, which had been a part of an ongoing study of flora and fauna and high productivity conditions. Following the eruption, the adundance of Diaptomus sicilis decreased sharply in both lakes, but this was also the time seasonally for this to occur. Also, after the ashfall, Moina hutchinsoni in Soap Lake and Daphnia pulex in Lake Lenore went through their seasonal increase. An unusual number of dead amphipods were seen in Lake Lenore but the population did increase during the summer. Salamander tracks were visible on the ash layer and chironomid larvae were able to burrow up through the ash layer and reestablish their tubes. (Baker-IVI)
W85-02643

CRATER LAKE STUDY: DETECTION OF POSSIBLE OPTICAL DETERIORATION OF A RARE, UNUSUALLY DEEP CALDERA LAKE IN OREGON, U.S.A.,
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 2H.
W85-02644

LAKE ACIDIFICATION AND THE BIOLOGY OF ADIRONDACK LAKES: I. ROTIFER COMMUNITIES,
New York State Museum, Albany. Science Service Div.
C. A. Siegfried, J. W. Sutherland, S. O. Quinn, and J. A. Bloomfield.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 549-558, July, 1984. 8 Fig, 1 Tab, 11 Ref.

Descriptors: *Mountain lakes, *Adirondack Mountains, *Acidification, *Rotifers, Water pollution effects, Aquatic animals, Acid lakes, Hydrogen ion concentration.

The lakes selected for study were all within the Adirondack Park. More than 50 rotifer species were identified from these lakes. The number of rotifer species present generally declined with decreasing pH levels. Waters with pH less than 5.0 generally had fewer than 8 rotifer species while waters with pH values greater than 6.0 generally had more than 10 species. The greatest number of species identified from any one lake was 18 from circumneutral Elk Lake. Two acid lakes, Goose Lake and Jones Lake contained only 2 species of rotifer. The differences in the structure of Adirondack rotifer communities in relation to pH may represent only an indirect relationship to pH. As pH decreases many other chemical changes also occur, such as mobilization of heavy metals, which may impact the rotifer community. Changes in other communities such as phytoplankton, crustacean zooplankton, or fish directly or indirectly related to pH may have significant impacts on the rotifer community. (Baker-IVI)
W85-02646

RECENT PH HISTORY OF BIG MOOSE LAKE (ADIRONDACK MOUNTAINS, NEW YORK, U.S.A.) INFERRED FROM SEDIMENT DIATOM ASSEMBLAGES,
Indiana Univ. at Bloomington. Dept. of Biology.
D. F. Charles.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 559-566, July, 1984. 4 Fig, 27 Ref.

Descriptors: *Mountains lakes, *Acidity, *Big Moose Lake, *New York, Adirondack Mountains, *Diatoms, Aquatic life, History, Hydrogen ion concentration, Acid deposition, Water pollution effects.

Attempts were made to reconstruct the pH history of an acidic Adirondack lake by analyzing changes in diatom assemblages and to determine probable causes for the changes which have occurred. Big Moose Lake is located in the southwestern Adirondacks at an elevation of 556 m. It has a surface area of 515 ha, a watershed area of 8760 ha, and maximum depth of 2 m. From about 1800 until about 1950 the inferred pH of the lake was about 5.7. Diatom assemblages were dominated by the euplanktonic taxon Cyclotella stelligera. After 1950 the inferred pH decreased steadily and relatively quickly to about 4.7. Measured pH has been at about this value for at least the last 10 yr. Measurements of air-equilibrated surface pH of the lake have typically ranged from 4.6 to 5.0 during the past eight years. Stauroneis gracillima and Fragilaria cf. virescens var 1 dominate the surface sediment assemblages. The decrease in inferred pH is corroborated by historical water chemistry data and by an assessment of the decline and disappearance of fish populations. The most reasonable explanation for the cause of the decline of inferred pH is strong acid deposition. This is indicated primarily by the rate and magnitude of the pH change. (Baker-IVI)
W85-02647

HETEROTROPHIC BACTERIAL COMMUNITY IN OLIGOTROPHIC LAKE TAHOE,
Tokyo Metropolitan Univ. (Japan). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W85-02649

LITTORAL PHYTOPLANKTON PRODUCTI TY AND BIOMASS AS INDICATORS OF D FERENTIAL NUTRIENT LOADING OF LA TAHOE,
California Univ., Davis. Inst of Ecology
S. L. Loeb, P. Eloranta, and J. E. Reuter.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 605-611, July, 1984. 3 Fig Tab, 21 Ref. California State Water Resour Control Board grant 0-136-160.

Descriptors: *Primary productivity, *Lake Tah *Phytoplankton, *Biomass, Nutrients, Bioindi tors, Algae, Littoral zone, Snowmelt.

The annual pattern of Lake Tahoe's littoral phy plankton productivity exhibited a rather la range for waters representing the most superfi waters of the euphotic zone. Maximum wa column productivity during 1981 usually occur between 20-40 m and rarely exceeded 1.00 mg cu m/hr. Phytoplankton productivity at three sh low littoral stations was greater than phytopla ton productivity measured in the shallow pelag waters. The April through June periods of high littoral phytoplankton productivity and great littoral-pelagial productivity differential were a coincident with the time period when over 50% the total annual stream runoff entered Lake Tah from the melting snow pack. These findings s gest that materials entering the lake from the s rounding watershed exert their initial and possi greatest biostimulatory effects on the littc waters. No significant correlations were found tween the size of the nutrient pools and littc phytoplankton productivity or biomass. Station-station differences in water chemistry showed discernible patterns. Ammonium-nitrogen a soluble phosphorus were below the levels of det tion. The utility of the littoral phytoplankton co munity as a site-specific method to evaluate nu ent pollution sources was demonstrated with so success. (Baker-IVI)
W85-02651

VARIABILITY IN PHOSPHORUS CONCE TRATIONS IN NORTH TEMPERATE LAKI A CASE STUDY OF ANTHROPOGENIC FOR ING,
Salford Univ. (England). Dept. of Civil Engine ing.
P. B. R. Archer, and B. Henderson-Sellers.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 633-637, July, 1984. 2 Fig, Ref.

Descriptors: *Phosphorus, *Lakes, *Recreati wastes, *Windermere Lake, *England, Water qu ity, Nutrient cycling, Water pollution effects, Bo ing.

The overall productivity of a lake or reservoir h been evaluated traditionally in terms of its tropl state. There is no widely accepted quantitati scheme for undertaking such an assessment a furthermore such values indicate trends over ye and give no information on time scales less tha year. The incorporation of nutrient concentratio into multi-box or multi-layer one-dimensional th mal stratification models is currently being teste Many details of the inlake phosphorus cycling a not yet fully evaluated. Some of these mechanis are reported. In this study of a mesotrophic nor temperate lake, Lake Windermere, a tempo scale of 1 week is used in evaluating P variabili at 5 sampling stations in the North basin of t lake. Windermere is subject to surges of inter tourist pressure on national holiday weekends. these times the human population of 10,000 trebl resulting in increased P concentrations in the lak The incidence of this additional forcing factor on concentrations, together with other, such powerboating, leads to the recognition of a ne for properly documented data bases to be ma available to mathematical modellers of water qu ity. (Baker-IVI)
W85-02652

EFFECTS OF ROTENONE TREATMENT O THE BENTHIC FAUNA OF A SMALL EUTR PHIC LAKE,

Trondheim Univ. (Norway).
J. I. Koksvik, and K. Aagaard.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 658-665, July, 1984. 9 Fig, 15 Ref.

Descriptors: *Rotenone, *Fish control agents, *Benthic fauna, *Haugatjern, *Norway, Eutrophic lakes, Toxicity, Midges, Predation, Dissolved oxygen, Competition.

Knowledge was sought on the toxicity of rotenone on benthos when used in a concentration commonly recommended in Norway for the extermination of fish. The development of the bottom fauna when no longer influenced by fish predation was also considered. Haugatjern is a eutrophic lake situated in Central Norway at an elevation of 697 m with a surface area of 9.1 ha, maximum depth of 15.5 m, and mean depth of 7.6 m. On September 22, 1980, 350 liters of rotenone were pumped into the surface layers which equals a concentration of roughly 0.5 ppm. The lake was kept empty of fish until 1982 when it was stocked with 4000 fry of charr. The different taxa of Chironomidae must have a widely different tolerance to rotenone. Procladius seemed rather unaffected by the treatment and most possibly gained due to the decreased fish population. Chironomus appeared at first to be equally unaffected, but by the following year the genus was nearly completely missing until October. Tanytarsini species managed to colonize the 7 m depth with a density of more than 3,000 ind/sq m by July of 1982 while no Tanytarsini at all occurred at such a depth in 1980. Except for the genus Chironomus the rotenone treatment had no toxic effect on the investigated bottom fauna. The most important factor for the development after treatment seemed to be ceased predation by fish, altered interspecific competition and better oxygen conditions. (Baker-IVI)
W85-02653

5D. Waste Treatment Processes

REDUCTION IN TOXICITY OF ORGANIC PRIORITY POLLUTANTS BY PILOT-SCALE CONVENTIONAL WASTEWATER TREATMENT PROCESS,
Environmental Monitoring and Support Lab.-Cincinnati, OH.
W. B. Horning, II, E. L. Robinson, and A. C. Petrasek, Jr.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 2, p 191-196, March, 1984. 1 Fig, 3 Tab, 7 Ref.

Descriptors: *Wastewater treatment, *Priority pollutants, *Toxicity, Minnows, Daphnia, Trout, Activated sludge process, Effluents, Water quality.

Static acute toxicity tests with fathead minnows, Daphnia magna, and rainbow trout were used to demonstrate the effectiveness of a pilot-scale conventional wastewater treatment system in detoxifying a raw municipal wastewater that continuously received a mixture of 22 organic priority pollutants. Wastewater from the City of Cincinnati (Ohio) was added to two parallel pilot-scale (control and experimental) conventional activated-sludge wastewater treatment systems. The effect of chlorination on the acute toxicity of effluent from the experimental system was also investigated. The system typically reduced the organic priority pollutants by 89 to > 99%, and both systems provided excellent treatment of conventional pollutants. Even though toxicity reduction as high as 90% was achieved, significant toxicity was present in the experimental effluent. The study clearly supports the premise that organism responses should be considered, in addition to chemical and conventional pollutant characterization, to determine the quality of a wastewater discharge. (Author's abstract)
W85-02201

FACTORS AFFECTING THE REMOVAL OF METALS DURING ACTIVATED SLUDGE WASTEWATER TREATMENT; I. THE ROLE OF SOLUBLE LIGANDS,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
P. S. Lawson, R. M. Sterritt, and J. N. Lester.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 4, p 383-390, July, 1984. 7 Fig, 5 Tab, 33 Ref.

Descriptors: *Activated sludge process, *Metal removal, *Ligands, Wastewater treatment, Biomass, Sludge age, Chelation.

Samples of mixed liquor were withdrawn from a laboratory-scale activated sludge simulation operated at a range of sludge ages from 3 to 12 days in order to examine the difference in metal uptake by the mixed liquor biomass in the absence and presence of soluble ligands. One half of the samples were centrifuged, washed, and resuspended in physiological saline solution, and the rest were left unchanged. In another experiment, aliquots of synthetic sewage were added to mixed liquor samples to investigate the effect of increased soluble influent sewage ligands on metal uptake. It was found that at low sludge ages, uptake of metals by biomass was lower in the presence of soluble ligands than in their absence, but as the sludge age increased uptake in the presence of soluble ligands also increased. It is suggested that at low sludge ages, ligands predominantly prevented metal uptake by the biomass by chelating the metals and stabilizing them in solution and, at longer sludge areas, ligands predominantly enhanced uptake. Increasing the concentration of synthetic sewage caused a reduction in metal removal and it is suggested that soluble ligands in the synthetic sewage were responsible for preventing metal uptake. (Author's abstract)
W85-02209

FACTORS AFFECTING THE REMOVAL OF METALS DURING ACTIVATED SLUDGE WASTEWATER TREATMENT; II. THE ROLE OF MIXED LIQUOR BIOMASS,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
P. S. Lawson, R. M. Sterritt, and J. N. Lester.
Archives of Environmental Contamination and Toxicology, Vol. 13, No. 4, p 391-402, July, 1984. 13 Fig, 6 Tab, 34 Ref.

Descriptors: *Activated sludge process, *Metal removal, Biomass, Wastewater treatment, Copper, Nickel, Manganese, Cadmium, Cobalt, Thallium, Heavy metals, Mixed liquor.

Samples of mixed liquor from a laboratory-scale activated sludge simulation, operated at a range of sludge ages from 3 to 12 days, were treated with formaldehyde in order to obtain a metabolically inactive biomass. The metal removal behavior of this biomass was compared with that of untreated biomass. Only Cu and Ni were found to exhibit a high degree of removal in the presence of active biomass. Manganese, Cd, Co, and Tl demonstrated removals little affected by the activity of the biomass, and at longer sludge ages more metal was taken up by formaldehyde-treated than by untreated cells. Dispersed mixed liquor in the form of a bulking sludge was found to have a greater affinity for most metals than a well-settled, compact mixed liquor. Consequently, it is proposed that the important factors in metal removal by the mixed liquor solids were related to their behavior as particulates, the physical characteristics of the particle being more important than their viability. (Author's abstract)
W85-02210

COPA II AND THE RIVER MERSEY - A REGIONAL WATER AUTHORITY VIEW,
North West Water Authority, Warrington (England).
E. Harper.
Chemistry and Industry, No. 14, p 502-505, July, 1984. 5 Fig.

Descriptors: *Estuaries, *Water pollution control, *River Mersey Estuary, *England, *Planning, Water management, Industrial wastes, Wastewater treatment, Municipal wastes.

The River Mersey Estuary is the only exception to the exemption order under the Control of Pollution Acta (COPA) II on an area basis rather than a category basis. Reasons for this exception are presented from the point of view of North West Water, and guidelines for pollution control on this Estuary and their relevance to COPA II are discussed, considering particularly the vital role industry must play in this area. The whole Mersey catchment draining to the freshwater river and to a tidal river is highly urbanized and industrialized. The rivers in the Mersey catchment contain 16% of the Class 3 rivers and 24% of the Class 4 polluted rivers in the United Kingdom while being only 4% of the total length. While the inland river remains badly polluted in national terms, it has shown massive improvement during the past two decades. Significantly less improvement has been noted in the Estuary. The estuary is unusual in having a seriously polluted freshwater inflow which, together with the tidal tributaries, makes a major contribution to the dissolved oxygen sag, particularly in the upper reaches. If there were no further pollution loads discharged to the estuary, it would recover rapidly. The North West Water Authority has set a minimum objective of restoring dissolved oxygen to the estuary at all times. The Authority plans to achieve the minimum objectives for the estuary by the mid 1990s. Significant expenditures on provision of sewers and sewage treatment works for the Estuary will be made by that time. North West Water formally adopted guidelines in 1978 for effluent control for new industry and expansion of existing industry on the Mersey Estuary. These are considered more appropriate than rigid rules, as each industrial case is treated as a special one. (Baker-IVI)
W85-02225

COPA II AND THE RIVER MERSEY - AN INDUSTRIAL VIEW,
Imperial Chemical Industries Ltd., Runcorn (England). Mond Div.
P. R. Edwards.
Chemistry and Industry, Vol. 14, p 506-508, July, 1984. 2 Ref.

Descriptors: *Estuaries, *River Mersey, *Mersey Estuary, *England, *Water pollution control, Industrial wastes, Municipal wastewater, Effluents, Dissolved oxygen.

The Mersey Estuary receives surface drainage, sewage and industrial waste flows from the catchments of the Mersey and Weaver. These discharges of partially treated or untreated effluent result in low levels or the absence of dissolved oxygen in the upper estuary, along with the presence of grossly objectionable solids in the lower estuary. Significant improvements made during the past 10 year period include a reduction of the total biochemical oxygen demand load to the estuary to a value 70% of that of its 1972 load. A significant part of the reduction is due to internal measures adopted by individual factories. The main impact of the Control of Pollution Act (COPA) II is seen as accelerating existing programs and giving more power to the NWWA to press for reductions in certain polluting effluents which would continue unabated without the legislation. An interim objective on the way to total control for the upper estuary is that the water should contain dissolved oxygen at all times to avoid odor nuisance (at least 10% DO). The long term objective for tidal waters is 30% DO at all times. Despite general agreement that improvement of the Mersey is long overdue, there is concern over the cost implications of the proposed improvement program on industry via increased rates, increased effluent charges and the building of in-house treatment plants. Specific examples where the ICI has been and is continuing to spend money to improve its liquid effluent discharges in the Mersey catchment area include mercury removal from aqueous effluents, sewage diversions, changing technology at solvents plant, reductions of caustic discharges, use of new chloromethanes complex, and controlling ammonia discharges from ICI mid-Cheshire factories. (Baker-IVI)
W85-02226

IRON REMOVAL FROM TI02-PLANT ACIDIC WASTEWATER,
Murdoch Univ. (Western Australia). School of Environmental and Life Science.
G. E. Ho, P. J. Murphy, N. Platell, and J. E. Wajon.
Journal of Environmental Engineering, Vol. 110 No. 4, p 828-846, August, 1984. 13 Fig, 5 Tab, 8 Ref.

Descriptors: *Titanium dioxide plants, *Industrial wastewater, *Iron, *Wastewater treatment, Leschenault Peninsula, Australia, Ilmenite, Steel industry, Industrial plants, Sand dunes.

Wastewater from a titanium dioxide plant has been disposed via unlined spreading basins located in sand dunes at Leschenault Peninsula in Western Australia since 1968. Characteristics of the wastewater are typical of waste produced by a plant processing ilmenite to titanium dioxide using the sulfate process and are also similar to the characteristics of spent pickle liquor in the steel manufacturing industry. Besides neutralization of the acid, over 75% of the iron in the wastewater is removed by limestone in the dune sand. Calcium carbonate content of the sand varies from 1%-30% with an average concentration of about 15%. A pilot scale laboratory column experiment to investigate the interactions between the waste and the sand showed that the iron was removed from solution as iron carbonate just beyond the acid neutralization zone. The wastewater used in the investigation had concentrations of 101.9 g H2SO4/L and 160.6 g FeSO4/L. The iron is deposited in a narrow band which is moved along by the advancing acid front. Iron removal in the column averaged 78%, which is similar to removal observed in the field. Iron concentrations near 100 ppm were observed in both the column and the field. The precipitated iron in the form of calcium-iron carbonates is considered to be very insoluble in the dune environment based on the known chemistry of the carbonates. Iron removal can be maximized by providing for a contact time of at least 3 weeks between the waste and the sand. More rapid iron removal will occur with higher concentrations of iron in the wastewater, but the impact on acid neutralization efficiency is unknown. (Collier-IVI)
W85-02278

HYDROELECTRIC GENERATOR USED BY TREATMENT PLANT,
North Andover, MA.
E. Teittinen.
BioCycle, Vol. 25, No. 5, p 38, 40-41, July-August, 1984. 2 Fig, 1 Tab.

Descriptors: *Hydroelectric plants, *Wastewater facilities, Design criteria, Planning, Energy, Feasibility.

A wastewater treatment plant was designed to be located 60 feet above the Merrimack River to treat 52 million gallons/day. This location necessitated the construction of a $5.4 million pump station and an energy dissipating structure at the outfall. The energy dissipator extracted the fifty feet of available energy in the treated wastewater so it wouldn't scour the river bed when discharged. After the facility was in operation, a study determined the feasibility of using the energy for the generation of electricity. A hydroelectric generator was put on-line on the plant's outfall in 1983. Hydroelectric power generation at the wastewater treatment facility has helped offset the high cost of energy. The determination of the hydroelectric potential is fairly straight-forward using expertise that is not normally found in wastewater treatment and a consultant should be used. The economics are enhanced if hydro is considered during initial construction rather than retrofitting a turbine to an existing facility. (Baker-IVI)
W85-02301

SEWERMAN AND THE SCIENTIST; A PARABLE FOR THE ACADEMIC FOLLOWING A COURSE OF DECONTAMINATION (L'EGOUTIER ET LE SAVANT; CONTE MORAL POUR UNIVERSITAIRE EN CURE D'ASSAINISSEMENT),
Institut National Polytechnique, Toulouse (France).
C. Thirriot.
Houille Blanche, No. 1/2, p 27-64, 1984. 56 Fig, 51 Ref.

Descriptors: *Social aspects, *Wastewater disposal, *Sediment transport, *Flow, Decontamination, Wastewater treatment, Turbulence, Stochastic hydrology, Model studies, Mathematical models.

Socio-economic problems associated with decontamination are reviewed and their history of development is traced. Fundamental hydraulic aspects of drainage systems currently in operation are described. Aquatic life at the outlets of treated and untreated water outfalls is discussed including outfalls in rivers, lakes and seas. The effects of turbulence on energy dissipation, the transport of solids and the mixture of air with water are extensively examined. The stochastic approach to particulate transport in conduits and sedimentation tanks is explained. Problems encountered in mathematical models created to represent transient flow in pipelines are detailed. Several natural situations in lakes or gulfs are considered in depth with reference to the hydrological and hydrodynamic aspects. (Baker-IVI)
W85-02351

MUNICIPAL WASTEWATER TREATMENT AND ITS CONTROL IN FINLAND,
National Board of Waters, Helsinki (Finland).
M. Makela.
Aqua Fennica, Vol. 13, p 44-48, 1983. 5 Fig, 1 Tab.

Descriptors: *Finland, *Wastewater treatment, *Sewer systems, Biological wastewater treatment, Chemical treatment, Biochemical oxygen demand, Phosphorus removal, Ammonium nitrate, Effluents, Sewer infiltration.

Sewer systems designed to serve more than 200 inhabitants currently cover 71% of the population of Finland, or 3.4 million persons. Plants employing at least chemical or biological treatment account for 97% of these systems. Wastewater treatment today removes 80% of the total amount of BOD7 and phosphorus discharged from public sewers. About 79% of municipal wastewaters are treated biologically-chemically, 17% chemically and 1% biologically. The permitted maximum limits for the BOD7 value and phosphorus content in the effluent are normally 20 to 25 mg/l O2 and 0.5 to 1.5 mg/l P with a requirement of more than 80-90% reduction. In addition, the removal of ammonium nitrate has been required in a few cases. The present treatment methods satisfy the current needs in most cases, whereas the operation possibilities and the management of plants frequently are unsatisfactory. Leakage water in sewer systems frequently deteriorates treatment results. Improvement of wastewater treatment usually requires renovation of sewer system networks, which is a major goal in municipal water pollution control. (Moore-IVI)
W85-02393

IMPROVED METHODS OF DESIGNING FILTER BOXES,
Camp, Dresser and McKee, Inc., Walnut Creek, CA.
R. D. G. Monk.
Journal of the American Water Works Association, Vol. 76, No. 8, p 54-59, August, 1984. 10 Fig, 2 Ref.

Descriptors: *Design criteria, *Hydraulics, *Filters, *Head loss, Filtration, Filter boxes, Weirs, Pressures, Cost factors.

An understanding of the hydraulics of filters, combined with calculations of fixed head losses and information obtained from pilot studies, permits use of shallower filter boxes that are therefore more economical. Where appropriate, side backwash channels may further help reduce the cost of constructing filter boxes. To avoid the operating conditions that result when all of the head loss occurs in the top few inches of the media, piezometer taps and a manometer board for one filter would be of help. This equipment also he showing operators what is occurring wit filter, in identifying when attrition is occurrin when surface scalping would be justified, in ing that the correct dosage of filter aid is applied, and in determining if a higher ra filtration could be applied to drive the floc d into the media without jeopardizing water qu An even better method would be to plot pr sive advances of head losses during the filte by means of a data logger so that head-loss c could be displayed on a cathode ray tube. (E IVI)
W85-02401

REMOVAL OF NITROGEN FROM INDUS AL WASTEWATERS WITH THE USE ALGAL ROTATING DISKS AND DENIT CATION PACKED BED REACTOR,
Warsaw Univ., Poland, Dept. of Environm Microbiology.
M. Przytocka-Jusiak, M. Blaszczyk, E. Kosins and A. Bisz-Konarzewska.
Water Research, Vol. 18, No. 9, p 1077-1082, 5 Fig, 1 Tab, 13 Ref.

Descriptors: *Wastewater treatment, *Nitr *Purification, *Bacteria, Stichococcus, Indu wastes, Denitrification, Nitrogen removal, A

A previously proposed method for the two biological purification of nitrogenous waste has been optimized. This study deals wit possibility of using Stichococcus bacillaris cu on rotating disks for the purification of nitrog wastewaters and the utility value of algal bi produced in purified wastewater as a sour carbon for denitrifying bacteria. S. bac formed a compact biological film on the surfa rotating disks working in wastewater fro nitrogen industry. In stationary culture ammo was removed first, followed by nitrites. Al nitrate nitrogen remained in the wastewater the end of the experiment, i.e., spontaneous pe off of the biological film. The removal of nit from nitrogenous wastewater during 40 da rotating disk operation with different rete times of the wastewater is presented. The rem from the wastewater of the different form nitrogen in packed bed reactor and algal rot disks are given as means from the results obt during 35 days operation of both systems join series with three series of wastewaters car different loads. The packed bed denitrificatio actor removed all the nitrate and nitrite nitr from the wastewater providing they were enr in the appropriate amount of methanol. The p bility of the use of algal biomass produced i wastewater for such purposes seems to ha great economical advantage. (Baker-IVI)
W85-02425

PRECIPITATION OF PHOSPHORUS FR WASTEWATER THROUGH PH VARIAT IN THE PRESENCE AND ABSENCE OF AGULANTS,
McMaster Univ., Hamilton (Ontario). Dep Chemical Engineering.
E. Diamadopoulos, and A. Benedek.
Water Research, Vol. 18, No. 9, p 1175-1179, 10 Fig, 1 Tab, 10 Ref.

Descriptors: *Wastewater treatment, *Activ sludge process, *Phosphorus removal, *Calc *Aluminum, Acidity, Sludge, Coagulants.

Interactions between calcium and phosphor the activated sludge process were investig Any possible influence these interactions m have on the removal of phosphorus by alumi were also considered. Variations of the pH of activated sludges resulted in variations of the l of calcium and phosphorus. Lowering the pH sulted in the release of these species into the tion, while increasing the pH led to their rem from the solution. Phosphorus and calcium, rally present in the wastewater, formed an inor ic precipitate, which is entrapped in the biolo flocs of the activated sludge system. For systems studied, the stoichiometric molar Ca:P in the calcium phosphate was found to

Removal of phosphorus from wastewater by the addition of aluminum coagulants to the aeration tank depends also on the parallel activity of calcium. The addition of a coagulant changed the nature of the supernatant suspended solids from biological to chemical. The supernatant suspended solids concentration in the case of coagulant addition was sensitive to variations in pH and exhibited a maximum value at around pH 8 where neither Al nor Ca were very effective. The particulate phosphorus concentration in the supernatant liquid when coagulants were used followed the same trend as the supernatant suspended solid. This also indicates the inorganic nature of the supernatant suspended solids in the case of the coagulant addition. (Baker-IVI)
W85-02438

MEASUREMENTS AND CONTROL OF DISSOLVED OXYGEN IN ACTIVATED SLUDGE PROCESSES,
R. Wilkes.
Water and Waste Treatment, Vol. 27, No. 7, p 32-34, July, 1984. 2 Fig.

Descriptors: *Dissolved oxygen, *Wastewater treatment, *Activated sludge process, Aeration, Computers, Secondary wastewater treatment, Automation.

Some 60% of all sewage in the United Kingdom receiving secondary treatment is treated in Activated Sludge Plants. The balance is mainly the percolating biological filter process. The present trend in treatment plants is towards low or no maintenance operating requirements. Systems which automatically clean themselves or check their own calibration are becoming necessary. The level of residual aeration on many plants varies from place to place within the aeration bay. Control of aeration can be by general control of total oxygen input. demands. During the last few years, the technique of using denitrification zones, or anoxic zones, has become more widely accepted. More and more use is made of programmable logic controllers for multiple control loop systems. Analogue type controls still provide the easiest way to set up or adjust systems, and these, combined with the power and versatility of the micro, will provide systems with multi function capabilities. (Baker-IVI)
W85-02487

INDUSTRIAL WASTE TREATMENT PILOT PLANTS,
Brown and Caldwell, Westwood, NJ.
V. C. D'Aco, and G. R. Campbell.
Chemical Engineering Progress, Vol. 80, No. 9, p 45-48, September, 1984. 2 Fig, 2 Ref.

Descriptors: *Pilot plants, *Wastewater treatment, Design criteria, Management, Decision making.

Pilot scale wastewater treatment systems will find increasing application as the Environmental Protection Agency promulgates the new BAT/BCT effluent limitations. Pilot systems can provide most of the key design criteria required to design a full-scale system to meet predefined performance objectives. The primary justification for conducting a pilot study is to minimize total project costs by reducing conservatism in design and to minimize risk by providing a firm basis for design. A decision to proceed with pilot testing must ultimately be made within the context of these objectives. For a pilot study to be successful, project objectives and planning should be carefully examined. In addition to design of the physical facilities, the project manager must consider sample requirements, analytical techniques, laboratory support, and data management procedures. In essence he must design a complete program, encompassing facilities and procedures within the time and budget constraints imposed by the overall project. The program and the project manager must be flexible enough to respond and adapt to new information and problems which will surface during the pilot study. (Baker-IVI)
W85-02550

CONCURRENT DEVELOPMENT OF AN INDUSTRIAL WASTE PRETREATMENT PROGRAM AND RESIDUAL SOLIDS MANAGEMENT PLAN,
CH2M/Hill, Denver, CO.
D. M. Wilson, T. J. Heinemann, F. Erwin, and F. Canahl.
Journal of the Water Pollution Control Federation, Vol. 56, No. 88, p 928-935, August, 1984. 7 Fig, 4 Tab, 2 Ref.

Descriptors: *Residual solids, *Industrial wastes, *Wastewater treatment, *Sludge, *Tulsa, *Oklahoma, Water quality control, Management, Sludge disposal.

Because of the reciprocal impacts of the Residual Solids Management Plan and the Industrial Wastes Pretreatment Program, for the City of Tulsa, they could not be accomplished independently. A strong technological base was developed as a basis for these decisions. This process resulted in a common-sense approach to industrial waste pretreatment, which was acceptable to the industrial community, while allowing the opportunity for sludge management goals to be met by pursuing a beneficial use of the residual solids. Common sense and judgement are needed to meet industrial pretreatment and sludge disposal goals that are compatible. A backup sludge disposal approach should be developed if there is any chance that the primary elements of the management plan for residual solids disposal will not be fully implemented. Industrial waste pretreatment cannot be relied upon as being a sufficient guarantee for sludge quality. (Baker-IVI)
W85-02572

SOIL-AQUIFER TREATMENT - A NEW APPROACH TO AN OLD METHOD OF WASTEWATER REUSE,
Tahal Consulting Engineers Ltd., Tel-Aviv (Israel).
E. Idelovitch, and M. Michail.
Journal of the Water Pollution Control Federation, Vol. 56, No. 8, p 936-943, August, 1984. 12 Fig, 6 Tab, 22 Ref.

Descriptors: *Water reuse, *Wastewater renovation, *Wastewater treatment, *Soil-aquifer treatment, Nitrification, Bacteria, Viruses, Land application, Groundwater recharge.

The soil-aquifer system can be used efficiently as a wastewater treatment plant. The complex physicochemical and biological processes occurring in the unsaturated zone and in the aquifer include: filtration, chemical precipitation, adsorption, cation exchange, biodegradation of organics, nitrification, denitrification, biological recarbonation, bacterial die-off, and virus inactivation. The lifetime of the physicochemical processes varies from short (removal of sodium and boron) to very long (removal of trace elements). The filtration effect of the upper soil layer and the biological processes can be effective indefinitely if the recharge operation is carefully managed. Soil-aquifer treatment (SAT) should be recognized as a modern approach to an old method of wastewater treatment and reuse, which involves low costs and simple operation. Besides its reliability with respect to effluent purification, it can also fulfill the function of seasonal and multi-annual water storage. Whenever feasible, SAT should be adopted and regarded as the nucleus of the wastewater treatment plant or reuse scheme, to be complemented when necessary, by suitable pretreatment, and post-treatment. (Baker-IVI)
W85-02573

TERTIARY FILTRATION: PRACTICAL DESIGN CONSIDERATIONS,
Montgomery (James M.), Inc., Pasadena, CA.
R. C. Siemak.
Journal of the Water Pollution Control Federation, Vol. 56, No. 8, p 944-949, August, 1984. 7 Fig, 4 Tab, 6 Ref.

Descriptors: *Wastewater treatment, *Filtration, *Tertiary wastewater treatment, *California, Sedimentation, Design criteria, Planning, Management.

Specific areas of concern related to tertiary filtration installations in the southern California area include media design, filter washing systems, chemical requirements, instrumentation and alarm provisions, and special considerations including upstream reliability. A good understanding of potable and tertiary filtration systems will aid the design engineer in making proper choices such as media selection, underdrain and backwash system design, and chemical system design. Proper filter media will provide consistent water quality and good operational characteristics. For tertiary applications, both water/surface wash and water/air scour systems are used. Average turbidity removal was approximately 50% with minimal chemical addition and improved to approximately 70% with chemical optimization for influent turbidity of 3 to 4 units. Attention to upstream secondary process reliability ensures that the tertiary filters perform properly and meet effluent quality goals. Secondary process optimization, chemical addition to final sedimentation tanks, and flow equalization are effective methods for maintaining upstream reliability. (Baker-IVI)
W85-02574

EFFECT OF PLASTIC MEDIA CONFIGURATION ON TRICKLING FILTER PERFORMANCE,
Brown and Caldwell, Walnut Creek, CA.
D. S. Parker, and D. T. Merrill.
Journal of the Water Pollution Control Federation, Vol. 56, No. 8, p 955-961, August, 1984. 10 Fig, 15 Ref.

Descriptors: *Wastewater treatment, *Trickling filters, Filtration, Design criteria, Plastic filter, Filter media, Solids contact.

A pilot investigation of the trickling filter/solids contact (TF/SC) process provided an opportunity to compare the performance of two types of corrugated sheet media. The modified Velz equation, a trickling filter design equation, was used to compare dissolved BOD5 removal characteristics of cross-flow and vertical media. Results indicated that cross-flow media had significantly higher reaction rate coefficients than vertical media. Moreover, parallel tests showed that the cross-flow media could accept 67% more load than the vertical flow media while producing effluent with the same dissolved BOD5. The superior performance of the cross-flow media was attributed primarily to higher oxygen transfer efficiency. Most of the dissolved BOD5 removal occurred in the top zone of the trickling filter which was limited by oxygen transfer efficiency. The cross-filter media has more interruptions in the film flow and, therefore, a higher oxygen transfer efficiency. The superior performance of the cross-flow media can significantly reduce trickling filter structural and media requirements for the TF/SC process which increases the cost advantages of the TF/SC process over conventional treatment processes. (Baker-IVI)
W85-02576

USE OF COAGULANTS TO TREAT SEAFOOD PROCESSING WASTEWATERS,
Alaska Univ., Fairbanks. Dept. of Environmental Quality Engineering.
R. A. Johnson, and S. M. Gallanger.
Journal of the Water Pollution Control Federation, Vol. 56, No. 8, p 970-976, August, 1984. 5 Fig, 5 Tab, 25 Ref. NOAA project R/35-03, grant NA81AA-D-00009.

Descriptors: *Wastewater treatment, *Food processing industry, Suspended solids, Coagulants, Acidity, Pilot plants.

A study was made of suspended solids removal from seafood processing wastewater. The initial phase involved a series of lab and pilot plant tests using hydrocyclone as solids-liquid separation devices. The hydrocyclones followed by coagulant addition and dewatering can produce a clarified effluent low in particulates and concentrate TSS by a factor of approximately 100. Chitosan and ferric sulfate were effective coagulants for crab, salmon, and shrimp processing wastewaters. The

proposed system may not be economical for Alaskan processors, but changes in the by-product market can alter this conclusion. (Baker-IVI)
W85-02578

INDUSTRIAL WASTEWATER TREATMENT WITH WATER REUSE AT A COAL-FIRED GENERATING STATION,
Gilbert/Commonwealth, Reading, PA.
J. F. Wagner, C. R. Kertell, and T. E. Strittmatter.
Journal of the Water Pollution Control Federation, Vol. 56, No. 8, p 977-982, August, 1984. 4 Fig, 5 Tab.

Descriptors: *Wastewater treatment, *Ash, *Seward Station, *Pennsylvania, Industrial waste, Powerplants.

Wastewater studies were performed in 1976 at Seward Station, Pennsylvania, in preparation for upgrading the waste treatment system. The present station consists of three coal-fired boilers and two turbine with a total rated capacity of 200 MW. The studies consisted of flow determination, discharge sampling and analyses, laboratory-scale treatability tests, waste collection schemes, conceptual treatment design and a preliminary report. The study recommended construction of a waste treatment and ash handling system which began in July 1978, and was completed in December 1980. Since the waste treatment facility start-up the plant has performed very well with minimal operator attention. There have been no problems that required additional engineering services other than normal plant maintenance. There have been no reports of operational problems or discharges that were not in compliance. Limits for suspended solids, pH, oil and grease and temperature analyses of the discharge to the Conemaugh River have been successfully met. (Baker-IVI)
W85-02579

ACHIEVING WASTEWATER COMPLIANCE WITH REDUCED GRANT SUPPORT,
Process Applications, Inc., Fort Collins, CO.
B. A. Hegg, J. R. Schultz, C. S. Zickefoose, and F. Matter.
Journal of the Water Pollution Control Federation, Vol. 56, No. 9, p 1007-1013, September, 1984. 5 Tab, 13 Ref.

Descriptors: *Wastewater treatment, *Management, Water quality control, Compliance, Financing.

The applicability of a plant-specific aproach for improving publicly owned wastewater treatment works (POTW) performance and compliance was completed. The results indicate that competing priorities prevent owners and administrators from gaining a clear focus and understanding of the performance objective of their wastewater treatment facilities. The required clarity has been masked by the complex interrelationship that exists between regulatory agency activities and local community reactions. This relationship involves the broad areas of technical assistance, construction grants, and enforcement. Focusing local priorities on achieving adequate treatment must be supplemented with an awareness of a probable need for increased local financial responsibility. (Baker-IVI)
W85-02582

NITRITE BUILD-UP IN ACTIVATED SLUDGE RESULTING FROM TEMPERATURE EFFECTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
C. W. Randall, and D. Buth.
Journal of the Water Pollution Control Federation, Vol. 56, No. 9, p 1039-1044, September, 1984. 3 Fig, 5 Tab, 16 Ref.

Descriptors: *Nitrites, *Temperature effects, *Activated sludge process, *Nitrification, Wastewater treatment, Nitrates, Sludge.

Factors which suppress nitrification in the activated sludge process and, in particular, factors that have a greater impact on nitrate formation than on nitrite formation, were investigated. Temperature had a greater effect on nitrate formation than on nitrite formation, giving rise to a critical temperature for each system studied at which the rate of nitrite formation exceeds the rate of nitrate formation. Under these circumstances, the formation of nitrate becomes the rate-controlling step. The apparent critical temperatures for the laboratory-scale and full-scale reactors were different, 14 and 12 C, respectively. Different temperatures for nitrification failure have been reported. The reason for the difference in critical or failure temperatures is not fully understood, but probably results from chemical differences in the supernatant, especially pH. It is also possible that the dominant nitrification species differ from plant to plant, and they have differing temperature requirements, which results in different critical temperatures. (Baker-IVI)
W85-02585

NITRITE BUILD-UP IN ACTIVATED SLUDGE RESULTING FROM COMBINED TEMPERATURE AND TOXICITY EFFECTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
C. W. Randall, and D. Buth.
Journal of the Water Pollution Control Federation, Vol. 56, No. 9, p 1045-1049, September, 1984. 4 Fig, 3 Tab, 17 Ref.

Descriptors: *Activated sludge process, *Nitrite, *Temperature effects, *Nickel, Metals, Toxicity, Wastewater treatment, Sludge, Nitrification.

The combined effects of temperature and toxicity on nitrification were examined, specifically to determine whether or not a synergistic inhibitory effect could be demonstrated. Data from other full-scale plants indicated that the initial inhibitory effect could be an increase in effluent nitrite concentration. The addition of nickel proved more toxic to nitrate formers than to nitrite formers and its presence at moderate concentrations could result in a build-up of nitrites in activated sludge systems. The inhibitory effects of nickel on nitrification was greater at 14 C than at 17 or 30 C. Therefore, there is a synergistic inhibitory effect between temperature and nickel toxicity for nitrification. The toxic effects of nickel on activated sludge should be evaluated on the basis of the nickel-to-MLVSS (mixed liquor volatile suspended solids) ratio rather than the concentration of the nickel alone. (Baker-IVI)
W85-02586

NITRIFICATION OF ANAEROBICALLY TREATED COAL GASIFIER EFFLUENT,
Georgia Inst. of Tech., Atlanta. Dept. of Civil Engineering.
F. Lu, W. H. Cross, E. S. K. Chian, F. G. Pohland, and H. Gao.
Journal of the Water Pollution Control Federation, Vol. 56, No. 9, p 1050-1058, September, 1984. 5 Fig, 4 Tab, 24 Ref. DOE grant DE-AC18-81FC10297.

Descriptors: *Nitrification, *Wastewater treatment, *Ammonia, *Coal gasification, Anaerobic conditions.

A biological nitrification process was evaluated for removal of high concentrations of ammonia from anaerobically treated coal gasifier effluent. The single stage activated sludge nitrification system was successfully used for the removal of ammonia-nitrogen from the effluent of the anaerobic filter treating 10% coal gasification wastewater containing as much as 601 mg total Kjeldahl nitrogen (TKN)/L. Performance of the nitrification system was significantly dependent on the effluent quality of the anaerobic fluidized bed activated carbon filter. Under the normal 31 day solids retention time (SRT) and loadings of 0.15 kg ammonia-N/kg MLVSS/day and 0.35 kg COD/kg MLVSS/day, removals of 97% TKN, 91% TOC and 95% COD were achieved. For effective nitrification of the coal gasification wastewater, solids retention time should be more than 22 days. Residual phenol and o-cresol could be completely removed in the nitrification system in all cases, but m-cresol and p-cresol removal depended on their influent conc trations. Addition of powdered activated carbon the nitrification system or periodic replacement a portion of granular activated carbon in the ana obic filter removed or reduced the concentrat of the inhibitory compounds and eliminated inh tion of nitrification. Nitrogen balances indica that the total effluent nitrogen accounted 90.2% of influent TKN; the unaccounted nitro was attributed to microbial cell growth requi ments and possible losses from denitrification, stripping, and analytic error. Alkalinity consun tion averaged 5.8 mg alkalinity consumed/mg a monia-nitrogen removed. (Baker-IVI)
W85-02587

WASTEWATER TREATMENT WITH AQUAT PLANTS: ECOTYPIC DIFFERENTIATION TYPHA DOMINGENSIS SEEDLINGS,
Commonwealth Scientific and Industrial Resear Organization, Griffith (Australia). Centre for I gation Research.
I. von Oertzen, and C. M. Finlayson.
Environmental Pollution (Series A), Vol. 35, N 3, p 259-269, 1984. 3 Fig, 3 Tab, 23 Ref.

Descriptors: *Cattails, *Salinity, *Biologi wastewater treatment, Aquatic plants, Calciu Magnesium, Plant growth, Potassium, Phosphor Nitrogen.

As part of a program to determine the ability aquatic plants to treat saline wastewater, the Na tolerance of seedlings from two populations Typha domingensis was examined under gla house conditions. One population (Coorow) ca from an NaCl-affected area while the seco (Mitta Mitta Bore) was from an area affected Ca and Mg salts. The Coorow seedlings gre better than those from Mitta Mitta Bore under NaCl range of 0 to 50 mm, with most grow occurring at 10 and 25 mM NaCl. The experime showed that ecotype differences in response NaCl occur, but did not determine the upper lev of tolerance of either population. While increas plant succulence was recorded, decreased leaf:ro ratios were not. While there was a decrease in t K, N, and P contents of the plant tissues the Na contents increased. The K, N, and P values wer however, still relatively high. (Author's abstrac
W85-02590

EVALUATION OF M-T7 AGAR AS A FECA COLIFORM MEDIUM,
Montana State Univ., Bozeman. Dept. of Microb ology.
For primary bibliographic entry see Field 5A.
W85-02598

5E. Ultimate Disposal Of Wastes

NATIONAL SURVEY OF ELEMENTS AN OTHER CONSTITUENTS IN MUNICIPA SEWAGE SLUDGES,
Pennsylvania State Univ., University Park. Pest cide Research Lab.
R. O. Mumma, D. C. Raupach, J. P. Waldman, S. S. C. Tong, and M. L. Jacobs.
Archives of Environmental Contamination an Toxicology, Vol. 13, No. 1, p 75-83, January, 198 3 Tab, 30 Ref.

Descriptors: *Sludge, *Polychlorinated biphenyl *Metals, *Nitrosamines, Gamma radiation, Hydro gen ion concentration, Calcium, Iron, Wastewate treatment, Carcinogens, Land disposal, Sludge di posal, Heavy metals.

Fifty-nine elements, polychlorinated biphenyl volatile N-nitrosamines and gamma emission wer determined in 30 sewage sludges from 23 Amer can cities using several analytical methods. Rela tively high concentrations of toxic metals wer found in sludges from specific municipal plants The pH and levels of calcium and iron in certain o the sludges appeared to reflect the addition of lime ferric chloride and/or spent pickle liquor durin sewage treatment. Of 15 sludges analyzed, the car cinogen, N-nitrosodimethylamine was detected i

14 and various other N-nitrosamines in 12 of them. Based on present federal guidelines, only 7 of the 30 municipal sludges analyzed would be considered suitable for land application owing to their elevated content of one or more heavy metals. (Author's abstract)
W85-02192

SEWAGE SLUDGE FOR CULTIVATING FRESHWATER ALGAE AND THE FATE OF HEAVY METAL AT HIGHER TROPHIC ORGANISMS; IV. HEAVY METAL CONTENTS IN DIFFERENT TROPHIC LEVELS,
Chinese Univ. of Hong Kong, Shatin. Dept. of Biology.
M. H. Wong, and F. Y. Tam.
Archiv fur Hydrobiologie, Vol. 100, No. 4, p 423-430, July, 1984. 1 Tab, 34 Ref.

Descriptors: *Sludge disposal, *Heavy metals, *Algal growth, Trophic level, Sludge, Manganese, Iron, Copper, Zinc, Pesticides, Recycling, Carp, Shrimp.

Aqueous extracts of sewage sludge were able to support excellent growth of the unicellular green alga, Chlorella pyrenoidosa with a high protein content. Although sludge-grown algae accumulated a substantial amount of various heavy metals (Mn, Fe, Cu, and Zn), organisms in the high trophic level (Caridina sp., freshwater shrimp and Cyprinus carpio, common carp) did not concentrate these metals. Possible transference of other toxic substances, such as pesticides, must also be considered in using waste materials for such purposes. It may be possible to cultivate algae directly in the sewage ponds or sludge settling ponds. This process may reduce time, space and effort being spent in the operations of sludge extraction and the establishment of new culture tanks. Perhaps shrimp or fish could also be reared in the same tank used for algal culture. Another alternative is to add sewage sludge into fish ponds as fertilizer for enriching the nutrient contents, accelerating algal growth and subsequently leading to higher fish yield via other organisms such as rotifers and crustaceans. Recycling of organic wastes for producing edible protein would be highly desirable in the future. (Baker-IVI)
W85-02237

EVALUATING ENCLOSED COMPOSTING SYSTEMS,
Metcalf and Eddy of New York, NY.
J. Anderson, M. Ponte, S. Biuso, D. Brailey, and J. Kantorek.
BioCycle, Vol. 25, No. 5, p 20-25, July-August, 1984. 5 Fig.

Descriptors: *Financial aspects, *Sludge disposal, *Composting, Odor control, Waste management.

The most cost effective solution to a sludge management problem existing in Clinton County and the City of Plattsburgh, New York was to use the open static pile method. Residents were opposed due to possible odor and dust problems. An enclosed composting system was viewed as necessary. Composting systems investigated included agitated solids bed system, silo systems, tunnel systems, and enclosed static pile. The functional analysis carried out considered the following points: total cost, quality of finished compost, operational experience, mechanical reliability, process control/reliability/flexibility, worker comfort, flexibility for future expansion, and aesthetic impact. The agitated bed type system was identified as the recommended process alternative. The two sub-alternatives of this process were reviewed - the circular and rectangular bin configurations. Due to the requirement of an enclosed system, a significant installed cost advantage was observed for enclosing the circular configuration, using a one piece geodesic dome. Thus the circular agitated bed system was recommended on the basis of this cost advantage. (Baker-IVI)
W85-02299

ECONOMIC COMPARISON OF COMPOSTING AND DUAL UTILIZATION,
R. D. Kuchenrither, W. J. Martin, D. G. Smith, and P. J. Psaris.
BioCycle, Vol. 25, No. 5, p 33-37, July-August, 1984. 10 Tab.

Descriptors: *Wastewater treatment, *Sludge disposal, *Denver, *Colorado, Composting, Economic factors, Decision making, Planning, Evaluation, Anaerobic conditions, Land disposal, Dual utilization.

The Metropolitan Denver Sewage Disposal District No. 1 provides wastewater treatment for approximately 1.5 million people. In 1983 the District adopted a dual utilization approach consisting of a multifaceted plan with two disposal alternatives: application of thickened, anaerobically digested sludge to agricultural land during the spring, summer, and fall; and windrow composting during the winter and periods of inclement weather. The selection of dual utilization was based on the recommendations of a sludge management plan which evaluated several sludge disposal alternatives for handling 100 dry tons of anaerobically digested sludge per year. These alternatives included dual utilization, windrow composting, land application with winter storage and incineration. The costs of additional equipment make the unit capital costs for dual utilization higher than those for composting. The operating costs for dual utilization are less than those of year round composting. Maintenance costs for dual utilization are more than double those for composting. The overall cost is approximately 10% less with composting than dual utilization. Increased reliability and flexibility plus the usefulness of a land application program made the choice swing to dual utilization. (Baker-IVI)
W85-02300

USING PILOT PLANTS TO DESIGN FACILITIES,
Camp, Dresser and McKee, Inc., Boston, MA.
J. F. Donovan, and D. F. Young.
BioCycle, Vol. 25, No. 5, p 46-48, July-August, 1984. 4 Fig.

Descriptors: *Pilot plants, *Decision making, *Planning, *Wastewater treatment, Composting, Aeration, Sludge disposal.

Pilot plant studies can be an effective method of improving the design of composting facilities. In Mansfield, Massachusetts a 3 mgd advanced wastewater treatment facility designed for seasonal nitrification and phosphorus removal is now under construction, to be operational in the spring of 1986. In November 1981 pilot composting studies were undertaken. The first study used filter pressed cake from a treatment plant with similar wastewater and sludge processes. The pilot test revealed that the shredder and the front-end loader were not appropriate devices for breaking up filter pressed cake. The tests also showed that despite inadequate mixing of sludge cake and woodchips, adequate temperature could be achieved with careful control of aeration rates. As a result of additional pilot tests, a materials balance was developed for the proposed facility. In Barrington, Rhode Island pilot tests showed that the planned mix of woodchips and sludge was good and exhibited a high void ratio that should aid in aeration. In Amherst, Massachusetts, a composting feasibility study resulted in a pilot program which showed that the compost product would probably qualify for a Type I classification under the State's land application regulation. A marketing survey was then conducted which revealed definite interest in that area for a compost like material. (Baker-IVI)
W85-02302

STABILIZATION OF SLUDGE FROM AN OXIDATION DITCH,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
J. T. Novak, M. P. Eichelberger, S. K. Banerji, and J. Yaun.
Journal of the Water Pollution Control Federation, Vol. 56, No. 8, p 950-954, August, 1984. 1 Fig, 2 Tab, 6 Ref.

Descriptors: *Sludge, *Land disposal, *Stability, *Oxidation ditch, Waste disposal, Bioindicators, Aerobic digestion.

The stability of sludge from an oxidation ditch operated over a range of sludge ages was evaluated. The stability data could then be used to determine if waste sludge from high sludge age or extended air processes could be directly land applied, and if not, the amount of further processing needed to achieve stability. Waste sludge from an oxidation ditch became increasingly more stable with regard to putrescibility as the sludge age increased. Indicator organism levels were influenced primarily by the influent concentration rather than the process sludge age. The specific oxygen uptake rate was an excellent indicator of stability with regard to putrescibility. The volatile solids reduction parameter contained in the regulations is not reasonable and for sludges from high sludge age processes may be unattainable. Indicator organism reductions by aerobic digestion were erratic and unpredictable. To ensure a reduction of two orders of magnitude at 20 C, required aeration times in excess of 40 days. Indicator organism reductions were greatly decreased at low temperatures. (Baker-IVI)
W85-02575

SLUDGE DEWATERING AND DISPOSAL IN THE PULP AND PAPER INDUSTRY,
Crown Zellerbach Corp., Camas, WA.
H. R. Amberg.
Journal of the Water Pollution Control Federation, Vol. 56, No. 8, p 962-969, August, 1984. 2 Fig, 9 Tab, 6 Ref.

Descriptors: *Sludge dewatering, *Sludge disposal, *Wastewater treatment, Sludge processes, Land disposal, Landfills, Pulp and paper industry.

Over 95% of the US pulp and paper industry capacity receives primary and secondary treatment. Overall BOD and TSS removal exceeds 90%. One drawback is the large amount of primary and secondary sludges generated. The key to minimizing sludge disposal costs is the dewatering technology used. The most common mechanical dewatering technologies used by the industry include vacuum filters, belt presses and solid bowl centrifuges. There is a trend toward use of belt presses which can dewater secondary sludges to 12 to 14% solids, primary sludges to 35% solids, and primary/secondary sludge mixtures to 16 to 25% solids. Polymer costs for mechanical dewatering vary widely with sludge characterisics. About 87% of the pulp and paper mill sludges produced are land filled and 13% are disposed of by incineration, composting, sale, and land application. Total dewatering and disposal costs for pulp and paper mill sludges vary widely, but they can account for about 40 to 45% of total wastewater treatment plant costs. Although a number of innovative systems are being used, the most widely used disposal systems for the next 10 yr will be landfill, incineration, and land application. (Baker-IVI)
W85-02577

5F. Water Treatment and Quality Alteration

AEROMONAS SOBRIA IN CHLORINATED DRINKING WATER SUPPLIES,
Oregon State Univ., Corvallis. Dept. of Microbiology.
M. W. LeChevallier, T. M. Evans, R. J. Seidler, O. P. Daily, and B. R. Merrell.
Microbial Ecology, Vol. 8, No. 4, p 325-333, 1982. 1 Fig, 2 Tab, 28 Ref. NOAA grant 04-8-M01-71.

Descriptors: *Aeromonas, *Drinking water, *Chlorination, *Oregon, Coliforms, Pathogenic bacteria, Water temperature, Bacterial analysis, Public health, Standard plate count.

Aeromonas, which has some virulence-associated factors, may occur in distribution water when total coliforms are absent. Aeromonas sp. were recovered from over 27% of 183 chlorinated drinking water samples collected from the finished water

supply of an Oregon coastal community during an 18-month period. Aeromonas was most frequently recovered during the warmer months, May through October, when water temperatures ranged from 15-20 C. Sixteen of 20 isolates tested elicited a cytotoxic response by Y-1 mouse adrenal cells. None of the strains was either enterotoxigenic by the rabbit ligated ileal loop assay, exhibited piliation, or show significant mannose resistant adherence to human buccal cells. The Aeromonas isolates were identified as A. sobria and were resistant to ampicillin and susceptible to chloramphenicol, kanamycin, streptomycin, and tetracycline. Total coliform levels did not correlate with Aeromonas densities in distribution water. Over 89% of the samples containing Aeromonas were negative for coliforms by the most probable number technique. In one instance the number of Aeromonas was 1,900/100 ml, yet no coliforms could be detected by either the membrane filtration or most probable number techniques. A significant correlation ($P < .001$) existed between standard plate count levels and Aeromonas. When high densities of Aeromonas (>100 bacteria/100 ml) were found in drinking water, the standard plate count exceeded 100 organisms/ml in 79% of the samples. (Moore-IVI)
W85-02187

WATERBORNE TRANSMISSION OF CAMPYLOBACTER ENTERITIS,
Center for Infectious Diseases, Atlanta, GA. Div. of Bacterial Diseases.
D. N. Taylor, M. Brown, and K. T. McDermott.
Microbial Ecology, Vol. 8, No, 4, p 347-354, 1982. 31 Ref.

Descriptors: *Campylobacter, *Enteritis, *Epidemiology, *Wyoming, *Illinois, Public health, Pathogenic bacteria, Surface waters, Water distribution, Animals.

Campylobacter jejuni is an important cause of human diarrheal disease throughout the world and like Salmonella enteritidis, has a large animal reservoir which includes most of man's domestic animals. Until recently, it has been difficult to trace the chain of transmission from animals to man because of inadequate environmental sampling techniques and means to distinguish strains. Recent improvements in these techniques have made environmental studies more feasible in 2 water-related outbreaks. In 1 study, C. jejuni was found to be an important cause of sporadic, summertime diarrheal disease among hikers in national wilderness areas of Wyoming. In this setting, illness was significantly associated with drinking untreated surface water. Subsequently C. jejuni was isolated from surface water, including mountain streams, and from animals in the area. Some of the environmental isolates were serotypically identical to strains isolated from humans. A second occurred as a result of an outbreak of Campylobacter enteritis in a community in northern Illinois which was epidemiologically associated with the community water system. Campylobacter jejuni was isolated from several surface water sources and from the implicated water system. These studies demonstrate that environmental isolation of C. jejuni is now possible and may add to our understanding of disease transmission. (Author's abstract)
W85-02188

EVALUATION OF GIARDIA CYST REMOVAL VIA PORTABLE WATER FILTRATION DEVICES,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
S. D. Schmidt, and P. G. Meier.
Journal of Freshwater Ecology, Vol. 2, No. 5, p 435-439, August, 1984. 2 Fig, 8 Ref.

Descriptors: *Filtration, *Water treatment, *Drinking water, *Giardia, Public health, Water quality control, Water treatment.

Evaluations were made of two portable water filtration devices for their effectiveness in removing potentially pathogenic Giardia cysts using a rigorous testing schedule that simulated in-field use. The portable filtration devices which were evaluated employ a silver-impregnated ceramic filter element of submicron porosity. The smaller, hand-held unit measures 25 cm in length, weights 650 g and is capable of filtering up to 0.75 liters of water per minute. The large device is 58 cm in length, weighs 4.9 kg and yields up to 8 liters per minute. Both are manually operated. No difficulties were encountered during the testing schedule in filtering the dense test challenge suspensions through the portable devices. Both the larger and smaller units were very efficient in retaining the Giardia cysts and other challenge protozoans. Direct evidence of cyst destruction during concentration/recovery of control preparations was observed. Centrifugal stress and inadvertent drying of membrane filters were most often responsible for control recoveries that averaged 66%. (Baker-IVI)
W85-02244

GAC TREATMENT COSTS: A SENSITIVITY ANALYSIS,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
R. M. Clark, R. G. Eilers, and B. W. Lykins, Jr.
Journal of Environmental Engineering, Vol. 110, No. 4, p 737-750, August, 1984. 9 Fig, 10 Tab, 7 Ref.

Descriptors: *Activated carbon, *Economic aspects, *Water treatment, Design criteria, Cost analysis, Drinking water.

Activated carbon is effective for removing a broad spectrum of organics from drinking water but is most effective for removing high molecular weight compounds. The sensitivity of granular activated carbon system costs to changes in certain operating variables is examined. Several variables have been identified as important. These include choice of system configuration, loading rate and size of system, reactivation frequency, interest rate and life of system, local construction and operating costs, inflation, and carbon use rate. With the help of the curves presented, these sensitivities can be studied. Based on this analysis any design changes that can use the capital invested in the system more efficiently will minimize the cost. For a given empty bed contact time, fewer contactors of greater volume yield minimum cost. Based on activated carbon use rate, however, bigger is not better. The relationship between activated carbon use rate, activated carbon loss and reactivation frequency must be studied carefully. Using a cheaper activated carbon with higher losses could mean increased activited carbon losses and more frequent reactivation. (Baker-IVI)
W85-02274

USE OF ZEOLITE TO REMOVE TOXIC SUBSTANCES FROM NITROGEN METABOLISM OF FISHES,
Moscow State Univ. (USSR). Dept. of Biology.
A. S. Konstantinov, and M. Yu. Pelipenko.
Journal of Ichthyology, Vol. 23, No. 6, p 159-161, 1983. 2 Tab, 8 Ref.

Descriptors: *Fish farming, *Nitrogen, *Adsorption, *Zeolite, Clinoptilolite, Nitrates, Nitrites, Carp, Danio.

In efforts to improve the quality of water for raising fishes, the efficiency of purifying water from nitrogenous compounds through their adsorption by zeolite was investigated. The experimental fish used were carp yearlings and immature striped danio. Clinoptilolite, one of the most common zeolites, was used as the adsorbent and was applied to the aquaria with carp and danio at the rate of 500 and 100 g. respectively. In the experiment with carp a chain of four aquaria was used which were connected with each other by a siphon. Nitrate and nitrite concentrations in aquarium no. 1 that had the purest water did not significantly increase over 30 days. In aquarium no. 2, concentration of both these nitrogenous compounds increased significantly and towards the end of the experiment, nitrite concentration was higher than OST standards. In the fourth aquarium receiving the largest quantity of both the nitrogenous compounds, but having the adsorbent in the bottom, nitrite and nitrate concentrations were almost at the same low level as in the first aquarium. The detoxification effect was clearly shown by the increase in fish growth rate. Similar results were observed in the experiments with danio. Apparently by absorbing ammonia salts, clinoptilolite inhibits formation of nitrates and nitrites as the products of catabolism of ionized ammonia and thus, pollution by toxic products of nitrogen metabolism is greatly reduced. (Baker-IVI)
W85-02281

ELECTROANALYTICAL METHODS FOR MONITORING POTABILIZATION PROCESSES,
Florence Univ. (Italy). Inst. of Analytical Chemistry.
G. Piccardi.
Science of the Total Environment, Vol. 37, No. 1, p 101-105, July, 1984. 1 Tab. 21 Ref.

Descriptors: *Water analysis, *Potable water, *Water treatment, *Electrochemistry, Drinking water, Water quality control, Monitoring, Chlorine, Chlorine dioxide, Ozone, Hypochlorite, Chlorite, Potentiometry, Disinfection.

Potentiometric, amperometric and coulometric methods are evaluated for monitoring water potabilization processes. Water potabilization is carried out by the addition of a gas such as chlorine, chlorine dioxide, ozone or by the addition of a solution of hypochlorite or chlorite. The most widely used method for monitoring the potabilization process is the amperometric one in which the concentration is measured by the current flowing through a cell containing one polarized electrode. This current, as a first approximation, is proportional to the area of the cathode and to the potabilizing agent concentration and inversely proportional to the thickness of the diffusion layer. While not widely used, the coulometric method is also viable working under the flow analysis technique. The chlorine solution to be analyzed is placed into an electrolysis cell where it reacts quantitatively with Fe(II) that has been generated electrolytically from Fe(III) that has been added with a peristaltic pump. Substances oxidizing Fe(II) interfere in the determination of chlorine. The main problems still to be resolved in the use of electrochemical techniques are specificity and long term stability. (Baker-IVI)
W85-02313

THRESHOLD ODOUR CONCENTRATIONS OF ODOROUS ALGAL METABOLITES OCCURRING IN LAKE WATER,
Helsinki Univ. (Finland). Dept. of Limnology.
P.-E. Persson, and F. Juttner.
Aqua Fennica, Vol. 13, p 3-7, 1983. 2 Fig, 1 Tab, 25 Ref.

Descriptors: *Odor-producing algae, *Lakes, *Reservoirs, Odors, Organoleptic properties, Algae, beta-Cyclocitral, Trimethylcyclohexenone, Trimethylcyclohexanone, Trimethylcyclohexene, Octadiene, Methylpentenal, Drinking water, Water quality control.

Threshold odor concentrations in water were determined for beta-cyclocitral, 2,6,6-trimethylcyclohex-2-en-1-one, 2,2,6-trimethylcyclohexanone, 1,3,3-trimethylcyclohexene, octa-1,3-diene and 2-methylpent-2-enal. Each of these compounds occurs in natural waters and is of biogenic origin. The total organic carbon values obtained for each compound are presented along with the odor characteristics. The relationship between odor intensity and concentration of beta-cyclocitral is demonstrated. Beta-cyclocitral can be isolated from blooms of Microcystis wesenbergii. Minor concentrations have been found during blooms of Synura uvella. Octa-1,3-diene can be isolated from a culture of Asterionella formosa. 2-Methylpent-2-enal was detected in the odor concentrate isolated from water of the Haltern reservoir rich in Tetraselmis sp. (Baker-IVI)
W85-02389

REMOVAL OF SEDIMENT PARTICLES BY VORTEX BASIN,

Tampere Univ. of Technology (Finland).
For primary bibliographic entry see Field 8B.
W85-02391

HISTORY OF THE ATTEMPTED FEDERAL REGULATION REQUIRING GAC ADSORPTION FOR WATER TREATMENT,
Houston Univ., TX. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6E.
W85-02399

SURVEY OF PROBLEMS WITH REVERSE OSMOSIS WATER TREATMENT,
Tennessee Technological Univ., Cookeville.
T. N. Eisenberg, and E. J. Middlebrooks.
Journal of the American Water Works Association, Vol. 76, No. 8, p 44-49, August, 1984. 1 Fig, 2 Tab. 4 Ref.

Descriptors: *Water treatment, *Reverse osmosis, *Surveys, Membrane processes, Cost factors, Water treatment.

Operators of 28 reverse osmosis (RO) water treatment plants were surveyed to obtain information on the types and causes of problems with such treatment installations. Reasons given for closing RO plants were the availability of a municipal water supply, obtaining a better quality water source, the cost of membrane replacement, the high cost of producing quality water, and a change in feedwater quality as a result of failure in well construction. Water requirements ranged from 0.0015 to 16.3 ML/d (0.0004 to 4.3 mgd). Storage capacities, available at all sites, ranged from 0.76 to 18.9 ML to unlimited due to the underground injection possibility. Some 95% of the plants that reported using pretreatment added some type of chemical to treat the feedwater. Pumping requirements were met most frequently by centrifugal multistage process pumps. Feedwater electroconductivity ranged from 430 to 38,000 microS/cm. Cellulose acetate membranes were used at 15 sites (71%) and polyamide was used at 6 (29%). Methods of brine disposal varied with geographic location. Only one plant did not posttreat product water. Posttreatment disinfection was practiced at 17 (90%) of the plants. Decarbonation or degasification was performed at all 19 installations. (Baker-IVI)
W85-02400

DETERMINING INTERNAL CORROSION POTENTIAL IN WATER SUPPLY SYSTEMS (COMMITTEE REPORT).
Southern California Metropolitan Water District, Los Angeles.
Journal of the American Water Works Association, Vol. 76, No. 8, p 83-88, August, 1984. 1 Fig, 4 Tab, 5 Ref.

Descriptors: *Corrosion, *Water conveyance, *Drinking water, Water quality control, Decision making, Planning.

A method is presented for analyzing and evaluating the internal corrosion potential of water systems so that the purveyor can solve various problems of corrosion within a system. An initial evaluation is offered of the characteristics of a water supply along with laboratory analyses, field investigations, and the development of a corrosion control strategy. The report converts easily to a manual for community water system operators. It provides guidance in evaluating potential internal corrosion problems for water system operators with limited technical resources. (Baker-IVI)
W85-02403

ACCOUNTABILITY MANAGEMENT BRINGS REVENUE INCREASES,
Springfield City Water, Light and Power, IL.
For primary bibliographic entry see Field 6B.
W85-02486

EFFECT OF BAQUACIL ON PATHOGENIC FREE-LIVING AMOEBAE (PFLA) 3. INCREASED BAQUACIL CONCENTRATION AND EXPOSURE TIME IN THE PRESENCE OF BACTERIA,
Massey Univ., Palmerston North (New Zealand). Dept. of Microbiology and Genetics.
M. W. Dawson, T. J. Brown, C. J. Biddick, and D. G. Till.
New Zealand Journal of Marine and Freshwater Reseach, Vol. 18, No. 1, p 53-56, 1984. 4 Fig, 14 Ref.

Descriptors: *Disinfection, *Water treatment, *Baquacil, *Amoeba, *Bacteria, Water quality control, Chlorine.

Baquacil is being studied as an alternative pathogenic free-living amoebae disinfectant to chlorine. Baquacil was tested against axenic and monoxenically grown pathogenic free-living amoeba cultures (Naegleria and Acanthamoeba spp.) fed with bacteria. When the initial concentration of Baquacil and/or the exposure time were increased, survival rates were reduced. Monoxenically cultured amoebae created a greater Baquacil demand than amoebae grown axenically. No marked difference in sensitivity was apparent between Naegleria and Acanthamoeba spp. (Baker-IVI)
W85-02506

INACTIVATION OF NAEGLERIA AND GIARDIA CYSTS IN WATER BY OZONATION,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
G. B. Wickramanayake, A. J. Rubin, and O. J. Sproul.
Journal of the Water Pollution Control Federation, Vol. 56, No. 8, p 983-988, August, 1984. 7 Fig, 4 Tab, 22 Ref. EPA grant R-808150-02-0.

Descriptors: *Water treatment, *Drinking water, *Ozonation, *Naegleria, *Giardia, Ozone, Disinfection, Water quality control, Protozoa, Public health, Water temperature, Hydrogen ion concentration.

The effect of ozone concentrations, at various pH and temperature regimes, on the rate and extent of inactivation of protozoan cycts was evaluated. Within the reported range of temperatures, pH, and ozone concentrations, the cyst inactivation kinetics deviated from Chick's law because there was an initial lag period. The rate of inactivation increased during this lag period and then declined where the inactivation rate was directly proportional to the number of viable cysts. At 99% inactivation, the results were well represented by Watson's law with the coefficient of dilution being close to one. Cysts of N. gruberi were more resistant to aqueous ozone than those of G. muris. With 0.2 mg/L of ozone at 25 C and pH 7, the contact times required for 99% kill were 7.5 and 1.05 minutes, respectively. Inactivation rates for both organisms in the pH range of 5 to 8 were not significantly different. At pH 9 ozone was relatively less effective for N. gruberi, whereas G. muris were more readily killed. The cysticidal effeciency of ozone increased with temperature. Ozone seemed more effective than free chlorine for cyst inactivation. Most of the protozoan cysts are more resistant than bacteria and viruses to ozone. In ozone disinfection at room temperature and neutral pH, G. muris cysts are comparable to viruses and bacteria that exhibit high resistance. (Baker-IVI)
W85-02580

EVIDENCE FOR THE ROLE OF COPPER IN THE INJURY PROCESS OF COLIFORM BACTERIA IN DRINKING WATER,
Montana State Univ., Bozeman. Dept. of Microbiology.
M. J. Domek, M. W. LeChevallier, S. C. Cameron, and G. A. McFeters.
Applied and Environmental Microbiology, Vol. 48, No. 2, p 289-293, August, 1984. 3 Fig, 3 Tab, 32 Ref. EPA grant R807092.

Descriptors: *Copper, *Bioindicators, *Coliforms, *Injured coliforms, *Drinking water, Cadmium, Lead, Heavy metals, Statistical models, Escherichia.

Low levels of copper in chlorine-free distribution water caused injury of coliform populations. Monitoring of 44 drinking water samples indicated that 64% of the coliform population was injured. Physical and chemical parameters were measured, including three heavy metals (Cu, Cd, and Pb). Copper concentrations were important, ranging from 0.007 to 0.54 mg/liter. Statistical analyses of these factors were used to develop a model to predict coliform injury. The model predicted almost 90% injury with copper concentration near the mean observed value (0.158 mg/liter) in distribution waters. Laboratory studies with copper concentrations of 0.025 and 0.050 mg/liter in an inorganic carbon buffer under controlled conditions of temperature and pH caused over 90% injury within 6 and 2 days, respectively. Studies of the metabolism of injured Escherichia coli cells indicated that the respiratory chain is at least one site of damage in injured cells. (Author's abstract)
W85-02594

ISOLATION OF AEROMONAS HYDROPHILA FROM A METROPOLITAN WATER SUPPLY: SEASONAL CORRELATION WITH CLINICAL ISOLATES,
Princess Margaret Children's Medical Research Foundation, Perth (Australia).
V. Burke, J. Robinson, M. Gracey, D. Peterson, and K. Partidge.
Applied and Environmental Microbiology, Vol. 48, No. 2, p 361-366, August, 1984. 7 Fig, 1 Tab, 29 Ref.

Descriptors: *Perth, *Australia, *Drinking water, *Aeromonas, Public health, Water treatment, Chlorination, Coliforms, Water temperature, Water quality standards, Pathogenic bacteria, Seasonal variation.

The occurrence of Aeromonas spp. in the metropolitan water supply of Perth, Western Australia, Australia, was monitored at several sampling points during a period of 1 year. Water within the distribution system conformed to international standards for drinking water but contained Aeromonas spp. in numbers comparable to those in raw surface water, although this water was free of Escherichia coli. Coliforms and E. coli were found in raw surface waters, and Aeromonas spp. were found in raw water from surface and underground sources. Chemical treatment, followed by chlorination at service reservoirs, resulted in water free of E. coli and a decrease in the number of Aeromonas spp. were found in the greatest numbers in summer. Multiple regression analysis that growth of Aeromonas spp. in chlorinated water was related to water temperature, residual chlorine, and interaction between these variables. The incidence of Aeromonas-associated gastroenteritis, determined from isolates referred for enterotoxin testing, paralleled the pattern of isolation of Aeromonus spp. in water within the distribution systems. It is suggested that the presence of Aeromonas spp. in drinking water needs public health appraisal and that further work should be undertaken to permit reevaluation of standards for the quality of drinking water. (Author's abstract)
W85-02596

ISOLATION OF AEROMONAS SPP. FROM AN UNCHLORINATED DOMESTIC WATER SUPPLY,
Princess Margaret Children's Medical Research Foundation, Perth (Australia).
V. Burke, J. Robinson, M. Gracey, D. Peterson, and N. Meyer.
Applied and Environmental Microbiology, Vol. 48, No. 2, p 367-370, August, 1984. 3 Fig, 24 Ref.

Descriptors: *Australia, *Aeromonas, *Drinking water, Coliforms, Escherichia, Public health, Pathogenic bacteria, Enterotoxins, Hemolysins.

The recovery of Aeromonas spp. from the unchlorinated water supply for a Western Australian city of 21,000 people was monitored at several sampling points during a period of 1 year. Membrane filtration techniques were used to count colonies of Aeromonas spp., coliforms, and Escherichia coli in water sampled before entry to service reservoirs, during storage in service reservoirs, and in distribution systems. Aeromonas spp.

were identified by subculture on blood agar with ampicillin, oxidase tests, and the use of Kaper medium and then were tested for production of enterotoxins and hemolysins. During the same period, two-thirds of all fecal specimens sent for microbiological examination were cultured on ampicillin-blood agar for Aeromonas spp. Recovery of Aeromonus spp. from water supplies at distribution points correlated with fecal isolations and continued during autumn and winter. Coliforms and E. coli were found most commonly in late summer to autumn. This pattern differs from the summer peak of Aeromonas isolations both from water and from patients with Aeromonas spp.-associated gastroenteritis in Perth, Western Australia, a city with a chlorinated domestic water supply. Of the Aeromonas strains from water, 61% were enterotoxigenic, and 64% produced hemolysins. (Author's abstract)
W85-02597

5G. Water Quality Control

UNITED STATES V. OSWEGO BARGE CORPORATION,
Goldstein (Seymour R.), Baltimore, MD.
For primary bibliographic entry see Field 6E.
W85-02177

OPTIMIZING PUMPING STRATEGIES FOR CONTAMINANT STUDIES AND REMEDIAL ACTIONS,
Robert S. Kerr Environmental Research Lab., Ada, OK.
J. F. Keely.
Ground Water Monitoring Review, Vol. 4, No. 3, p 63-74, 1984. 10 Fig, 6 Ref.

Descriptors: *Pumping wells, *Water pollution control, *Groundwater pollution, Groundwater movement, Flow rate, *Hydraulic gradient, Cone of depression, Wells, Pumping strategies.

One of the more common techniques for controlling the migration of contaminant plumes is the use of pumping wells to produce desired changes in local flow rates and hydraulic gradients. When seeking to optimize an array of pumping well locations and discharge rates, it is important to consider the effects that non-ideal aquifer conditions, well construction and demographic constraints produce. Heterogeneous and anisotropic aquifer conditions seriously complicate siting and discharge rate requirements for pumping wells because of the distorted cones of depression that result from withdrawing water in such settlings. Proper screen selection, gravel pack emplacement and well development are crucial factors affecting the operational characteristics and economics of pumping wells; these factors are generally recognized, though often undervalued. The impacts that well depth and diameter, and screen length and position have on the effectiveness of pumping efforts are also often undervalued, with detrimental consequences. Perhaps the most difficult problems to overcome in designing pumping schemes, however, are posed by demographic constraints. Denial of property access, vandalism and the unpredictability of nearby water supply and irrigation pumpage tend to wreak havoc with the best of pumping strategies. (Author's abstract)
W85-02217

DERIVATION OF ENVIRONMENTAL QUALITY OBJECTIVES AND STANDARDS FOR BLACK AND GREY LIST SUBSTANCES,
Water Research Centre, Stevenage (England).
G. Mance.
Chemistry and Industry, No. 14, p 509-512, July, 1984. 1 Fig, 2 Tab, 2 Ref.

Descriptors: *Standards, *Water quality control, *European Community, Water pollution control, Regulations, Heavy metals, Pesticides, Chlorinated hydrocarbons.

The derivation of environmental quality standards as derived from the European Community Dangerous Substances Directive is considered. The Directive is aimed at controlling the discharge of certain toxic substances to the aquatic environment, but it does not specify numeric standards. It identified two categories of substances: List I contains cadmium, mercury, and persistent organochlorine and organophosphorus pesticides. List II contains those metallic elements which are generally less toxic than cadmium and mercury, together with a number of other groups of substances such as plant nutrients and those exerting an oxygen demand. For List I the aim is the elimination of pollution caused by these substances. For List II the aim is to reduce pollution levels. For the common uses of surface waters, environmental quality standards are required for use in consenting discharges. These standards are intended to control pollution sources of pollutants and represent the maximum safe concentration of a particular substance applied at the edge of the area of initial dilution. An environmental quality objective was defined as the requirement that a body of water should be suitable for those uses identified by the controlling authority. Environmental quality standard was defined as that concentration of a substance which must not be exceeded if a specified use of the aquatic environment is to be maintained. In preparing recommendations for EQSs, or maximum safe concentrations, it has to be recognized that current understanding of the toxic effects of even the more commonly occurring dangerous substances is limited. (Baker-IVI)
W85-02227

LEACHATE COLLECTION SYSTEM PERFORMANCE ANALYSIS,
D'Appolonia Waste Management Services, Inc., Pittsburgh, PA.
D. J. Cosler, and R. E. Snow.
Journal of Geotechnical Engineering, Vol. 110, No. 8, p 1025-1041, August, 1984. 10 Fig, 2 Tab, 9 Ref.

Descriptors: *Leachates, *Collection systems, *Waste disposal, *Liners, Pressure, Filtration, Drainage, Hydraulic pressure, Computer models.

The sensitivity of a waste disposal impoundment's leachate collection system performance at a range of design parameter values is investigated based on a computer modeling study. The piezometric head distribution in a vertical cross section of the impoundment is simulated using the finite element method to solve the combined equation of motion and continuity for two-dimensional flow through a saturated anisotropic porous media. The design parameters studied included saturated waste depth, ground slope, underdrain spacing, and the hydraulic conductivities of the waste, clay liner, drainage blanket, and drain filter. Emphasis is placed on the effect of the design parameters on the hydraulic pressure distribution directly above the clay liner which underlies the waste. The three key parameters which appeared to control liner pressure are the drain spacing, the hydraulic conductivity of the drainage layer underlying the waste, and the hydraulic conductivity of the drain filter. The other parameters affect the hydraulic pressure distribution, but not as significantly. The results are directly appliable only for analyzing the future disposal of wastes which are not contained within a synthetic membrane or for evaluating the added protection that can be provided in synthetically lined impoundments to minimize the impacts of a liner rupture. (Baker-IVI)
W85-02261

TWO-DIMENSIONAL TIME-DEPENDENT SIMULATION OF CONTAMINANT TRANSPORT FROM A LANDFILL,
Miami Univ., Coral Gables, FL. Coll. of Engineering.
D. Dasgupta, S. Sengupta, K. V. Wong, and N. Nemerow.
Applied Mathematical Modelling, Vol. 8, No. 3, p 203-209, June, 1984. 10 Fig, 2 Tab, 11 Ref. DOE contract DE-AS05-78EV10133.

Descriptors: *Solute transport, *Model studies, *Landfills, Waste dumps, Leaching, Mathematical models, Public health.

In order to simulate solute transport in flow groundwater a numerical model is developed us finite-difference solutions to the groundwater fl equation and the solute transport equation. T model is applied to problems of groundwater co tamination in a waste-disposal area in Miami, Flo da. Several factors that controlled changes in ir concentrations were successfully integrated by t model which successfully reproduced the reco of contamination observed during a one-ye period. The model was insensitive to chemic parameters, but sensitive to an aquifer dispersi coefficient and the groundwter flow velocity. Th implies that there can be sites where the chemic attenuation can be approximated without a signi cant impact on results. (Baker-IVI)
W85-02272

LAKE RESTORATION BY BIOMANIPUL TION: ROUND LAKE, MINNESOTA, TH FIRST TWO YEARS,
Minnesota Univ., Minneapolis. Limnological R search Center.
J. Shapiro, and D. I. Wright.
Freshwater Biology, Vol. 14, No. 4, p 371-38 August, 1984. 6 Fig, 2 Tab, 39 Ref

Descriptors: *Round Lake, *Minnesota, *Lake re toration, *Biomanipulation, *Rotenone, Fish co trol agents, Rehabilitation, Phytoplankton, Popul tion density, Transparency, Chlorophyll a, Dap nia, Nitrogen, Phosphorus, Grazing pressure.

Rotenone was applied to Round Lake in t autumn of 1980 in order to eliminate predominan ly planktivorous and benthivorous fish. The la was subsequently restocked with higher populatio density of piscivores. The effect of this biomanip lation on the phytoplankton and zooplankton com munities and on total nutrient concentrations w monitored at fortnightly intervals during the sum mers, from May 1980 to September 1982. Th abundance of phytoplankton was much lower aft biomanipulation and was consistent with observe changes in secchi disc transparency, total atten ation coefficient and chlorophyll a concentratio Zooplankters were also less abundant in 1981 an 1982 but the decrease in numbers was more tha offset by the large increase in the mean sizes of th zooplankters present, so that the estimated grazin pressures in 1981 and 1982 were at least double th 1980 value. Daphnia, rare in 1980, became th dominant genus in 1981 and 1982, and a shift t progressively larger-bodied Daphnia species wa observed. Although total nitrogen and total pho phorus levels generally lower after biomanipula tion, their decline could not explain the reductio in phytoplankton abundance which was attributed to the increased grazing pressure. Possible cause of the observed declines in nutrient concentration are discussed. (Author's abstract)
W85-02284

ATTEMPTS TO ALLEVIATE FISH LOSSE FROM ALLEGHENY RESERVOIR, PENNSYL VANIA AND NEW YORK, USING ACOUSTICS
Corps of Engineers, Pittsburgh, PA. Pittsburgh District.
E. J. Smith, and J. K. Andersen.
North American Journal of Fisheries Management Vol. 3, No. 3, p 300-307, 1984. 2 Fig, 3 Tab, 7 Ref

Descriptors: *Allegheny Reservoir, *Pennsylvania *New York, *Reservoir operation, *Fish conserva tion, *Acoustics, Reservoir storage, Fish behavior Reservoirs, Reservoir fisheries.

As a consequence of pool drawdown each fall and winter to enhance flood storage, numerous fish are lost through the bottom sluices of Allegheny Res ervoir (located on the western border of Pennsyl vania and New York). The sudden release of pres sure accompanying the passage of these fish from deep zone of the reservoir into the tailrace can result in a substantial fish kill. The conditions under which fish are lost apparently are enhanced when the pool level is low and discharge is high In an effort to reduce these losses, underwater broadcasts of recorded sound effects were tested The sound projector was a low-frequency trans ducer mounted above the bottom sluices on the

ipstream face of the dam. While the sound broadcasts were being evaluated, the Corps of Engineers maintained a higher winter pool at the project to est the effect of controlled flow releases on ice formation at downriver locations. Although the nderwater sound broadcasts were not effective, naintenance of a higher winter pool resulted in a narked reduction in the fish losses. (Author's abtract)
W85-02373

EXPERIENCES GAINED IN RESTORING A WILDERNESS RIVER,
Kuopio Water District Office (Finland).
R. Porttikivi.
Aqua Fennica, Vol. 12, p 26-36, 1982. 5 Fig, 6 Ref.

Descriptors: *Vaikko River, *Finland, *River restoration, *Wilderness areas, Recreation, Fisheries, Rapids, Hydrology, Water quality, Boating, Costs, Habitat improvement, Landscaping.

The Vaikko River has its source in Eastern Finland and it is a part of the great Vuoksi River drainage basin. Due to channel works carried out for improving timber floating, which ceased in the beginning of the 1960's, the condition of the river for recreational and for fisheries use has been poor. At the initiative of the Kaavi commune in 1972 the development of the scenic river was started by the Water District Office of Kuopio. The objective of the restoration plan was to mitigate the adverse effects of the channel works and to improve rapids-shooting possibilities, to construct recreational facilities, to promote sport-fishing by enhancing fish habitat, and to form the Vaikko River into a central tourist attraction in the region. The implementation of the restoration started in 1979 and the last finishing and landscaping measures were accomplished in 1982. In the paper the project is described from the point of view of hydrology and water quality, boating, fisheries, outdoor recreation and camping. The total length of the restored river is 5.0 km and the total restored area 10.7 ha. Actual river restoration cost was 120.000 mk per kilometer and 6 mk per square meter. The costs are estimated to be returned in ten years. The skillful operation of working machines proved to be very important to obtaining good results in river bed modification work. The follow-up of the project is considered necessary for the sake of developing restoration methods for altered water bodies. The need for this kind of water resources development is evidently great. (Author's abstract)
W85-02386

LAKE MANAGEMENT AND RESTORATION,
Vesi-Eko Ky, Kuopio (Finland).
K. M. Lappalainen.
Aqua Fennica, Vol. 12, p 37-46, 1982. 4 Fig, 42 Ref.

Descriptors: *Lake management, *Lake restoration, *Phosphorus, *Finland, Oxygenation, Eutrophication, Lake sediments, Destratification, Hypolimnetic oxygenation, Lakes.

Phosphorus is the most limiting factor in algal production of Finnish lakes, and the effects of primary BOD loading are only local. Sediments of polluted lakes are a source of internal loading which tends to maintain eutrophication, even after reduction of the wastewater load. Lake bottom sediment plays a key role in the sense that the upper 30 cm layer of the bottom sediment contains 100-500 times more soluble phosphorus than the water above it. Polluted lake sediment must be removed, isolated or conditioned to retain phosphorus. The oxygenation of hypolimnion and, through it, bottom sediment, is a cornerstone in lake management. The initial phase of oxygenation may consume great volumes of oxygen. Techniques to be used are sediment oxygenation with nitrates, and a transfer of oxygen to the near-bottom layers by destratification or hypolimnetic oxygenation. (Moore-IVI)
W85-02387

NITRATE LEACHING FROM GRASSLAND,
Grasslands Research Inst., Hurley (England).
J. C. Ryden, P. R. Ball, and E. A. Garwood.
Nature, Vol. 311, No. 5981, p 50-53, September, 1984. 1 Fig, 3 Tab, 27 Ref.

Descriptors: *Nitrates, *Grasslands, *Leaching, *England, Animal wastes, Grazing, Pastures, Water pollution sources, Fertilizers.

Increased awareness of the economic importance of losses of nitrogen from agricultural land, together with the recognition that nitrate in drinking water is potentially detrimental to human health, have stimulated research on nitrate leaching. Substantial amounts of nitrate can be leached from intensively farmed grassland as well as when grassland is ploughed in a ley-arable system. The most striking feature is the effect of ruminant production on nitrate leaching. The annual loss of nitrate from a grazed grass sward was 5.6 times greater than that below the comparable cut sward, despite a common input of fertilizer N and defoliation frequency. The enhanced nitrate movement below the grazed sward can be attributed mainly to the return in urine and dung of as much as 90% of the N in the herbage consumed by cattle. At the end of the grazing season in October 1982, the mean nitrate content of soil below urine- and dung-affected areas of pasture was 3.2 to 7.7 times greater than that observed during random sampling across the grazed sward. Additional inorganic N was present as NH4(+), much of which had been nitrified by the time the profile was sampled in December at the onset of the drainage season. The small amount of residual inorganic N below the cut sward reflected the removal of at least 75% of the applied N in the harvested herbage. The cutting and conservation of herbage, and its subsequent use as feed, merely serves to delay the loss of nitrate that can occur after the disposal of slurry and farm-yard manure from winter-housed cattle. (Baker-IVI)
W85-02404

BEHAVIOUR OF PHOSPHATE, NITRATE, CHLORIDE AND HARDNESS IN TWELVE WELSH RIVERS,
Welsh Water Authority, Powys (Wales).
M. P. Brooker, and P. C. Johnson.
Water Research, Vol. 18, No. 9, p 1155-1164, 1984. 6 Fig, 6 Tab, 31 Ref.

Descriptors: *Water quality, *Land use, *Rivers, *Wales, Phosphates, Nitrates, Hardness, Chloride, Domestic wastes, Agricultural chemicals, Runoff, Flow, Urban runoff, Geology.

Water quality data from the 12 rivers was sought as part of the Harmonized Monitoring Scheme (HMS) in efforts to increase the information available regarding location, time and flow and improve attempts to estimate mass flows. In particular these determinands were chosen to establish the general variability of behavior in relation to urban settlement (phosphate-P), land use (nitrate-N) and geology (total hardness). Chloride was included as an example of a relatively conservative substance. Mean nitrate-N concentrations varied from 0.4 to 3.7 mg/l and were significantly related to the intensity of average catchment runoff. Mean orthophosphate-P concentrations ranged from the limit of analytical detection to 0.730 mg/l; chloride from 11 to 42 mg/l and total hardness, as calcium carbonate, from 13 to 173 mg/l. No long term seasonal trends could be established. Relationships between concentration and flow were established for most determinands at many sites; increasing flow generally resulted in decreased concentration. Positive relationships were established at 7 sites between nitrate concentration and flow. Mass flows were calculated at nine sites. Orthophosphate flows were related to sewered population density, estimates of per capita and land drainage contributions being 1.9 g/day and 0.112 kg/ha/yr, respectively. (Baker-IVI)
W85-02435

STREAM ECOSYSTEMS IN MOUNTAIN GRASSLAND (WEST CARPATHIANS); 7. CILIATA,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
E. Grabacka.
Acta Hydrobiologica, Vol.24, No. 4, p 367-373, 1982. 1 Fig, 1 Tab, 13 Ref.

Descriptors: *Grasslands, *Protozoa, *Runoff, *Water pollution sources, *West Carpathians, *Poland, Population dynamics, Fertilizers, Land use, Grazing, Streams.

The composition and numbers of communities of Ciliata were investigated in two streams of the upper Grajcarek catchment basin where agricultural wastes are introduced by the groundrunoff from areas where the traditional pastoral system is practiced and from those areas of intensive pasturing. Communities were evaluated on stony bottom and on a slimy bottom of the mountain streams Biala Woda and Kamionka. The current runoff of pollution to the streams did not bring about any significant change in Ciliata communities. The differentiation of these communities depended rather on the variability of the stream bottom. (Baker-IVI)
W85-02518

STREAM ECOSYSTEMS IN MOUNTAIN GRASSLAND (WEST CARPATHIANS); 8. BENTHIC INVERTEBRATES,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
A. Kownacki.
Acta Hydrobiologica, Vol. 24, No. 4, p 375-390, 1982. 5 Fig, 1 Tab, 16 Ref.

Descriptors: *Grassland, *Benthic environment, *Streams, *Land use, *Western Carpathians, *Poland, Midges, Seasonal variations, Floods, Nutrients, Grazing.

The dependence between the intensification of pastoral economy and the communities of benthic invertebrates in streams was investigated. The quantitative and qualitative changes in the fauna in the different habitats at the sampling stations, the percentage structure, and the pattern of seasonal cycles at the stations were analyzed. The influence of sheep grazing was chiefly manifested by the growing percentage of Chironomidae in the whole fauna, changes in the domination structure and disturbances in regular seasonal cycles of benthic invertebrates. In the qualitative composition of the fauna, however, there was little change. The changes in the communities were brought about not only by the increase in content of mineral nutrients in the water but also by the variability of water flow, insulation, and temperature caused by the cutting down of forests and associated with pastoral land use. (Baker-IVI)
W85-02519

SUPERFUNDING ACID RAIN CONTROLS, WHO WILL BEAR THE COSTS,
S. L. Rhodes.
Environment, Vol. 26, No. 6, p 25-32, July-August, 1984. 4 Fig, 38 Ref.

Descriptors: *Acid rain, *Economic aspects, Water pollution control, Legislation, Taxation, Federal jurisdiction, Political aspects.

Acid rain has become a major environmental and political issue in the United States. There have been several legislative proposals to control acid rain in the eastern US. The idea of creating an acid rain superfund to help finance the installation of flue gas desulfurization systems or other technologies to reduce the release of sulfur dioxide and nitrogen oxides by old coal burning electric power plants in the eastern states is proposed. Different variations on the superfund theme can make it more or less politically attractive. Regional conflicts can be intensified or moderated by the features of such a fund. Furthermore, the superfund idea does not appeal to everyone. Some of these liabilities and strengths must be evaluated in the context of both economic and political realities in a presidential election year. Some questions of concern include the raising of the superfund revenue and the technology forcing character of the super-

fund concept as currently discussed, which protects the interests of those associated with high-sulfur coal and discourages them from switching to low-sulfur coal. (Baker-IVI)
W85-02549

INTEGRATING WATER QUALITY AND CONSTRUCTION GRANTS MANAGEMENT,
CH2M/Hill, Reston, VA.
F. W. Ellis, K. S. Klima, R. L. Wycoff, and L. D. McKay.
Journal of the Water Pollution Control Federation, Vol. 56, No. 9, p 1022-1029, September, 1984. 11 Fig, 1 Tab. 5 Ref.

Descriptors: *Water quality control, *Management, Construction, Quality control, COGENT, Computers.

In response to recent legislative and administrative incentives, EPA has developed a new information tool, COGENT, to integrate municipal wastewater treatment management into water quality and water use considerations in the 1984 Needs Survey. COGENT links previously unrelated facility and water quality data by use of the Reach File. It consists of a data base containing information relating to stream systems and characteristics, point source pollution sources, state water quality standards and ambient conditions; a water quality model that simulates dissolved oxygen and ammonia, and a reporting capability that displays the results of the water quality simulations or the contents of the data base in either graphic or tabular form. (Baker-IVI)
W85-02583

REMOVAL AND INACTIVATION OF BACTERIA DURING ALUM TREATMENT OF A LAKE,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
P. C. Bulson, D. L. Johnstone, H. L. Gibbons, and W. H. Funk.
Applied and Environmental Microbiology, Vol. 48, No. 2, p 425-430, August, 1984. 5 Fig, 1 Tab, 18 Ref. EPA contract R805604-01.

Descriptors: *Alum, *Lake restoration, *Bacteria, Flocculation, Recreational lakes, Eutrophic lakes, Fecal coliforms, Escherichia, Public health, Swimming, Potable water.

Flocculation and removal of bacteria were observed during two separate aluminum sulfate (alum) treatments for removal of phosphorus from a eutrophic recreational lake. In addition, die-off and release of bacteria from alum floc were studied in columns under laboratory conditions. Membrane filtration and spread plates were used to determine concentrations of indicator species and total cultivatable bacteria, respectively. During the alum treatment of the lake, 90% of the fecal coliform (FC) population and ca. 70% of the fecal streptococci population were removed from the water column within 72 h. Numbers of FC in the floc on the lake bottom exceeded 2,400/100 ml at 120 h compared with the pretreatment concentration of 30 FC/100 ml. Inactivation of FC in the floc proceeded at a rate of 200 FC/100 ml per 24 h. In a second alum application to the lake, 95% of the total culturable bacterial population was removed from the water column. In a laboratory column study of survival and release rates, over 90% of an Escherichia coli suspension was concentrated in a floc formed at the bottom. E. coli was not released from the floc. The numbers of and survival of E. coli in the floc suggest the probable concentration of other enteric organisms, including pathogens. Thus, the floc poses a potential human health risk if ingested by swimmers or if others use the lake as a potable water source. (Author's abstract)
W85-02602

AERATION OF ANOXIC HYPOLIMNETIC WATER: EFFECTS ON NITROGEN AND PHOSPHORUS CONCENTRATIONS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
D. J. McQueen, and D. R. S. Lean.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 268-276, July, 1984. 4 Fig, 53 Ref.

Descriptors: *Nitrogen, *Phosphorus, *Aeration, *Hypolimnion, *Lake St. George, *Ontario, Nutrients, Oxygen, Iron, Thermal stratification.

The concentrations of NH3-N, NO3-N, NO2-N, total Kejdahl N, total soluble P, soluble reactive P, total particulate P, soluble unreactive P and total iron were measured periodically at depths of 1, 3, 5, 8, 12, and 14 m in two large enclosures situated at Lake St. George, Ontario. Each enclosure contained about 550 cu m of water, was 8 m in diameter, and 14 m deep and was open to the mud water interface. One enclosure received hypolimnetic aeration from June 17, 1980 until November 2, 1981, the other was not aerated. Macronutrients were added to both enclosures each week during the summer months. Iron was added to the hypolimnetic waters of both enclosures once during September 1980 and three times during September of 1981. Oxygen levels in the aerated encosure were kept at $>$ 4 mg oxygen/liter. In the control, oxygen levels fell to 0 mg oxygen/liter. Thermal stratification was similar in both enclosures. All of the forms of N that were measured were higher in the aerated hypolimnion. All of the forms of P that were measured were less concentrated in the aerated hypolimnion and iron additions caused further reductions in the aerated enclosure, but had no effect in the anoxic control. Iron concentrations were lower in the aerated hypolimnion. (Baker-IVI)
W85-02626

NUTRIENT REDUCTION BY BIOMANIPULATION: AN UNEXPECTED PHENOMENON AND ITS POSSIBLE CAUSE,
Minnesota Univ., Minneapolis. Limnological Research Center.
D. I. Wright, and J. Shapiro.
Verhandlung Internationale Vereinigung Limnologie, Vol. 22, No. 1, p 518-524, July, 1984. 4 Fig, 1 Tab, 30 Ref.

Descriptors: *Zooplankton, *Nutrients, *Biomanipulation, Trophic level, Algal growth, Daphnia, Crustaceans, Phosphorus, Transport, Thermocline, Thermal stratification, Herbivores.

A variety of mechanisms can be hypothesized to explain how changes in the zooplankton community cause nutrient declines. To test an active transport hypothesis, a series of lab experiments was performed using stock cultures of Ankistrodesmus, labelled with P-33 which were fed to D. pulex over a 8 day period. Uniformly labelled D. pulex were then induced to migrate in columns through a 12 C thermocline on a 16:8 hour cycle. The results of the migration experiments indicate that significant quantities of dissolved P were transported across the thermocline into the upper halves of the columns. The rate of transport by excretion remained relatively constant over the 3-day duration of the experiment. Such transport of nutrients can remove nutrients from the water column entirely. If the large-bodied herbivores reach the lake bottom or migrate into macrophyte beds, the excreted nutrients may be actively sorbed by the oxidized sediments and benthic algae, or by macrophytes and their associated periphyton. If true, biomanipulation becomes a two-edged sword - eliminating algae by grazing and by reducing nutrient resources simultaneously. (Baker-IVI)
W85-02645

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

COPA II AND THE RIVER MERSEY - A REGIONAL WATER AUTHORITY VIEW,
North West Water Authority, Warrington (England).
For primary bibliographic entry see Field 5D.
W85-02225

STOCHASTIC OPTIMIZATION MODEL FO REAL-TIME OPERATION OF RESERVOIR USING UNCERTAIN FORECASTS,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W85-02360

FORECASTING WATER LEVELS FOR LAK CHAD,
Imperial Coll. of Science and Technology, Londo (England). Dept. of Civil Engineering.
K. Guganesharajah, and E. M. Shaw.
Water Resources Research, Vol. 20, No. 8, p 105 1065, August, 1984. 7 Fig, 7 Tab, 6 Ref.

Descriptors: *Lake Chad, *Lakes, *Water leve fluctuations, *Forecasting, River Chari, Manage ment planning, Model studies, Selective withdraw al, Markov process.

Since the early part of the last decade, a wide spread drought in the semi-arid zone surroundin Lake Chad (Chad, Nigeria, Niger, and Cameroun has affected the lake levels and runoff from certai contributing catchments in the basin. A model wa developed for accurately predicting the low level in Lake Chad as many as 8 months ahead; it wi assist in the planning of the agriculture operation one season in advance for schemes that rely on th lake water. A statistical model for describing th probability of the low-level variations at variou periods ahead was also developed and can be use to measure the risk involved in selecting variou abstraction levels of water from the lake during th proposed life span of the projects; this is also particularly useful aid in economic and planning studies for future development. The probabilistic model is based on the Markov chain process ap plied to two statistical models of the main inpu variable (the runoff from the River Chari); the firs assumes the annual discharge to be random and th second incorporates significant cyclical compo nents, although determined from inadequate data and a large stochastic component. The error com ponent leads to some error in the state transition matrices which can be neglected due to the high value of coefficient of determination of the mode and the generous discrete interval of 0.5 m chosen in representing the lake states. (Collier-IVI)
W85-02362

SHORT-TERM, SINGLE, MULTIPLE-PURPOSE RESERVOIR OPERATION: IMPORTANCE OF LOSS FUNCTIONS AND FORECAST ERRORS,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W85-02658

MONTE CARLO OPTIMIZATION FOR RESERVOIR OPERATION,
Humboldt State Univ., Arcata, CA. Dept. of Environmental Resources Engineering.
For primary bibliographic entry see Field 4A.
W85-02659

6B. Evaluation Process

DETERMINATION OF ECONOMICALLY FEASIBLE PARAMETERS OF CONDUITS OF HYDROELECTRIC STATIONS,
V. M. Adamov.
Hydrotechnical Construction, Vol. 17, p 657-663, December, 1983. 3 Tab, 7 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 12, p 45-49, December, 1983.

Descriptors: *Economic aspects, *Conduits, *Hydroelectric plants, *Feasibility studies, Tunnels, Powerplants.

Economically expedient dimension of tunnels and pipelines are most simply calculated by formulas. Such formulas are available only for circular water conduits; analytical calculation methods have still not been developed for free-flow tunnels and

anals. Insufficient attention is being devoted also o schemes of hydraulic connections in layout de- gns for which it is required to use special calcula- on methods. The design of conduits is substantial- hindered in connection with the absence of ufficiently founded formulas for approximate cal- ulation of their cross sections. Calculations are roposed to help solve some of these problems. he optimal cross sections of tunnels (pressure and ree-flow) and of steel conduits should be deter- ined by means of exact equations for detailed esign stages and by approximate equations for ough calculations. In the case of complex layout chemes with the presence of daily storage reser- oirs it is not possible to use analytical methods of alculating the cross sections of tunnels and con- uits. The possibilities of using equations for calcu- ting optimal cross sections of canals and flumes f hydroelectric stations are extremely limited. It is ecessary to develop methods of optimizing power onduits, including both analytical and ordinary ower-economic methods of their calculation. Baker-IVI)
V85-02233

IYDROELECTRIC GENERATOR USED BY REATMENT PLANT,
Iorth Andover, MA.
or primary bibliographic entry see Field 5D.
V85-02301

CONOMIC EFFECTS OF RIVER CONSTRUC- ION WORKS,
National Board of Waters, Helsinki (Finland).
.. Kattelus, and O. Niemi.
qua Fennica, Vol. 13, p 34-43, 1983. 3 Fig, 1 Tab, Ref.

Descriptors: *Economic evaluation, *Flood pro- ection, *Construction costs, *Lapuanjoki, *Fin- and, Cost-benefit analysis, Hydroelectric plants, Rivers, Drainage.

he economic profitability of the river construc- on works and their importance to the communes f the river basin have been studied using the apuanjoki watercourse as a case study. The impe- us of the Lapuanjoki river construction works in 959 - 1978 was flood protection for agriculture. he investments required an input of nearly 200 illion FIM. The construction works created con- itions for complementary investments, namely lirvikoski powerplant, underground ditching and orestry drainage. The study was mainly carried ut by the National Board of Waters together with ampere University of Technology. The essential ethods applied in the study were input-output nalysis, profitability analysis, allocation analysis nd cumulative effect of consumption analysis. Vithout the complementary investments the utput-input ratio was 0.78, and the project was ot economically profitable. The computing inter- st in analyses was 4% up to 1981 and from 1981 to 010, 3%. Hirvikoski powerplant made the project xpedient from the national point of view (output- nput ratio 1.27). Other complementary invest- ents improved the output-input ratio. The input- utput analysis showed that the works were profit- ble from the regional point of view. This was ecause the government paid for the river con- truction works and the income during the con- truction and the outputs after the construction emained for the most part in the region. The llocation analysis revealed that a third of the ssets returned to the state as taxes and social ecurity payments. A great part of the construction ost remained as salaries in the region and the rofits of the construction works remain in the egion. (Author's abstract)
V85-02392

ACCOUNTABILITY MANAGEMENT BRINGS REVENUE INCREASES,
Springfield City Water, Light and Power, IL.
R. J. Orr.
Water Engineering and Management, Vol. 131, No. 9, p 22-26, August, 1984. 5 Tab.

Descriptors: *Decision making, *Water loss, Water distribution, Management, Testing, Eval- ation.

City Water, Light and Power which serves Spring- field, Illinois, has an average daily metered output to the distribution system of 20 mil gal. At various times during past years, unaccounted for water was as high as 25%. The program to find the problem was divided into four steps. The first phase consisted of testing high service water source meters at the purification plant to determine the actual quantity of water pumped to the distri- bution system. Phase two called for testing of 3 inch and larger meters. Phase three called for testing, repair and/or recalibration of 1-2 inch meters. Phase four of the loss reduction program targeted residential meters. By implementing cor- rections in each of these four phases, much reve- nue was saved and service was significantly im- proved. (Baker-IVI)
W85-02486

CONCURRENT DEVELOPMENT OF AN IN- DUSTRIAL WASTE PRETREATMENT PRO- GRAM AND RESIDUAL SOLIDS MANAGE- MENT PLAN,
CH2M/Hill, Denver, CO.
For primary bibliographic entry see Field 5D.
W85-02572

PUMPED-STORAGE: PEAK GENERATION OR OPERATING RESERVE,
For primary bibliographic entry see Field 8A.
W85-02673

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COST SHARING WITH IRRIGATED AGRI- CULTURE: PROMISE VERSUS PERFORM- ANCE,
Wyoming Univ., Laramie. Dept. of Agricultural Economics.
D. R. Franklin, and R. K. Hageman.
Water Resources Research, Vol. 20, No. 8, p 1047- 1051, August, 1984. 6 Tab, 9 Ref.

Descriptors: *Cost sharing, *Irrigation, *Cost anal- ysis, Capital costs, Operating costs, Maintenance costs, Replacement costs, Upper Colorado River Basin, Upper Missouri River Basin, Pick-Sloan Missouri River Basin Program, Accounting proce- dures, Water projects.

Since the Reclamation Project Act of 1939, irrigat- ed agriculture has been assigned responsibility for privately funding a portion of the capital costs, and 100% of the allocated operations/maintenance costs, for federal water projects. Actual cost share payments from agriculture have contributed rela- tively little to project funds. The extent of the deviation between projected private user cost shar- ing and actual payments collected was determined by analysis of financial data from various federal water projects. Irrigated agriculture is heavily sub- sidized, not only with respect to capital expendi- tures, but also for operation, maintenance, and replacement (OM and R) costs. Financial data was compiled for 19 projects implemented beginning in the late 1940's on the Upper Colorado River Basin and on the Upper Missouri River Basin. Irrigation is allocated 73.2% of total capital costs but is ultimately expected to repay 3.8% of capital costs allocated to irrigated agriculture. This indicates that the capital cost subsidy to irrigated agriculture is in excess of 96%. Of this, financial records indicate that over 78% of the repayment of cost is made by power revenues in the two Basin Funds. Data from the Pick-Sloan Missouri River Basin Program, 1979 financial statement provide support for the observation that the structure of OM and R repayments by agricultural users is altered by strat- egic shifting of accounts; of $853,000 in OM and R costs for nonelectric uses, only 4% was allocat- ed to agricultural users, whereas 64% was allocat- ed to nonreimbursable features. Enforcement of current guidelines for requiring private funding to a portion of capital costs and all of proportionate OM and R costs would be facilitated with the establishment of standardized and systematic finan- cial accounting guidelines; this is especially true with respect to allocating water use by irrigated agriculture among reimbursable and nonreimburs- able categories. (Collier-IVI)
W85-02361

COST ESTIMATES FOR HYDROPOWER AT EXISTING DAMS,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
J. S. Guliver, and A. Dotan.
Journal of Energy Engineering, Vol. 110, No. 3, p 204-214, September, 1984. 5 Fig, 1 Tab, 10 Ref.

Descriptors: *Cost analysis, *Hydroelectric plants, Construction costs, Estimating, Costs, Evaluation, Hydraulic equipment.

Guidelines are developed for quick and simple hydropower project cost estimating in the prelimi- nary site assessment stage. A concept which incor- porates a single equation using design power and head for total equipment cost and a site factor to determine total project cost forms the basis of this approach. Total cost for the project is estimated by multiplying the equipment cost and the site factor. Total project cost data from a number of hydro- power projects are compiled to provide guidelines for choosing the site factor which can vary great- ly, especially for micro and mini hydropower projects. Envelope curves for site factors are given and a weighting factor which is the fraction dis- tance between upper and lower envelope curves is chosen for each site. Comparison with recently completed projects, a knowledge of the compo- nents which can greatly increase civil works costs, and engineering judgement are combined to make the choice of weighting factor. This factor is then used in calculations to determine optimum plant capacity. The method was used in a survey of the hydropower potential at existing Minnesota Dams. (Baker-IVI)
W85-02442

6D. Water Demand

VIRGINIA'S WATER LAW: RESOLVING THE INTERJURISDICTIONAL TRANSFER ISSUE,
Virginia Polytechnic Inst. and State Univ., Blacks- burg. Dept. of Civil Engineering.
W. E. Cox, and L. A. Shabman.
Virginia Journal of Natural Resources Law, Vol. 3, No. 2, p 181-234, Winter, 1984. 1 Fig. 190 Ref.

Descriptors: *Water supply, *Water demand, *Water tranfer, *Legal aspects, Legislation, Vir- ginia, Common law, Water allocation.

Recent water shortages in urban areas of southeast- ern Virginia have led to the development of con- troversial water transfer proposals which reveal the potential for competition among local govern- ments in the state over water supplies. The present water allocation system consists of the common law system developed in the early history of the Commonwealth, as supplemented by several rela- tively independent regulatory measures affecting water use. The creation of a specialized administra- tive mechanism to resolve conflicts over interjuris- dictional water transfers for public water systems is proposed as the most appropriate and economi- cally efficient modification of the present system. Water use is explored in the commonwealth and the need for interjurisdictional water transfers is examined. The current water allocation is outlined and its ability to resolve conflicts associated with interjurisdictional water transfers is analyzed. The implementation and operation of the proposed ad- ministrative allocation mechanism is examined. The legal impediments to the adoption of such an administative allocation mechanism are scrutinized. (Baker-IVI)
W85-02183

FLOW REQUIREMENTS FOR RECREATION AND WILDLIFE IN NEW ZEALAND RIVERS - A REVIEW,
Ministry of Works and Development, Christ- church (New Zealand).
M. P. Mosley.
Journal of Hydrology, Vol. 22, No. 2, p 152-174, 1983. 4 Fig, 4 Tab, 55 Ref.

Descriptors: *Water quality control, *Recreation demand, *Recreation wastes, *Water use, *New Zealand, Wildlife, Reviews, Instream flow.

Increasing pressure is being placed on development in areas surrounding New Zealand rivers. As this pressure grows there is an increasing concern that non-developmental uses, with particular attention given to recreation, providing fish and wildlife habitat and enhancement of scenic beauty, be safeguarded. This review covers factors which are associated with these uses and considers their relationship with discharge. Factors which determine the character of a river are grouped into the following categories: landscape setting, floodplain setting, channel character, water character, and scenic quality and recreational potential. Application of the incremental method of flow analysis is described, even though vigorous adherence to the method is presently limited by lack of full information on the flow needs of each instream use. Still, it provides the best framework for assessing instream flow requirements. The Montana method, which is the other commonly used method, has severe limitations and should be restricted to reconnaissance level planning. (Baker-IVI)
W85-02558

6E. Water Law and Institutions

PROBLEMS IN POLLUTION RESPONSE LIABILITY UNDER FEDERAL LAW: FWPCA SECTION 311 AND THE SUPERFUND,
J. C. Helfrich.
Journal of Maritime Law and Commerce, Vol. 13, No. 4, p 455-479, July-October, 1982. 104 Ref.

Descriptors: *Water pollution control, *Legislation, *Superfund, *Federal Water Pollution Control Act, History, Regulations, Evaluation, Enforcement.

A discussion is offered of the history of the Federal Water Pollution Control Act followed by an analysis of the effectiveness of the enforcement arm of the Act, called Section 311. Strengths and weaknesses of the federal government's first major attempt to protect the nation's water environment from vessel and facility pollution are pointed out. The purpose, functions, and regulations of the Superfund are described both as it stands alone and in relation to the FWPCA. While much of the superfund is based upon the FWPCA, most of its elements respond to a specific problem found to be inadequately handled by the FWPCA provisions concerning hazardous substances. The implementing regulations are examined in relation to those previously used for FWPCA operation and enforcement. Many of the shortcomings experienced with the FWPCA have been removed from the scene in the Superfund program. Significant in this respect are increased liabilities; definition expansion of terms; incentives for the responsible parties to conduct their own cleanup; direct action access against insurors; and, the specific non-exclusive nature of the Superfund remedy. A couple of the old problems still exist, however, including the continuing third party confusion in measuring liability and the failure of the new Act to recognize the shortcoming of the FWPCA in not expressly addressing the statute of limitations question. (Baker-IVI)
W85-02172

STATE ENGINEER'S AUTHORITY WITH REFERENCE TO CHANGE OF USE, PLACE OF USE, POINT OF DIVERSION, AND MEANS OF CONVEYANCE OF WATER EMBRACED BY WATER PERMITS,
P. J. Crank.
Land and Water Law Review, Vol. 19, No. 1, p 59-70, 1984. 81 Ref.

Descriptors: *Water permits, *Water demand, *Legislation, *Wyoming, *Green River, Water use, Green River Development Company, Water rights.

The Green River Case is sub-divided into two sections for discussion: the portion of the case dealing with the State Engineer's authority to amend water permits; and the portion of the case dealing with the nature of water permits and their transferability in Wyoming. The Wyoming Supreme Court held that the State Engineer had no authority to change the permit; water permits were not transferable in Wyoming; and all corrections must be within the original intention of the permit. A decision which allowed the State Engineer to transfer a water permit for water which never was beneficially applied would have wreaked havoc on the system and given rise to all manner of speculative ventures for which no substantial or honest investment was intended. (Baker-IVI)
W85-02173

LIMITS OF FEDERAL RESERVED WATER RIGHTS IN NATIONAL FORESTS,
S. D. Emery.
Land and Water Law Review, Vol. 19, No. 1, 1984. 110 Ref.

Descriptors: *Water rights, *National forests, *Colorado, Federal jurisdiction, Reserved rights, Legislation, Instream flows.

On appeal, the Colorado Supreme Court considered the extent to which the federal government possessed reserved water rights on its forest reservations. The United States claimed that its reserved water rights included instream flows, while Denver argued that federal reserved rights did not exist at all. How and why the Colorado Supreme Court restricted the federal government's reserved water rights is examined. Federal reserved rights were limited by the Court to the minimum amount of water necessary to fulfill the primary purposes of national forests. It is viewed as unfortunate that this decision was made which might be the beginning of a trend toward narrow construction of the reserved rights doctrine. The United States is expected to make appeal on the grounds that the federal government had instream flow rights before 1960 for fire protection and erosion control, and after 1960 for wildlife, fish and recreation purposes. (Baker-IVI)
W85-02174

IMPAIRMENT OF EXISTING WATER RIGHTS UNDER THE WYOMING WATERSHED ACT,
C. W. Hansen.
Land and Water Law Review, Vol. 19, No. 1, p 83-92, 1984. 102 Ref.

Descriptors: *Legislation, *Reservoirs, *Water rights, *Wyoming, *Condemnation, Toltec Watershed Improvement District, Reserved rights.

The Toltec Watershed Improvement District (Toltec) was organized in January 1968 to construct a multi-purpose reservoir near Garrett, Wyoming. In 1970 Associated Enterprises, Inc. began a series of actions against Toltec to prevent the condemnation of its land and water rights for the proposed reservoir site. The District court of Albany County granted condemnation for the construction of the reservoir and determined just compensation for the land taken. The Wyoming Supreme Court decided in favor of the condemnation, despite a statutory provision purportedly barring any impairment of such rights. The trend in Wyoming from a predominantly ranching and agricultural area to a more industrial state with an increasing population is underlined by this decision toward optimum use and allocation of water resources. The Court's rejection of the no-impairment provision represents a marked departure from the Wyoming rule that water rights cannot be detached from the land, place or purpose from which they were first acquired. Farmers and ranchers can no longer depend upon this no change rule to protect their water rights, appropriations and priorities. (Baker-IVI)
W85-02175

STATUTORY FORFEITURE OF WATER RIGHTS IN WYOMING,
K. J. Kapp.
Land and Water Law Review, Vol. 19, No. 1, p 93-104, 1984. 88 Ref.

Descriptors *Water rights, *Forfeiture, *W
ming, Dam stability, Beneficial use.

In April of 1972 the Wyoming State Engi
reduced the amount of water which could
stored in a local reservoir due to weaknesses in
dam. During the time it took for the dam to
repaired, 8 years, Wheatland Irrigation Dis
filed a forfeiture petition with the Board of C
trol. The forfeiture declared that the Lara
Rivers Company had forfeited its rights to 41
acre feet of water, the difference between
68,500 usually held in the reservoir and the res
tion of 27,400 acre feet imposed by the S
Engineer. While a lower court upheld the
reconstruction and rejected the forfeiture filed
the Laramie Rivers Company, the Supreme C
of Wyoming reversed the lower court's decis
This established the rule that forfeiture of w
rights under section 41-3-401 of the Wyoming S
utes may only be avoided by application of
water to beneficial use. Thus, undertaking eff
to repair a dam in order to put a reservoir b
into use will not prevent forfeiture, even if s
efforts are commenced before a forfeiture peti
is filed. (Baker-IVI)
W85-02176

**UNITED STATES V. OSWEGO BARGE C
PORATION,**
Goldstein (Seymour R.), Baltimore, MD.
A. S. Lyons.
Ocean Development and International Law, V
14, No. 1, p 107-117, 1984. 51 Ref.

Descriptors: *Oil spills, *Legal aspects, *Clea
operations, Legislation, Federal Water Pollut
Control Act, Water pollution control.

The holding and analysis used by the court
United States v. Oswego Barge Corporation
discussed and it is concluded that the governme
source of compensation is limited to the frequen
inadequate provisions of the Federal Water Po
tion Control Act. When the applicable FWP
limits exceed government cleanup costs, the sta
tory scheme works well. But the FWPCA does
always adequately compensate the federal gove
ment. The FWPCA will prove insufficient to
nance removal of a spill from a relatively sm
vesssel or barge, as well as when a large ves
spills a great deal of oil. Therefore the fede
government may be forced to require the states
assume greater responsibility for oil spill clean
If the federal government may avail itself of
remedies the federal common law of nuisance a
maritime tort afford, the alternate route of enco
aging state cleanup becomes less attractive. A r
ulatory scheme that emphasizes the federal r
and relies on federal law would be more consist
with the general admiralty purpose of assur
uniform adjudication of maritime law clai
(Baker-IVI)
W85-02177

**MIDDLESEX COUNTY SEWERAGE AUTHO
ITY V. NATIONAL SEA CLAMMERS ASS
CIATION,**
C. M. Smith.
Ecology Law Quarterly, Vol. 10, No. 1, p 39-
1982. 97 Ref.

Descriptors: *Legislation, *Enforcement, *Wa
pollution effects, *Fishing, Federal Water Poll
tion Control Act, National Sea Clammers Assoc
tion, New York, Harbors.

One concern in this case was whether a priva
group of fishermen could recover damages und
federal law for business injuries allegedly caus
by pollution of New York Harbor and adjace
waters. The New Jersey District Court grant
summary judgment for defendants on all counts
the complaint, and the judge dismissed with pre
dice all claims arising under federal law. The co
refused to hear the claims arising under FWPC
and MPRSA because plaintiffs had failed
comply with the 60 day notice requirement of t
private enforcement provisions of the acts. T
court also rejected plaintiffs' nuisance claim on t
ground that a private cause of action is not ava

able under the federal common law of nuisance. The Court of Appeals for the Third Circuit reversed the district court on each of these issues. The Supreme Court limited its review to three questions: whether private rights of action apart from those provided in the citizen-suit provisions may be implied in FWPCA and MPRSA; whether FWPCA and MPRSA preempt the federal common law of nuisance in the area of ocean pollution; and if there is no preemption, whether a private citizen has standing to sue for damages under federal common law of nuisance. The Supreme Court rules against plaintiffs on all the federal claims it had granted certiorari to review and remanded the case to the Circuit Court for further consideration. The Sea Clammers Court casts doubt on the integrity of its process of statutory construction by a questionable construction of the language and legislative history of the Acts. In light of its continuing reluctance to imply private rights of action in federal statutes and its apparent goal of restricting the availability of the section 1983 remedy, it is evident that the Sea Clammers Court forced a ruling of anti-private rights doctrine through an opening of statutory construction. (Baker-IVI)
W85-02178

CITY OF MILWAUKEE V. ILLINOIS (ILLINOIS II),
J. Derr.
Ecology Law Quarterly, Vol. 10, No. 1, p 51-68, 1982. 155 Ref.

Descriptors: *Legislation, *Nuisance, *Water pollution control, *Milwaukee, *Illinois, Legal aspects, Common Law.

The Court in Illinois II appears to apply a blanket preemption of the federal common law of nuisance. The decision need not be that broad. Separation of powers would be maintained, and the supremacy of Congress recognized, even if the Court required clear Congressional intent to preempt the federal common law. The Act authorized relief of the same type granted by the lower court in Illinois II - effluent standards and timetables for overflow control. The federal common law, however, did not speak primarily to the type of relief it was to provide. Rather, it spoke to the avoidance of state law remedies in order to protect state and federal interests in uniform and fair resolution of interstate disputes. The Act does not speak to protection of these interests. Even if the bulk of the statute did speak directly to the questions formerly governed by federal common law, the savings clauses appear to preserve the common law remedy. The majority's strained reading of the savings clauses, and its uncritical application of a preemption test, have needlessly recreated the very problems that originally justified the federal common law of nuisance. (Baker-IVI)
W85-02179

EPA V. NATIONAL CRUSHED STONE ASSOCIATION,
A. Ranken.
Ecology Law Quarterly, Vol. 10, No. 1, p 161-180, 1982. 162 Ref.

Descriptors: *Water pollution control, *Industrial waste, *Legislation, Federal Water Pollution Control Act, National Crushed Stone, Environmental Protection Agency.

The Supreme Court's decision in National Crushed Stone is considered against a background of the relevant portions of the Federal Water Pollution Control Act and the appellate court's holdings. The weaknesses in the apellate court's decision invalidating EPA's variance provision is examined and an alternative argument for invalidation tendered by the industries challenging the provision is evaluated. An examination is offered of the potential impact of the National Crushed Stone decision on future water pollution control efforts, as well as with some observations on the role of the judiciary when reviewing agency interpretation of a statute it administers. (Baker-IVI)
W85-02180

RECOVERY OF DAMAGES BY STATES FOR FISH AND WILDLIFE LOSSES CAUSED BY POLLUTION,
For primary bibliographic entry see Field 5C.
W85-02181

PROTECTING THE PEOPLE'S WATERS: THE CALIFORNIA SUPREME COURT RECOGNIZES TWO REMEDIES TO SAFEGUARD PUBLIC TRUST INTERESTS IN WATER,
K. M. Raymond.
Washington Law Review, Vol. 59, No. 2, p 357-373, April, 1984. 90 Ref.

Descriptors: *Water supply development, *Public trust doctrine, *Legal aspects, *California, *Mono Lake, Water rights, Legislation, Appropriation, Water allocation.

Public trust remedies presently in place in California are outlined by discussing the background of the public trust doctrine and the appropriative water rights system in California as well as the holdings of the Mono Lake court. A change is proposed to improve both the administrative and judicial public trust remedies. In Mono Lake the California Supreme Court addressed two issues critical to the protection of public trust interests in state water allocation decisions. The first was whether the public trust doctrine was subsumed within the appropriative water rights system. The second was whether plaintiffs seeking to enforce the public trust were required to exhaust administrative remedies before filing suit. Mono Lake mandates consideration of the public trust in all water rights decisions. To ensure that the public trust is taken into account when required, the Mono Lake court recognized both an administrative and a judicial remedy. Important public trust interests in water resources may not be adequately protected unless the remedies designed to protect them are strong. Recommended changes to the administrative and judicial remedies recommended would help to ensure that the mandates of Mono Lake are realized. (Baker-IVI)
W85-02182

VIRGINIA'S WATER LAW: RESOLVING THE INTERJURISDICTIONAL TRANSFER ISSUE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W85-02183

GROUNDWATER AND INTERGOVERNMENTAL RELATIONS IN THE SOUTHERN SAN JOAQUIN VALLEY OF CALIFORNIA: WHAT ARE ALL THESE COOKS DOING TO THE BROTH,
For primary bibliographic entry see Field 4B.
W85-02184

HISTORY OF THE ATTEMPTED FEDERAL REGULATION REQUIRING GAC ADSORPTION FOR WATER TREATMENT,
Houston Univ., TX. Dept. of Civil Engineering.
J. M. Symons.
Journal of the American Water Works Association, Vol. 76, No. 8, p 34-43, August, 1984. 3 Fig, 2 Tab, 49 Ref.

Descriptors: *Activated carbon, *Water treatment, *Organic compounds, Legislation, Federal jurisdiction, Environmental Protection Agency, History, Trihalomethanes, Drinking water.

Attempts made by the federal government to require certain water systems to use granular activated carbon (GAC) adsorption treatment for the removal of synthetic organic contaminants are traced. The Safe Drinking Water Act has two main features which are important to the history of the control of organics in drinking water: the intent of Congress to control organics in drinking water by passing the Act; and the Act gave EPA the option to specify the treatment technique that designated water utilities must use. In February of 1978 the EPA proposed a two part regulation for the control of organic contaminants in drinking water, part of which proposed the use of GAC adsorption as a treatment technique. In November of 1979 the EPA issued a regulation for the control of trihalomethanes in drinking water. In March-April of 1981 the EPA held a symposium on the treatment of water with GAC. During the fall of 1982 bills were introduced to congress that would have changed the language of the Safe Drinking Water Act and would have eliminated the option of specifying a treatment technique as one method of regulating water quality. During 1982 the American Water Works Service Company permanently removed spent GAC from five of its systems due to the presence of GAC in the filters which seemed to be aggravating an intermittent problem of positive coliform samples. In January of 1983 the council of Cincinnati, Ohio voted to authorize the design of an upgraded water treatment plant using GAC adsorption in the postfiltration mode. (Baker-IVI)
W85-02399

MUNICIPAL COMPLIANCE - ANOTHER VIEW,
Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control.
D. J. Schaeffer, H. W. Kerster, and K. G. Janardan.
Journal of the Water Pollution Control Federation, Vol. 56, No. 8, p 924-917, August, 1984. 4 Tab, 6 Ref.

Descriptors: *Water pollution control, *Compliance, *Municipal wastewater, Water quality control, Industrial wastes, Effluents, Statistical studies.

General Accounting Office (GAO) studied the noncompliance rates of a random sample of 631 major dischargers - 274 municipal and 257 industrial - in six states. The data in the GAO report is reanalyzed and the statistical basis for evaluating compliance is examined. The important conclusion is that EPA noncompliance rates are consistent with GAO rates. The distribution of noncompliance results from a mixing process, and estimating the rate of noncompliance entails some explicit and implicit assumptions. One factor affecting the size of GAO's significant noncompliance rates is definitional, the other is statistical. The definitional problem is that GAO included fecal coliform and flow, pollutants likely to have high noncompliance rates. The statistical problems are complex and are summarized. (Baker-IVI)
W85-02571

INTEGRATING WATER QUALITY AND CONSTRUCTION GRANTS MANAGEMENT,
CH2M/Hill, Reston, VA.
For primary bibliographic entry see Field 5G.
W85-02583

6F. Nonstructural Alternatives

TWO-DIMENSIONAL FLOOD ROUTING ON STEEP SLOPES,
Post, Buckley, Schuh and Jernigan, Inc., Tampa, FL.
R. A. Laura, and J. D. Wang.
Journal of Hydraulic Engineering, Vol. 110, No. 8, p 1121-1135, August, 1984. 6 Fig, 3 Tab, 13 Ref. FEMA contract H-4734.

Descriptors: *Flood routing, *Model studies, *Rio Culebrinas Basin, *Puerto Rico, ROUTWEIR, Computer models.

The Rio Culebrinas Basin in Puerto Rico was studied in detail with the two-dimensional ROUTWEIR model, as part of a federal flood insurance study approved by FEMA (Federal Emergency Management Agency) The study included a calibration against known high-water marks from a 5-yr flood. This was achieved mainly by adjusting the conveyance coefficient. The application of the model, with its parameters calibrated using one set of data, has produced reasonable results over a large range of flow. The formulation of flow from element to element allows the model to have a moving boundary. Dry elements can be

allowed to flood and flooded elements can be allowed to dry up. Elements can also be partially filled with water. This approach combined with the flexible schematization afforded by the triangular elements enables the program to handle a highly variable topography with relative ease. The model is expected to perform equally well in other areas with relatively peaked hydrographs, steep slopes, and extensive flood plains. The run time is in general a function of time step size, hydrograph duration, and the number of elements. The described model, ROUTWEIR, has been successfully applied in a federally funded flood insurance study. (Baker-IVI)
W85-02267

6G. Ecologic Impact Of Water Development

IMPAIRMENT OF EXISTING WATER RIGHTS UNDER THE WYOMING WATERSHED ACT,
For primary bibliographic entry see Field 6E.
W85-02175

PROTECTING THE PEOPLE'S WATERS: THE CALIFORNIA SUPREME COURT RECOGNIZES TWO REMEDIES TO SAFEGUARD PUBLIC TRUST INTERESTS IN WATER,
For primary bibliographic entry see Field 6E.
W85-02182

SESTON MICROBIAL ACTIVITY IN A RIVER-RESERVOIR SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 2H.
W85-02249

MINERAL CONCENTRATION WITHIN FRESHWATER MARSH PLANT COMMUNITIES,
Florida Univ., Gainesville. School of Forest Resources and Conservation.
W. S. Terry, and G. W. Tanner.
Journal of Freshwater Ecology, Vol. 2, No. 5, p 509-518, August, 1984. 5 Fig, 1 Tab, 12 Ref.

Descriptors: *Minerals, *Marshes, *Florida, *Vegetation, Calcium, Iron, Potassium, Magnesium, Manganese, Nitrogen, Phosphorus, Seasonal variation, Flood control, Environmental effects, Land use.

Freshwater marshes have often been drained or channelized in Florida for tame pasture conversion, flood control or urban development. This has exacerbated water quality problems. Three freshwater marshes in south Florida were studied. Each was a watershed possessing varying degrees of agricultural development: rangeland, tame pasture and one watershed with a combination of rangeland, tame pasture and groveland. Samples were analyzed for concentrations of Ca, Fe, K, Mg, Mn, N and P. Mineral concentrations in the macrophytes growing in these marshes reflected the agricultural activities found in their respective watersheds. Higher concentrations of nutrients were found in vegetation growing in watersheds with tame pastures and citrus groves than in the rangeland watershed, except for Fe concentrations. At each marsh site, mineral concentrations in the vegetation tended to increase with an increased degree of inundation. This response probably was due to increased nutrient loading from runoff water and stored nutrients in the inundated soils. Little seasonal fluctuation of mineral concentrations in the green vegetation samples was noted with the exception of potassium concentrations. Not only did vegetation in the marsh communities generally have the highest mineral concentrations on a per gram basis, total mineral accumulation within the marsh community would be greater due to the higher amounts of standing phytomass. (Baker-IVI)
W85-02250

DETERMINATION OF OPTIMUM MINIMUM FLOW FROM A DAM BY USING ENERGY ANALYSIS,
South Carolina Univ., Columbia. Dept. of Environmental Health Sciences.
For primary bibliographic entry see Field 4A.
W85-02297

ATTEMPTS TO ALLEVIATE FISH LOSSES FROM ALLEGHENY RESERVOIR, PENNSYLVANIA AND NEW YORK, USING ACOUSTICS,
Corps of Engineers, Pittsburgh, PA. Pittsburgh District.
For primary bibliographic entry see Field 5G.
W85-02373

EFFECTS OF WATER LEVEL MANIPULATION ON ABUNDANCE, MORTALITY, AND GROWTH OF YOUNG-OF-YEAR LARGEMOUTH BASS IN WEST POINT RESERVOIR, ALABAMA-GEORGIA,
Alabama Cooperative Fishery Research Unit, Auburn.
L. E. Miranda, W. L. Shelton, and T. D. Bryce.
North American Journal of Fisheries Management, Vol. 4, No. 3, p 314-320, 1984. 3 Fig, 3 Tab, 22 Ref.

Descriptors: *West Point Reservoir, *Alabama, *Georgia, *Bass, *Fish management, *Water level, Reservoir operations, Fish populations, Fisheries, Water level.

Water level manipulation was examined as a potential management technique for increasing recruitment of largemouth bass (Micropterus salmoides) in a reservoir where prey availability and utilization were major factors influencing the largemouth bass population. Raising the water level above normal summer pool inundated terrestrial vegetation and provided cover for young-of-year (YOY) largemouth bass. A positive relationship was observed between early survival of YOY largemouth bass and water level during the spawning period. In the post-spawning period, survival rate and abundance of YOY were related directly to water level, but growth was inversely affected. Average standing stock of YOY largemouth bass in August was similar during the 5 years of study, indicating the system supports a particular biomass, and growth decreased when greater number of young were added through enhanced survival. Results of this study suggest that, unless carrying capacity and food availability for YOY largemouth bass are increased concurrently with water level, use of this technique may not result in a strong year class. (Author's abstract)
W85-02375

STUDY AND DEVELOPMENTAL PROJECT FOR LESSENING THE DRAWBACKS OF RIVER CONSTRUCTION WORKS IN FINLAND,
National Board of Waters, Helsinki (Finland).
H. Laikari.
Aqua Fennica, Vol. 12, p 17-25, 1982. 4 Fig, 10 Ref.

Descriptors: *Finland, *Water resources development, *Rivers, *Construction, *Environmental effects, Fisheries, Acidity, Sulfides, Mercury, Peat, Economic aspects, Hydroelectric power, Ice dams.

River construction works in Ostrobothnia (Finland) have been subject to some criticism, which led the National Board of Waters to institute a special project to study and propose measures to diminish the adverse effects of these works. The project consists of 11 separate subprojects: the impacts of the construction works on the fisheries in the River Kyronjoki and its estuary; acidity due to sulfide soils; the accumulation of mercury in fish, especially in artificial lakes; the economic profitability of the river construction works and their importance to the communes of the river basin; means and costs of eliminating floating peat in artificial lakes; increasing the oxygen content of river water at overflow weirs and power stations; flood forecasts; the formation of ice dams and the possibility of prevention; the adjustment of hydraulic structures to the landscapes; the adverse eff of daily flow operation at power stations; an historical review of the utilization of the ri Silkajoki, Pyhajoki and Kalajoki. (Moore-IVI)
W85-02385

EFFECTS OF ENVIRONMENTAL CHANG ON THE FISHERIES AND FISH STOCKS THE ARCHIPELAGO SEA AND THE FINNI PART OF THE GULF OCH BOTHNIA,
Helsinki Univ. (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5C.
W85-02388

TROPICAL LAKES - FUNCTIONAL ECOLO AND FUTURE DEVELOPMENT: THE NE FOR A PROCESS-ORIENTED APPROACH,
Oslo Univ. (Norway). Zoological Inst.
For primary bibliographic entry see Field 2H.
W85-02408

WATER QUALITY IMPLICATIONS OF AR FICIAL FLOW FLUCTUATIONS IN REGULA ED RIVERS,
Loughborough Univ. of Technology (Englan Dept. of Geography.
For primary bibliographic entry see Field 2K.
W85-02413

EFFECT OF FOREST AMELIORATION ON I VERSITY IN AN OMBROTROPHIC BOG,
Helsinki Univ., Lammi (Finland). Lammi Biolo cal Station.
H. Vasander.
Annales Botanici Fennici, Vol. 27, No. 1, p 7- 1984. 2 Fig, 3 Tab, 66 Ref.

Descriptors: *Forestry, *Environmental effec *Bogs, *Laaviosuo Bog, *Finland, Ecosysten Plants, Species diversity, Biomass, Eutrophicatio

In a continuation of the study of the Laaviosu bog ecosystem, the biomass diversity and abu dance relationships were examined in different sit and communities. Diversity was calculated fro the biomass of plant species in different microsit on virgin, drained and drained/fertilized sectio of an ombrotrophic bog in southern Finland. C virgin bog the diversity increased from wet ar moist hollows to low hummocks. On high hur mocks the diversity was decreased by the dom nance of Scots pine and ericoid dwarf shrubs. C drained bog the diversity was lower in all pla comunities than on virgin bog, except in the moi hollows, where the proportion of the dominar species had decreased. On drained, fertilized bo the diversity was lower in all plant commniti than on virgin bog, except in the hollows, wher the proportion of the dominant species had d creased and which had been colonized by typic hummock species. The total diversity decrease from virgin to drained and fertilized bog, reflectin a general trend in eutrophicated or disturbed ec systems. During the succession following drainag biomass and production usually increased, but d versity decreased. (Baker-IVI)
W85-02484

DETERMINATION OF MINIMUM DIS CHARGE FOR O+ BROWN TROUT (SALMO TRUTTA L.) USING A VELOCITY RESPONSE
R. N. B. Campbell, and D. Scott.
New Zealand Journal of Marine and Freshwate Research, Vol. 18, No. 1, p 1-11, 1984. 4 Fig, Tab, 46 Ref.

Descriptors: *Trout, *Fish behavior, *Flow dis charge, *Velocity, *Silverstream, *New Zealand Water currents, Ecological distribution, Shoaling behavior, Pools, Aquatic habitats.

Discharge criteria are being developed which are designed to protect fish in situations where wate abstraction is at significant levels. The effects o decreasing discharge on the behavior and distribu tion of O+ brown trout were studied in the Silver stream, a tributary of the Taieri River, Otago, New Zealand. Water is abstracted for domestic use; the

mated mean annual discharge after abstraction
l.17 cu m/s. Before 1972, leakage from the
eline was sufficient to maintain a population of
t in the lower Silverstream, but improvements
he line resulted in absence of surface flow in
periods. The trout population now is almost
rely of age classes O+ and 1+ for most of the
r, with a spawning run of large trout from the
eri during the winter. The preferred habitat is
s, where the behavior is territorial, but with
reasing discharge most of the population
ved into pools and adopted shoaling behavior.
rrent velocity was the significant factor, with a
eshold value of 0.30 m/s for poolward move-
nt. The discharge giving a mean run velocity of
0 m/s was compared with empirical criteria for
imum satisfactory flows for fish, and very close
eement was found. (Moore-IVI)
5-02505

REAM ECOSYSTEMS IN MOUNTAIN ASSLAND (WEST CARPATHIANS); 1. IN-ODUCTION AND DESCRIPTION OF THE VESTIGATED AREA,
lish Academy of Sciences, Krakow. Zaklad Bio-ii Wod.
Kownacki.
ta Hydrobiologica, Vol. 24, No. 4, p 291-305, 32. 3 Fig, 2 Tab, 18 Ref.

scriptors: *Land use, *Runoff, *Erosion, *Per-ability, *Poland, Soil properties, Ecosystems, reams, West Carpathians, Hydrography.

e investigations were carried out in the upper ajcarek catchment basin, in the region of the lage Jaworki (the West Carpathians). The soils the catchment basin are vulnerable to erosional ocesses whose intensity is limited by the forest d pastural land use. The perviousness of brown d podzolic soils varies and depends on the way ey are used. On arable land the speed of percola-n is 35 mm/min. In forests it falls to 2.5 mm/n, while on pastures it is reduced to as little as 7 mm/min. The possibility of surface run-off on pes under pasture thus increases considerably. reams investigated included Biala Woda, Czarna oda, and Kamionka. (Baker-IVI)
85-02512

TREAM ECOSYSTEMS IN MOUNTAIN RASSLAND (WEST CARPATHIANS); 4. EAVY METALS,
olish Academy of Sciences, Krakow. Zaklad Bio-gii Wod.
or primary bibliographic entry see Field 5B.
85-02515

TREAM ECOSYSTEMS IN MOUNTAIN RASSLAND (WEST CARPATHIANS); 8. ENTHIC INVERTEBRATES,
olish Academy of Sciences, Krakow. Zaklad Bio-gii Wod.
or primary bibliographic entry see Field 5G.
85-02519

TREAM ECOSYSTEMS IN MOUNTAIN RASSLAND (WEST CARPATHIANS); 9. OLI-OCHAETA,
olish Academy of Sciences, Krakow. Zaklad Bio-gii Wod.
or primary bibliographic entry see Field 5B.
85-02520

LOW REQUIREMENTS FOR RECREATION ND WILDLIFE IN NEW ZEALAND RIVERS - REVIEW,
Ministry of Works and Development, Christ-hurch (New Zealand).
or primary bibliographic entry see Field 6D.
85-02558

7. RESOURCES DATA

7A. Network Design

STATISTICAL PROCEDURES FOR APPLYING HILSENHOFF'S BIOTIC INDEX,
Wisconsin Dept. of Natural Resources, Madison. Water Quality Evaluation Section.
For primary bibliographic entry see Field 5A.
W85-02245

USE OF NEPHELOMETRIC TURBIDITY TO CALCULATE CARLSON'S TROPHIC STATE INDEX IN KEYSTONE LAKE OKLAHOMA,
Corps of Engineers, Vicksburg, MS.
For primary bibliographic entry see Field 2H.
W85-02248

SYSTEMATIC PROBLEM-ORIENTED APPROACH TO HYDROLOGICAL DATA REGIONALISATION,
Vrije Univ., Amsterdam (Netherlands). Dept. of Hydrogeology and Geographical Hydrology.
For primary bibliographic entry see Field 2A.
W85-02459

SENSITIVITY OF FLOW MEASUREMENT TO STAGE ERRORS FOR NEW ZEALAND CATCHMENTS (NOTE),
Ministry of Works and Development, Wellington (New Zealand).
For primary bibliographic entry see Field 2E.
W85-02559

COMPUTER MODELLING OF RESERVOIR NETWORKS AND HYDROELECTRIC PLANTS,
Main (Charles T.), Inc., Boston, MA.
For primary bibliographic entry see Field 8A.
W85-02680

7B. Data Acquisition

DETERMINATION OF INORGANIC ANIONS IN RIVER WATERS BY COLUMN-COUPLING CAPILLARY ISOTACHOPHORESIS,
Komenskeho Univ., Bratislava (Czechoslovakia). Dept. of Analytical Chemistry.
I. Zelensky, D. Kaniansky, P. Havasi, and V. Lednarova.
Journal of Chromatography, Vol. 294, p 317-327, June, 1984. 5 Fig, 5 Tab, 24 Ref.

Descriptors: *Isotachophoresis, *Anions, *Inorganic compounds, *Chemical analysis, Sulfates, Chlorides, Nitrates, Nitrites, Fluorides, Phosphates, Ion chromatography, Water analysis.

Concentrations of sulfate, chloride, nitrate, nitrite, fluoride and phosphate in river water have been suitably determined using suppressed and nonsuppressed ion chromatography with conductivity and/or photometric detectors. These methods are instrumentally simple but sample pretreatment and analysis of individual aliquots may be necessary. Column-coupling capillary isotachophoresis permitted the simultaneous determination of Cl(-), NO3(-), SO4(2-), NO2(-), F(-) and PO4(3-) in river water; the time for the complete analysis of both macro- and micro-constituents was about 25 min and no sample pretreatment was needed. Detection limits for constituents that are present in river water at lower concentrations (NO2(-), F(-) and PO4(3-)) were in the range 30-60 pmoles. In spite of observed partial decomposition of NO2(-) during the separation, the determination of nitrite at concentrations down to 0.1 ppm is possible using the proposed operating conditions. (Collier-IVI)
W85-02304

TRACE ANALYTICAL PROCEDURES WITH MODERN VOLTAMMETRIC DETERMINATION METHODS FOR THE INVESTIGATION AND MONITORING OF ECOTOXIC HEAVY METALS IN NATURAL WATERS AND ATMOSPHERIC PRECIPITATES,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
H. W. Nurnberg.
Science of the Total Environment, Vol. 37, No. 1, p 9-34, July, 1984. 7 Fig, 2 Tab, 75 Ref.

Descriptors: *Voltammetry, *Trace metals, *Heavy metals, *Trace levels, *Chemical analysis, Water analysis, Cadmium, Measuring instruments, Atomic absorption spectrometry, Potentiometry, Detection limits.

The voltammetric approach with differential pulse modes is superior to atomic absorption spectrometry for the determination of ecotoxic heavy metals and metalloids in natural waters. Voltammetry is an oligo-substance method which enables the simultaneous determination of several metals in the same run. Due to its extraordinary determination sensitivity, voltammetry enables speciation studies to be made at more realistically low overall levels of dissolved heavy metals than do other methods such as potentiometry. When the differential pulse mode was used in connection with the electrochemical preconcentration techniques applied in differential pulse stripping voltammetry (DPSV) or adsorption differential pulse voltammetry (ADPV), the ultimate sensitivity limit of the method was not reached in practice; determinations are possible down to heavy metal trace concentrations of 0.001 micro g/L and, in exceptional cases, even more than one order of magnitude lower, as has been demonstrated for Cd in arctic snow. At present, the attainable determination limit is not set by the voltammetric properties, but by practical facts stemming from the small blank levels that remain even under ultraclean working conditions at those ultra-trace levels. For exploitation of the full potential of voltammetry, the method should be applied in connection with appropriate, advanced, and reliable sampling and sample pretreatment procedures. (Collier-IVI)
W85-02306

ELECTROCHEMICAL SPECIATION OF TRACE METALS IN SEA WATER,
Akademie der Wissenschaften der DDR, Rostock-Warnemuende. Inst. fuer Meereskunde.
L. Brugmann.
Science of the Total Environment, Vol. 37, No. 1, p 41-60, July, 1984. 6 Fig, 4 Tab, 122 Ref.

Descriptors: *Trace metals, *Seawater, *Electrochemistry, *Chemical analysis, Polarography, Voltametry, Potentiometry, Instrumentation, Lead, Copper, Speciation.

Various approaches, such as bioassays, computer-assisted modelling and direct measurement following physical separation are currently being used to investigate the speciation of trace metals in sea water. The electrochemical techniques used successfully as a necessary prerequisite for the experiments involved include conventional polarography, anodic stripping voltammetry (ASV) and potentiometry. Differential pulse anodic stripping voltammetry (DPASV) using mercury film electrodes enables direct studies in ultratrace levels present in non-contaminated ocean waters. By varying the conditions of the sample chemistry and electroanalysis it is possible to characterize metal-organic interactions. This is demonstrated in the case of natural sea water samples subjected to ASV diagnosis. Differences in the Pb and Cu values yielded for Baltic waters by two methods based on DPASV and AAS are discussed with regard to speciation. An analysis of the existing literature is used to briefly summarize the needs of future research. Important problems requiring a more precise quantitative analysis include the adsorption of organics on electrodes and the kinetics and thermodynamic constants of chelates with special regard to the physico-chemical nature of metal-humic substances. The introduction of new and improved electroanalytical techniques and equipment for speciation studies is strongly recommended. (Author's abstract)
W85-02308

ELECTROCHEMICAL DETERMINATION OF POLLUTANTS IN SEA WATER: TOXIC SUBSTANCES AND NUTRIENTS,
Marie Curie-Sklodowska Univ., Lublin (Poland). Dept. of Analytical Chemistry and Instrumental Analysis.
K. Sykut, and R. Dumkiewicz.
Science of the Total Environment, Vol. 37, No. 1, p 91-94, July, 1984. 21 Ref.

Descriptors: *Electrochemistry, *Seawater, *Chemical analysis, *Nutrients, *Heavy metals, Phosphorus, Ammonium, Nitrates, Nitrites, Ion selective electrodes, Voltametry.

Coastal marine waters have a wide variety of important human uses and therefore must be protected against contamination. The main sources of their pollution (by toxic substances and nutrients) are the discharge of municipal sewage and runoff from agricultural areas. Excessive nutrient enrichment in the form of inorganic nitrogen (NH4(+), NO2(-), NO3(-)) may be directly estimated by the use of ion selective electrodes (ISE), whereas the inorganic phosphorus can only be estimated indirectly. The total content of N, P and heavy metals may be estimated after decomposition of organic substances, using the ISE method in the case of P and N determination and the differential pulse anodic stripping voltammetry (DPASV) method for determining the heavy metals. (Author's abstract)
W85-02312

ELECTROCHEMICAL METHODS AND SENSORS FOR MONITORING OF WATER,
Ceskoslovenska Akademie Ved, Prague. J. Heyrovsky Inst. of Physical Chemistry and Electrochemistry.
J. Tenygl.
Science of the Total Environment, Vol. 37, No. 1, p 113-120, July, 1984. 4 Fig, 22 Ref.

Descriptors: *Electrochemistry, *Electrodes, *Passivation, Calibration, Microprocessor control, Reactivation, Chemical analysis, Chemical oxygen demand, Biological oxygen demand.

Continuous monitoring of water for various substances is made difficult by the passivation of the electrochemical sensors which causes a change (usually a decrease) of the signal during prolonged contact with contaminated water. Passivation is usually caused by a combination of several effects such as oxidation, deposition, or slime growth. Frequent calibration and zeroing elimates the effect of passivation as well as of changes in physical parameters. Introduction of the automatic calibration and zeroing with microprocessor control opens up new possibilities for long term analysis. A very efficient method to protect the electrode is covering its surface with a thin membrane made of polyethylene, teflon, or other plastics. Only gases or volatile substances can diffuse through the membrane to the electrode surface while ionic species and impurities cannot penetrate. Many mechanical, chemical, physical, and various electrochemical methods have been developed for reactivating sensors. A rotating mercury pool membrane electrode was used for the continuous determination of metal ions in water. For reactivation of the solid electrodes in the anodic region, a thermal regeneration of the electrode was developed with a heated wire electrode. Methods for the determination of the species after its transfer from the water phase into a gas stream are used for determining chemical oxygen demand and biological oxygen demand. (Collier-IVI)
W85-02315

ION SELECTIVE ELECTRODES FOR MEASUREMENTS IN FRESH WATERS,
Rome Univ. (Italy). Ist. di Chimica Analitica.
M. Mascini, and A. Liberti.
Science of Total Environment, Vol. 37, No. 1, p 121-128, July, 1984. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Ion selective electrodes, *Potentiometry, *Somalia, Well water, Detection limits, Fluorides, Chemical analysis.

Ion selective electrodes (ISE), now commonly employed for measurements in fresh waters, are simple, sturdy, and reliable. Samples need only a minor pretreatment before being appropriate for analysis. The detection limit of a potentiometric measurement is usally in the range of 10 to the -5 power M to 10 to the -6 power M. Several features make potentiometry very attractive as an analytical method in water analysis. One advantage is that measurements can be performed in field conditions with portable instruments, this feature is of considerable importance in environmental monitoring of water quality, especially when storage and transportation may be sources of errors in analytical determinations. Applications of the ISE in field measurements have been realized in a Somalia survey with simple equipment. The water wells of several desert districts were characterized with the aim of evaluating future residential and cattle raising areas. About 100 wells were analyzed in a desert area located far from any village. Through this survey, experimental evidence was obtained of endemic illness of nomadic populations due to the high fluoride content of some wells. (Collier-IVI)
W85-02316

MODELS AND STRATEGY FOR TAKING MEASUREMENTS IN WATER AND IN THE AIR (MODELISATION ET STRATEGIE DE LA MESURE DANS L'EAU ET DANS L'AIR),
J. Jacquet.
Houille Blanche, No. 1/2, p 67-78, 1984. 1 Fig, 15 Ref.

Descriptors: *Measuring instruments, *Model studies, Water analysis, Monitoring, Water quality control.

In order to devise models to show changes in phenomena occurring in aquatic and atmospheric media, it is necessary to at the same time devise suitable measurement strategies for acquiring data necessary to create, calibrate and validate such models. Different stages of computing models for a complex system of ecological proportions are used as proof to illustrate this statement from the aspect of systems analysis. Significant examples are provided from research into the atmospheric water cycle. These studies were undertaken to highlight man's influence on the behavior of natural surroundings. Strategies involving permanent metering networks are particularly emphasized. These form the corner-stone for devising ways and means of effectively administering areas of the biosphere. A review must also be made of the administration of the metering networks themselves in order to guarantee that they continue to function economically and to provide reliable information. (Baker-IVI)
W85-02352

CUT-THROAT FLUME CHARACTERISTICS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
R. J. Keller.
Journal of Hydraulic Engineering, Vol. 110, No. 9, p 1248-1263, September, 1984. 8 Fig, 2 Tab, 8 Ref.

Descriptors: *Flumes, *Measuring instruments, *Cut-throat flumes, Open channels, Flow, Stream flow.

The characteristics of cut-throat flow measuring flumes are examined with special attention to scale effects and the transition submergence at which the flow regime changes from undrowned to drowned. The results for undrowned flumes indicate a small scale effect at low flow rates only. The scale effect is completely eliminated by adjusting the data to correct for dissimilar boundary layer growth. For drowned flow there was no scale effect for relative submergences below 0.85. Above this value an apparent scale effect is noted although it is of little practical consequence. The value of transition submergence is nonconstant and dependent on the discharge through the structure. Hydraulic model testing of cut-throat flumes to obtain prototype submerged rating data is feasible, provided the entrance and exit conditions are correctly modeled and the submergence ratio is kept below 0.85. At higher submergence there is an apparent significant scale effect which is not fully explained present studies. The transition submerg which the flow regime changes from und to submerged, is itself a function of the di through the flume. In the present study ranging from 52 to 95% were measure throat flumes are most accurate when ope the undrowned mode. If submerged flow avoidable, cut-throat flumes should not be ed at submergences greater than 0.85. (Bak W85-02453

ERRORS IN LEVEL RECORDER DATA VENTION AND DETECTION,
Agricultural Univ., Wageningen (Nethe Dept. of Land and Water Use.
S. Van der Schaaf.
Journal of Hydrology, Vol. 73, No. 3/4, p 3 August, 1984. 2 Fig, 2 Tab, 4 Ref.

Descriptors: *Water level, *Measuring ments, *Errors, Error analysis, Computers.

The occurrence of errors in water-level re data can be reduced by both prevention and tion with subsequent correction. For effecti vention, the error sources should be known. sources in the conversion steps include zer shift, nonlinearity, hysteresis, scale factor, re bility, environmental variations, timing, and deformation. For effective detection, knowle error symptoms and their relationship with sources is essential. The effectiveness of both prevention and detection depends on field p tions, the quality and frequency of field chec field check reports, on the quality of equi maintenance and, as far as detection/correct concerned, on the sampling interval. Errors data should be detected by a computer pro not manually. A computer produced error and field-check reports are necessary for err the data to be corrected. (Baker-IVI)
W85-02495

RAPID BIOLOGICAL METHOD FOR MONITORING OF EUTROPHICATION,
National Board of Waters, Helsinki (Fin Water Research Inst.
P. Heinonen, and S. Herve.
Archiv fur Hydrobiologie, Vol. 101, No 1 135-142, August, 1984. 2 Fig, 2 Tab, 7 Ref.

Descriptors: *Measuring instruments, *Fi *Eutrophication, *Monitoring, Filter media, fiber filters, Lakes.

A new, rapid biological method for the monit of watercourse eutrophication is described. method is based on the use of glass fiber filte artificial substrate. The test filters were incub both in rivers and in a lake. Various combina of filter material were employed. A single fiber filter was found unsuited for use in waters due to its mechanical weakness. Single double glass fiber filters with plastic sheet over side or between the two fibers proved unsati tory as removing the plastic sheets consider slowed the process. The best results were obta using a double glass fiber filter. (Baker-IVI)
W85-02526

SIMPLE FIELD METHOD FOR CONCENT TION OF VIRUSES FROM LARGE VOLUM OF WATER,
Arizona Univ., Tucson. Dept. of Microbiology Immunology.
G. A. Toranzos, C. P. Gerba, and H. Hanssen.
Applied and Environmental Microbiology, V 48, No. 2, p 431-432, August, 1984. 1 Fig, 1 Tab Ref.

Descriptors: *Water sampling, *Sample prepa tion, *Viruses, *Concentration, Water quality c trol, Sampling, Field tests, Microporous filters.

A lightweight, low-cost, plastic spray tank h been developed for use in concentrating viru from water with microporous filters. The system able to process from 10 to more than 22 liters finished tap water with the 47 mm diameter filt

from 22 to more than 154 liters with the 142 diameter filters. The device was successfully in recent field studies to concentrate viruses positively charged 30S Zeta-plus and 1-MDS zorb filters. These filers have an advantage negatively charged filters in that pH adjust- or addition of cation salts is not required re processing the water. The effect of turbidity he volumes which could be processed is dis- ed. (Baker-IVI)
5-02603

LICATION OF DERIVATIVE SPECTROS- PY IN BIOASSAYS ESTIMATING ALGAL AILABLE PHOSPHATE IN LAKE SEDI- NTS,
gheemraadschap van Rijnland, Leiden (Neth- nds).
primary bibliographic entry see Field 5A.
5-02615

REHOLE METHODOLOGY FOR HYDRO- OCHEMICAL INVESTIGATIONS IN FRAC- RED ROCK,
ional Hydrology Research Inst., Ottawa (On- o).
J. Bottomley, J. D. Ross, and B. W. Graham.
ter Resources Research, Vol. 20, No. 9, p 1277- 0, September, 1984. 20 Fig, 2 Tab, 23 Ref.

scriptors: *Sampling, *Groundwater, *Bore- es, *Hydrogeochemistry, Geological fractures, meability coefficient.

e major complications in obtaining representa- samples from boreholes in low permeability ctured rock include contamination from drilling d, vertical mixing in open holes of groundwater different chemistries between fractures of differ- hydraulic head, and low hydraulic conductivi- fractures which limit the rate at which ground- ter can be pumped to the surface. A geochemi- probe controlled and operated with an umbili- cable system has been field tested to a depth of m in a multilevel ported casing at the Chalk er Nuclear Laboratories (CRNL), Chalk River, tario. The probe provides in situ measurements pH, redox potential, dissolved oxygen, tempera- e, conductivity, and pressure while allowing undwater sample collection both at surface and wnhole. The multilevel ported casing preserves subsurface hydrogeochemical zonation and fa- tates sampling at various depths. In the CRNL rehole, dilute Na/HCO3 and Na/Cl waters ging in age from 500 to 12,000 years have been served in gneissic rock at depths of 85 to 350 m. curate hydrogeochemical characterization of low-permeability metagabbro present from 400 600 m has been frustated by contamination from ing installation water. Modifications in the sign of the casing are required so that the casing n be installed rapidly and the casing packers lated without the introduction of nonindigenous ids. (Moore-IVI)
85-02670

FLECTION MEASUREMENTS OF THE UP- REAM ASPHALTIC MEMBRANE OF ARCHLYN DAM,
r primary bibliographic entry see Field 8D.
85-02682

ENGINEERING WORKS

A. Structures

ALCULATION OF COMPLETE INTERCEP- ION OF GROUNDWATER INFLOW TO 'PER- ECT' TRENCHES BY LIGHT WELLPOINT STALLATIONS,
r primary bibliographic entry see Field 4B.
'85-02229

ALCULATION OF THE LINING OF A NON- IRCULAR TUNNEL,
. F. Ilyushin.
Hydrotechnical Construction, Vol. 17, p 627-632, December, 1983. 2 Fig, 4 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 12, p 25-28, December, 1983.

Descriptors: *Tunnel construction, *Linings, Tunnel linings, Concrete, Reinforced concrete, Mathematical equations, Hydroelectric plants.

High-head hydroelectric stations located in mountainous regions have underground structures on which one of the main loads is the pressure of groundwaters. The most common noncircular cross-sectional shape of a tunnel is the horseshoe with a crown outlined over the arc of a circle and flat walls and invert. Such a shape is the most technologically efficient during construction. The lining has usually a minimum design thickness and can be concrete or reinforced. The reinforcement is installed in the crown in conformity with the diagram of moments and in the walls and invert in the middle of the lining thickness. The lining is equipped with drainage reducing the pressure of the groundwaters to a practically acceptable value. Residual pressure is absorbed by the lining of the crown having an efficient axis outlined over the arc of a circle and by the flat walls and invert transmitting forces through the anchors to the surrounding rock mass. There are no restrictions with respect to the conditions of hydraulics and seepage with respect to cavitation erosion and abrasion, and permissible gradients of the seepage flow through the lining. Methods are given for calculating the crown, concrete wall and invert, anchors, and concrete-rock walls and invert. (Baker-IVI)
W85-02230

WEDGE-WIRE INTAKE SCREENS FOR SHALLOW SAND-BED RIVER,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
R. Ettema, and J. C. Johnson.
Journal of Hydraulic Engineering, Vol. 110, No. 8, p 1139-1144, August, 1984. 4 Fig, 1 Ref.

Descriptors: *Screens, *Intakes, *Hydroelectric plants, *Kansas River, Water supply development, Powerplants, Filters, Sand, Soil properties.

The Kansas River near Belvue Kansas was selected as an alternate source of make-up water for the Jeffrey Energy Center's condenser cooling system. The river is a relatively shallow sandbed river of constantly changing bottom geometry. Wedge-wire intake screens have been an effective and practical means of drawing water from the river, provided that the screens are positioned in a protective enclosure such as a trough. The local flow field around the trough generally acts to prevent accumulation of sediment near the intake screens and a system of water jets can be applied to successfully sluice sediment from the trough. For the JEC river intake, two pairs of water jets effectively sluice the trough. The upstream pair, which are at the end of the trough, will be applied initially. After a sufficient period, the second pair, which are located under the downstream screen, are consecutively applied. (Baker-IVI)
W85-02268

OPTIMAL CHANNEL CROSS SECTION WITH FREEBOARD,
Colorado Univ. at Denver. Dept. of Civil and Urban Engineering.
C.-Y. Guo, and W. C. Hughes.
Journal of Irrigation and Drainage Engineering, Vol. 110, No. 3, p 304-314, September, 1984. 7 Fig, 1 Tab, 5 Ref.

Descriptors: *Channels, *Construction costs, *Design criteria, *Optimization, Geometry, Mathematical equations, Cost analysis, Friction, Freeboard.

An analytical procedure is presented for determining the dimension of an open channel, including freeboard, which either minimizes frictional resistance or minimizes construction cost. The least-cost solutions indicate the importance of including the channel width in the formulation of channel cost function, since otherwise the solution always results in a wide shallow channel. A graphical method is suggested which simplifies the computations required to determine a hydraulically optimum trapezoidal channel cross section. Owing to the regionalization of construction costs, the solutions for the least-cost trapezoidal channel cross section can only be expressed as a function of those constraints involved in the localized channel cost function. By analyzing historical cost data near the site or summing estimates of idividual channel costs, the proposed channel construction cost function can be established and a general expression for the least cost trapezoidal channel cross section can be reduced to a solvable stage. Similar figures to those shown for the minimum resistance channel cross section can be also produced for the least cost channel section. (Baker-IVI)
W85-02448

TRENDS IN PUMPED-STORAGE DEVELOPMENT,
Acres Consulting Services Ltd., Toronto (Ontario).
J. G. Warnock, and B. L. Smith.
International Water Power and Dam Construction, Vol. 36, No. 8, p 15-19, August, 1984. 3 Fig, 3 Tab.

Descriptors: *Pumped storage, *Design criteria, *Construction, *Reservoirs, Pumps, Turbines, Liners, Water management, Water resources development.

Various trends emerging in pumped-storage development are described with particular attention given to those trends which influence flexibility of performance, effectiveness in meeting rapid changes in system demand, load frequency control and economy in relation to other means of providing the same system services. The concept of underground pumped hydro is also mentioned. Notable trends in the design and construction of the civil works of pumped storage projects include the evolution of a reliable type of lined reservoir, geotechnical investigations of increasing complexity and detail, ever-increasing heads where permitted by geology and topography, a limited use of prestressed reinforced concrete as a substitute for steel liners in pressure tunnels, a dramatic increase in the use of underground locations for power stations, an awareness of environmental considerations, and the further development of the asphaltic-lined type of reservoir in connection with underground pumped storage. (Baker-IVI)
W85-02672

PUMPED-STORAGE: PEAK GENERATION OR OPERATING RESERVE,
M. Monti, P. Sandrin, and J. P. Gonot.
International Water Power and Dam Construction, Vol. 36, No. 8, p 20-23, August, 1984. 5 Fig, 2 Ref.

Descriptors: *Pumped storage, *Model studies, *DEMETER, *France, Design criteria, Planning, Water management, Optimization.

The trade-off which must be established between the various functions of pumped-storage plants is examined. A compromise between supply security and economic planning can be found only by coordinated planning of pumped-storage units and thermal generation plants. A model used by Electricite de France (EDF) to ensure optimized daily planning of thermal and pumped-storage units is described. The model, called the DEMETER model, ensures the optimization of the daily planning of thermal and pumped-storage plants. The model iterates between two levels: coordination where the prices of the generated energy and the operating reserve are determined to adjust generation to load and keep a sufficient reserve; and decomposition where the schedule of each unit is optimized on the basis of the above prices and taking into account local constraints such as unavailability, and minimum shut down time. The role of EDF is to supply customers with energy while seeking the lowest generation cost. As electricity cannot be stored in its original form, only that which can be used should be generated. (Baker-IVI)
W85-02673

Field 8—ENGINEERING WORKS

Group 8A—Structures

PUMPED STORAGE FOR THE GERMAN RAILWAY,
Energy Engineering International, Munich (Germany, F.R.).
H. Reges.
International Water Power and Dam Construction, Vol. 36, No. 8, p 35-36, August, 1984. 2 Fig, 2 Tab.

Descriptors: *Pumped storage, *Design criteria, *Water management, *West Germany, Railways, Energy, Construction, Pumps, Turbines, Electrical equipment.

The Langenprozelten pumped-storage plant supplies the German railway with peak energy. It obtains its pump energy from the German railway network and feeds energy back into this network by being operated as a generator. The upper reservoir of the plant is located on the Sohlhohe hill and the lower reservoir in a valley 300 m below. Each of the two vertical machine sets installed in the plant consists of a pump-turbine, a starting turbine and a synchronous generator. An approximately 1300 m long pressure pipeline, with an interior diameter of 3.9 m, connects the upper reservoir with the powerplant. The powerplant is a shaft structure with a rectangular plan, located in the center of the dam of the lower reservoir. Electromechanical equipment described in the article includes pump turbines, starting turbines, synchronous generatores and accompanying electrical equipment. (Baker-IVI)
W85-02675

MODULAR EQUIPMENT FOR THE AUTOMATIC CONTROL OF SMALL HYDRO PLANTS,
Hidroelectrica Espanola, Madrid.
J. Regoyos, and G. Gomez.
International Water Power and Dam Construction, Vol. 36, No. 9, p 18-21, September, 1984. 6 Fig.

Descriptors: *Computers, *Microcomputers, *Automation, *Hydroelectric plants, Management, Water management.

The application of a microcomputer and an assembly of modular equipment for the automatic control of three small run-of-river plants is described. The systems controlled by the modular set up include gates, turbines with adjustable runner blades, induction generators, speed increasers, turbine and generators system, circuit breakers, power transformers, auxiliary supplies and condenser batteries. The stages of research in developing a system suitable for easy application for any small hydro plant are as follows: analysis of the automation of different kinds of small hydroplants and definition of basic control criteria for them; definition of the auxiliary devices which collect the data for the control microcomputer; modular standardized development of the common systems; definition of the control functions; definition and development of the starting and stopping sequences, and the ways of tripping the unit; preparation of technical specification of the control microcomputer; design of a prototype microcomputer; simulation tests of the microcomputer and auxiliary systems; and installation and operation tests in three small hydro plants. (Baker-IVI)
W85-02679

COMPUTER MODELLING OF RESERVOIR NETWORKS AND HYDROELECTRIC PLANTS,
Main (Charles T.), Inc., Boston, MA.
C. K. Sarkar.
International Water Power and Dam Construction, Vol. 36, No. 9, p 22-24, September, 1984. 4 Fig.

Descriptors: *Computer models, *Hydroelectric plants, Automation, Optimization, Water management, Simulation, Reservoir networks, Model studies.

HYMS (Hydroelectric Simulation) is a general purpose hydroelectric simulation model having the capability of simulating precisely almost any hydroelectric plant and reservoir system, large or small, simple or complex. Computations may be performed at a desired level of accuracy consistent with the availability of new input data. The program may be used to study the feasibility of new developments and their impacts on exising systems, effects of changes in operational procedures in an existing system, or at any component plant. It can be used to determine hydroelectric power potential in a river basin, to help optimize reservoir sizes, dam heights, plant sizes and expansions, sizes of penstocks and tailrace tunnels/channels, determine reservoir and plant operating procedures, and the like. It is a versatile, flexible and powerful tool. (Baker-IVI)
W85-02680

DESIGN AND CONSTRUCTION OF THE AGUS IV POWER CAVERN, PART THREE: CONTROL OF BEHAVIOR,
Lahmeyer International G.m.b.H., Frankfurt am Main (Germany, F.R.).
K. Honisch, and H. Schranz.
International Water Power and Dam Construction, Vol. 36, No. 9, p 51-56, September, 1984. 6 Fig, 3 Tab, 2 Ref.

Descriptors: *Power cavern, *Design criteria, Construction, Measuring instruments, Tunnels, Excavation, Anchor load, Deformation.

The monitoring of a sufficient and representative amount of rock deformations and anchor loads is an indispensible part of a non-rigid method to excavate large underground openings safely. One of the new methods is the New Austrian Tunnelling Method (NATM) which has been applied for the cavern of the Agus IV hydroelectric project. The instrumentation for the cavern of the Agus IV project consisted of 26 multiple and five single extensometers, seven convergency cross sections with up to ten measured distances and 26 disc load cells. Geodetic surveying has supported the measurements. Because of blasting, breakage and non-operational times of bolts, the convergency measurements provided only 50% of the data expected, while the extensometers gave about 85% reasonable results. The performance of the cavern has demonstrated the presence of homogeneous almost linear elastic, isotropic rock, with a deformability described by Young's modulus of 1750 MN/sq m. Consolidation grouting has improved the rock quality up to a Young's modulus of 2000 MN/sq m. An integral part of the excavation using the NATM is the immediate evaluation of deformations. Two independent but simultaneous measuring techniques are required. (Baker-IVI)
W85-02683

8B. Hydraulics

PERTURBATION SOLUTION FOR DAM-BREAK FLOODS,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
B. Hunt.
Journal of Hydraulic Engineering, Vol. 110, No. 8, p 1058-1071, August, 1984. 7 Fig, 12 Ref.

Descriptors: *Dam construction, *Flood control, *Mathematical equations, Perturbation, Kinematic waves.

The method of matched asymptotic expansions has been used to calculate an approximate solution for a dam-break flood. This work suggests that the solution becomes asymptotically valid after the wave front (shock) has advanced about four reservoir lengths downstream. Calculations show that depth hydrographs downstream from this point are virtually independent of the way in which mass is initially distributed within the reservoir and that a significant simplification of the mathematical solution can be achieved by modeling the reservoir with a point source of mass. The solution away from the leading edge of the flood wave is given by the kinematic-wave approximation, which results from neglecting depth-gradient and acceleration terms in the momentum equation. The solution near the leading edge of the flood wave is obtained by neglecting accelerations and including the bed-slope, bed-resistance and depth-gradient terms in the momentum equation. This suggests that results given by the closed-form approximation are ... ally identical with results obtained from the ... inertia or diffusion analogy numerical meth... Comparisons with experiment show good qu... tive agreement. (Baker-IVI)
W85-02264

ONE-DIMENSIONAL MODELS FOR P... TIALLY BREACHED DAMS,
Utah Univ., Salt Lake City. Dept. of Civil E... neering.
D. R. Schamber, and N. D. Katopodes.
Journal of Hydraulic Engineering, Vol. 110, N... p 1086-1102, August, 1984. 13 Fig, 14 Ref. ... grant ENG 73-04233 A01.

Descriptors: *Dam failure, *Flow, Model stu... Dam breach, Mathematical models, Unste... flow, Floods.

Under the assumption that the rapidly varied ... in the vicinity of a partial breach can be treate... an internal boundary condition, one-dimensi... models based on the complete unsteady flow e... tions gave satisfactory results for the cases stud... A theory for flow through a partial dam failu... presented which identifies three distinct flow ... ditions at the breach: free flowing/supercrit... condition; free flowing/subcritical conditions ... submerged condition. These conditions are for... lated in terms of fundamental mass, moment... and energy considerations written for specific ... tions in the breach vicinity and coupled with ... propriate characteristic relations written for gra... ally varied unsteady flow. The theory is tested ... various cases of breach width and channel rou... ness. The numerical computations agree favora... with the available experimental data. The econo... of computation resulting from these one-dim... sional approximations is tremendous and the us... such models whenever possible is highly desira... Such models provide no information on the lo... tudinal extent of the convergent-divergent, t... dimensional flow in the vicinity of the breach. ... consideration of such phenomena is indeed app... priate for a floodwave emanating from a breac... dam onto an unbounded plain, with no confin... side walls. (Baker-IVI)
W85-02266

FLOW ANALYSES IN IDEALIZED RUBBI... MOUND BREAKWATER,
Kanazawa Inst. of Tech. (Japan). Dept. of C... Engineering.
K. Mizumura.
Journal of Waterway, Port, Coastal and Oce... Engineering, Vol. 110, No. 3, p 344-355, Augu... 1984. 12 Fig, 1 Tab, 5 Ref.

Descriptors: *Flow characteristics, *Breakwate... Mathematical equations, Flow channels, Wa... action, Water currents.

Wave-induced currents in rubble-mound bre... waters are analyzed. Particular regard is given ... the modeling of flow channels and computing ... method of characteristics. The horizontal wa... motion by incident wave at the leading points ... the breakwater is transformed to the vertical wa... motion in the breakwater. For large friction coe... cient the flow velocitites are depressed and t... flow condition becomes faster. The correspon... ence of the flow velocities to the incident wave ... delayed by the increasing friction coefficient. F... large cross-sectional areas the flow velocities a... increased and the flow condition becomes stea... slowly. The correpondence of the flows to t... incident wave is advanced by the increasing cro... sectional area. For the same number of rubbles ... the horizontal direction and increased number ... rubbles in the vertical direction, the flow velociti... are increased. This is equivalent to the increase ... cross-sectional area and the effectiveness of rubb... also increases. The effective constructing meth... of the rubble-mound breakwater for wave refle... tion is to increase gaps among rubbles in the ver... cally upper zone and to increase the height of t... breakwater. Since a large quantity of water ente... the breakwater during one wave period if flo... velocity is high in the breakwater, the wave refle... tion decreases at the front of the breakwater. T...

er of rubbles in the vertical direction is more tant for wave reflection than that in the ntal direction. The high velocity in the case ge rubble thickness is caused by the pressure nce between the top and the bottom of the layer in front of the breakwater. One cause sea bed erosion in front of a rubble-mound water is the wave induced currents. (Baker-

02271

MATIC PROTECTION OF LARGE S AGAINST HYDRODYNAMIC PRES- FLUCTUATION OF SEISMIC ORIGIN TECTION PNEUMATIQUE DES BAR- ES CONTRE LES SURPRESSIONS HY- DYNAMIQUES D'ORIGINE SISMIQUE),
sel.
le Blanche, No. 1/2, p 133-138, 1984. 6 Fig.

riptors: *Seismology, *Dam stability, *Air ts, Pressure distribution, Dams, Hydrodyna- Model studies.

ockets distributed all over the upstream face dam communicate with the water, providing natic protection for large dams against seis- pressure fluctuations. While the damping of such air cushions is readily understand- a theoretical linearized model is presented to quantitative analyses of such phenomena. Al- h it is linear, the theory appears to give le orders of magnitude and shows that pres- fluctuations may be drastically reduced, chief- r frequencies of a few hertz. Fundamental ance frequencies of large dams are often in me range. Detailed computations are provid- Baker-IVI)
02356

OVAL OF SEDIMENT PARTICLES BY TEX BASIN,
ere Univ. of Technology (Finland).
Mashauri.
Fennica, Vol. 13, p 27-33, 1983. 6 Fig, 6 Ref.

riptors: *Vortex basins, *Settling basins, *Par- tes, Hydrologic models, Clarifiers, Water ment, Irrigation headworks, Hydroelectric s, Velocity, Vorticity, Sediments.

vortex-type settling basin is essentially a 'bath with a central orifice to discharge settled cles. A physical model was constructed to y the parameters and governing equations of basin settling patterns, and efficiency. Two ons are studied: the horizontal floor type and loping floor type. Parameters such as angular city, the vorticity force, and the settling effi- y are determined as functions of the inflow harge, orifice diameter and its ratio to the basin eter and the particle size. Settling efficiency amount of water through orifice are given for versions (horizontal floor and sloping floor) they show a respectable performance. Settling iency is well above 80% for particles as small 125 mm in diameter. The amount of water ugh the orifice hardly exceeds 15% of the w discharge. The basin dimensions are small pared to classical basin. Since the basins can ve particles > 0.2 mm efficiency, their use in opower intakes is recommended. Smaller par- s can also be removed to some extent, so that asins may be useful in water supply intakes as ary clarifiers. This type of basin can also be at irrigation headworks to deter sediment cles from entering the irrigation canals down- um. (Moore-IVI)
02391

OT EXPERIMENTS ON THERMAL BAR OCK EXCHANGE FLOW,
Master Univ., Hamilton (Ontario). Dept. of l Engineering and Engineering Mechanics.
. Marmoush, A. A. Smith, and P. F. Hamblin.
nal of Energy Engineering, Vol. 110, No. 3, p 227, September, 1984. 5 Fig, 2 Tab, 18 Ref.

criptors: *Density, *Thermal pollution, *Ther- bar, *Lock exchange, *Cold regions, Temperature effects, Physical properties, Powerplants, Flow.

In cold climates, the behavior of thermal density currents may be altered when the receiving water is close to the freezing point due to the fact that fresh water attains its maximum density at a temperature of 4 C. The existence of a density extremum in water at 4 C and the resulting nonlinear relation between density and temperature gives rise to densimetric flows, which are markedly different from those in the linear range. Experiments are described that give some insight into the phenomenon of the thermal bar and the manner in which it may influence nearshore transport processes in the vicinity of a thermal outfall in a cold climate. The experiments provide dramatic proof that the existence of an extremum in the density/temperature relation has a profound influence on the behavior of densimetric flow in general and lock exchange behavior in particular. The three zones of interest in the vicinity of a thermal bar are clearly demonstrated: the overflow region, the thermal bar, and the thermal underflow region. The quantitative results were sufficiently good to give a picture of a gradually thickening interfacial layer of maximum density that eventually dominates the flow regime. The location of the thermal bar appears to be strongly linked to the initial density difference, although the scope of the tests and limitations of equipment were such that other influences cannot be ruled out. (Baker-IVI)
W85-02443

EFFECT OF ICE COVER ON HYDROPOWER PRODUCTION,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
P. D. Yapa, and H. T. Shen.
Journal of Energy Engineering, Vol. 110, No. 3, p 231-234, September, 1984. 2 Fig, 7 Ref. St. Lawrence Seaway Development Corp. Contract DTSL55-83-CO215.

Descriptors: *Hydroelectric plants, *Electric power production, *Ice cover, *Power Dam, *St. Lawrence Seaway, Energy, Economic aspects, Hydraulic resistance, Frazil ice, Hydraulic roughness.

The loss of power due to the resistance of the ice cover in the 27 mile reach between the Iroquois Dam and the Power Dam on the St. Lawrence River is analyzed. This reach, which includes a steep fast flowing section, is most critical in the ice formation process. The average power loss per winter is about 50,000 MW-hr. Relationships between three parameters that affect the hydraulic resistance of the ice cover are analyzed in efforts to identify major factors that influence the energy loss due to the ice cover. These three parameters are the total cumulative freezing degree-days, the total frazil ice production per unit area, and the Manning's roughness coefficient of the initial ice cover. The power loss can only be related to the initial ice cover roughness. Based on the analysis it is concluded that it is important to form a smooth, stable initial ice cover with a minimum open water area in order to be able to reduce the power loss. Once the initial ice cover is formed, the only means of improving power production would be through the regulation of discharge at the Power Dam. (Baker-IVI)
W85-02444

DYNAMICS OF JETS IN TWO-LAYER STRATIFIED FLUIDS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
P. J. W. Roberts, and P. R. Matthews.
Journal of Hydraulic Engineering, Vol. 110, No. 9, p 1201-1217, September, 1984. 11 Fig, 3 Tab, 11 Ref.

Descriptors: *Fluid mechanics, *Jets, *Flows, *Stratification, Hydraulic engineering, Stagnant water, Entrainment, Pumped storage, Density jump.

Experiments were performed on nonbuoyant jets discharging horizontally into a stagnant, two layer stratified ambient fluid. The ambient stratification is characterized by a well mixed upper layer separated by a density jump from a deeper layer which is linearly statified. This is an idealization of the stratification that occurs in lakes, reservoirs, and ocean waters. The discharge is into the lower layer, and the flow situation arises in pumped storage reservoirs during power generation or pump back and in Ocean Thermal Energy Conversion (OTEC) plants in the ocean. The effects of source momentum flux, lower layer stratification, and interfacial density jump were studied for a range of conditions for which the nozzle size exerts only a small influence. The jet behaves initially in a manner similar to that of one in an unstratified fluid, but at some distance from the nozzle, the ambient stratification caused the jet to collapse vertically and spread rapidly sideways. Following collapse, the inflow proceeds as a density current. Depending on the relative strengths of the parameters involved, entrainment from the upper layer into the jet may occur. This type of flow is termed unstable, and one in which no entrainment occurs is termed stable. For stable conditions the flow is entrained selectively into the jet from a layer of finite thickness. Analysis is based primarily on dimensional analysis and length scale arguments and results are presented to predict whether entrainment from the upper layer occurs, the widths and locations of the entrained flow and depth of the ambient mixed by the jet, the total jet volume flux, and the collapsed layer thickness. (Baker-IVI)
W85-02450

LIVE-BED SCOUR AT BRIDGE PIERS,
Auckland Univ. (New Zealand). Dept. of Civil Engineering.
B. W. Melville.
Journal of Hydraulic Engineering, Vol. 110, No. 9, p 1234-1247, September, 1984. 10 Fig, 1 Tab, 13 Ref.

Descriptors: *Scour, *Piers, *Sediments, Sediment transport, Abrasion, Erosion, Bridges, Velocity.

The relationship between scour depth at cylindrical bridge piers founded in cohesionless sediments, and mean approach flow velocity is defined for flows above the threshold of particle motion. Experimental data are collected in which pier size, sediment size and mean approach flow velocity are systematically varied. These data show that the relationship between scour depth and flow velocity differs, depending on whether the bed sediment is ripple forming or non-ripple forming, and separate functions are identified for each case. Both functions exhibit two scour peaks. These occur at the threshold and transition flat bed conditions. Contrary to previous findings, the maximum scour depth is found to occur at the transition flat bed condition in the case of ripple forming sands. For nonripple forming sediments, however, the maximum scour depth occurs at threshold condition. It is expected that local scour depths would be reduced from those for uniform sediment of the same mean size in situations where armoring occurs. (Baker-IVI)
W85-02452

SEEPAGE CHARACTERISTICS OF COARSE GRANULAR MEDIA,
Lincoln Coll. (New Zealand). Dept. of Agricultural Engineering.
V. Sriboonlue, and T. R. H. Davies.
Journal of Hydrology, Vol. 22, No. 2, p 138-151, 1983. 7 Fig, 4 Tab, 26 Ref.

Descriptors: *Seepage, *River beds, *Forchheimer equation, Porosity, Fluid mechanics, Mathematical equations.

Seepage flow through coarse porous materials such as river-bed gravels, rockfill dams, slurry separators, and fish incubators is governed by a nonlinear relationship. The coefficients of nonlinear seepage flow can be estimated from a reformulation of the Forchheimer equation, using grain diameter, porosity and fluid properties. These parameters are measureable by simple tests. This avoids the use of permeameter tests in preliminary investigations of seepage in coarse media. A semi-

empirical procedure is suggested which agrees satisfactorily with data from a range of tests on various coarse granular media. (Baker-IVI)
W85-02557

8C. Hydraulic Machinery

HYDRAULIC MODEL STUDY OF PUMP SUMP DESIGN,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
A. J. Odgaard, and J. J. Dlubac.
Journal of Hydraulic Engineering, Vol. 110, No. 9, p 1267-1272, September, 1984. 4 Fig, 4 Ref.

Descriptors: *Design criteria, *Hydraulic models, *Sumps, Pumps, Model studies, Scale models.

The results of a model study are reported which suggest that potential flow theory may be used as a guide toward the development of sump design modifications, which may include in-channel turning vanes, and perhaps, may even be used in the development of the conceptual layout of pump sumps. The model study was concerned with a proposed design of a 4-pump sump for withdrawal of cooling water from a natural draft cooling tower at Trimble County Generating Station. The model was constructed at an undistorted scale of 1:10 and was operated according to the Froude scaling law. (Baker-IVI)
W85-02454

COMMISSIONING PUMPS AND PUMP-TURBINES,
Brown and Root Development, Inc., Houston, TX.
B. Eyden.
International Water Power and Dam Construction, Vol. 36, No. 8, p 23-28 and 33-34, August, 1984. 5 Fig, 12 Ref.

Descriptors: *Design criteria, *Pumps, *Turbines, *Planning, Water resources development, Construction, Safety, Economic aspects.

Inadequate or poorly planned commissioning programs can lead to costly delays or even damage. These problems become particularly onerous with increasing unit size. A well designed and properly implemented commissioning program is increasingly important. A test procedure is outlined which constitutes a minimum for placing a hydraulic turbine or pumped turbine in commercial service with reasonable assurance of safe and satisfactory operation. Principal advantages to be gained from such a proceedure are in the line of safety, meeting contractual requirements, unit system operation, design innovations, reference standard, and personnel training. (Baker-IVI)
W85-02674

GEARS FOR PUMPED-STORAGE UNITS,
Allen Gears Ltd., Pershore (England).
B. J. Marsh, and G. L. Lack.
International Water Power and Dam Construction, Vol. 36, No. 8, p 37-38, August, 1984. 2 Fig, 1 Tab.

Descriptors: *Pumped storage, *Gears, *Mechanical equipment, Design criteria, Water management, Water resources development.

Due to the limitations in turbine runner design and the high cost of two-speed electrical machinery of the multi-pole, tandem mounted or solid state control type, a compromise is usualy accepted which never attains optimum operational efficiency in either the generating or pumping mode. A method does exist which enables considerably higher efficiencies to be obtained at an installation cost which could be recovered within a relatively short time. The method involves the installation of an epicyclic gear between the electrical machine and the turbine runner. The gear unit offers two possible speeds so that the synchronous speed of the electrical machine could remain constant while the runner would operate at its most efficient speed in the pumping and turbine modes. An example of the application of such a gear is offered. (Baker-IVI)
W85-02676

BEHAVIOUR OF HYDRAULIC MACHINES UNDER STEADY OSCILLATIONS,
Hydroart S.p.A., Milan (Italy).
G. Borciani.
International Water Power and Dam Construction, Vol. 36, No. 8, p 45-49, August, 1984. 11 Fig, 10 Ref.

Descriptors: *Hydraulic equipment, *Resonance, *Pumped storage, Oscillation, Design criteria, Turbine, Pumps.

Applications of a code designed to define the resonant frequencies in a hydraulic circuit at the Lete-Sava pumped storage plant are described. The plant has a 3 m diameter head-race tunnel, followed by a penstock of 2.3 m diameter. A cylindrical surge shaft, 9.5 m in diameter and upstream of the penstock, has an inlet throttle. The penstock supplies two units consisting of motor-generator, Pelton turbine and four-stage centrifugal pump through a branch pipe. This hydraulic system was excited in different operating conditions in generation and in pumping by injecting a sinusoidal electric signal into the governor of the four needles of turbine number 2. Numerous different pressure measurements were carried out, but the pressure response measured at point P20 is used to explain the methods used in interpreting the measurements. While such interpretations are not easy, the method employed has provided useful results. (Baker-IVI)
W85-02677

MEASUREMENT OF REAL TIME TURBINE EFFICIENCY,
Westinghouse Oceanic Div., Annapolis, MD.
G. P. Erickson, and J. C. Graber.
International Water Power and Dam Construction, Vol. 36, No. 9, p 15-17, September, 1984. 4 Fig.

Descriptors: *Turbines, *Efficiency, *Optimization, *Economic aspects, Design criteria, Water managment, Planning, Computers.

Real time efficiency measurement of hydroturbine generators can be provided today. The utilities recognize the need in terms of the loss in revenue that inefficiencies create. Losses of more than $100,000 per turbine per year can result from either turbine inefficiencies or increased penstock losses. These losses can go undetected for some time because of the difficulty in identifying them. A system designed to satisfy these requirements has been built by the Ocean Division of Westinghouse. Designated the LEFM-824, the system includes a Hewlett packard HP-85 desktop computer to perform the necessary computations. Whether this or a simpler system is used, on-line, the overall plant efficiency measurement is available today at virtually no risk to the utility. The economic payback period of such a system could be as little as six months. (Baker-IVI)
W85-02678

RESONANCE SENSITIVITY OF HYDROPOWER AND PUMPING STATIONS,
Institute of Hydraulic Engineering Research, Bucharest (Romania).
M. Popescu, and A. Halanay.
International Water Power and Dam Construction, Vol. 36, No. 9 p 25-28, September, 1984. 6 Fig, 6 Ref.

Descriptors: *Hydroelectric plants, *Design criteria, *Resonance, *Pumping stations, Optimization, Surge tanks, Air chambers.

Comparative analysis of resonance diagrams for several hydropower and pumping stations with surge tanks and air chambers shows large differences in the maximum resonance pressures. A strategy is advocated which consists of hydraulic resonance computations coupled with practical surveillance measures during the operation of resonance sensitive hydraulic systems. A fundamental hydraulic scheme is considered consisting of a reservoir, a pressure tunnel, a surge tank, a penstock and a turbine combined into a hydropower station. It is suggested that for each hydraulic surge system it is necessary to carry out special resonance analyses following the normal
dure to obtain the resonance sensitivity
draulic systems which are resonance sensiti
cial electronic equipment should be used
ure non-stationary pressures of the water
conduit as a way of continuous surveillance
functioning. (Baker-IVI)
W85-02681

8D. Soil Mechanics

DAM OF ARGILLITES AND SILTSTONE
S. S. Golik.
Hydrotechnical Construction, Vol. 17, p 6
December, 1983. 4 Fig, 2 Tab, 3 Ref. Tra
from Gidrotekhnicheskoe Stroitel'stvo, No
29-33, December, 1983.

Descriptors: *Dam construction, *Earth
*Crimea, *USSR, Soil properties, Alluvial
its, Seepage, Settlement, Argillites, Siltstones

A dam was constructed with a loam co
shoulders of low strength argillites and siltst
create a river reservoir for water supply of a
region and irrigation of lands in arid pla
Crimea. A spillway and intake structure wer
structed next to the dam. The reservoir is l
in a river valley on the north slope of the C
mountains composed of the Taurian Series
consists of flysch intercalating argillites, silts
and thin layers of sandstone. Seepage inv
tions of the soils of the dam foundation
carried out in the alluvial deposits of the
floor by single and group pumping tests. Th
cessful use of low-strength argillites and silt
in this dam showed that these soils can be
widely in dam construction. The transport
for hauling the soil masses were markedly re
by placing soils of useful excavations into the
The location of the borrow pits in the flood
reduced the area of lands allocated for con
tion and loss of agricultural production. The
round excavation and placement of argillite
siltstones in the dam accelerated the constru
of the structures and delivery of water to co
ers. The observed operating settlement of the
was considerably less than the predicted,
evidently is related to the gradual soaking
Taurian soils from the reservoir as it filled d
construction. (Baker-IVI)
W85-02231

POST-CONSTRUCTION DEFORMATION ROCKFILL DAMS,
Scott, Wilson, Kirkpatric and Partners, Ba
stoke (England).
R. P. Clements.
Journal of Geotechnical Engineering, Vol.
No. 7, p 821-840, July, 1984. 9 Fig, 7 Tab, 67

Descriptors: *Construction, *Rockfill dams,
formation, Mathematical equations, Safety, D
mation, Settlement, Camber.

A study was made of the post-construction
settlements and deflections of 68 rockfill dam
order to assess the usefulness and accuracy o
prediction of such deformations using empi
equations. Graphs of deformation per unit he
against time are plotted for membrane-f
(dumped and compacted rockfill), sloping,
central core dams. These predictions can be
in determining the requisite camber and provid
early warning system of problems within the d
Existing methods are based on simple empi
relationships of displacement with height or t
The errors involved are considered to be too
nificant to allow reasonable predictions to
made. An alternative approach is proposed, ba
on the comparison with dams having similar c
acteristics. Details are given in tabular form
each of the dams in the survey, as an aid to
approach. (Baker-IVI)
W85-02257

**STEADY FLOW CALCULATIONS F
CUTOFF WALL DEPTH VARIATION,**

onal Technical Univ., Athens (Greece). Dept. ivil Engineering.
Kalkani, and A. J. Michali.
nal of Geotechnical Engineering, Vol. 11, No. 899-907, July, 1984. 7 Fig, 2 Ref.

criptors: *Groundwater movement, *Seepage, th dams, Cutoff wall, Foundation failure, Dam re, Safety, Dam foundations.

flow through the permeable foundation of an n dam with an impervious core and an impervi- cutoff was studied. Different permeability os (Kx/Kz) of the foundation and depths of the ff in the foundation were considered. It is vn that calculation of flow through the dam the foundation may be simplified for cases re Kx/Kz = 10 and 100, and a range of cutoff h from 35 to 100% in the foundation. Such olifications in the study of groundwater seepage ugh the dam and its foundation will give no e than 10% excess flow for the cases described. simplified calculations can be performed as by hand. For other cases of Kx/Kz and cutoff h, more sophisticated techniques will be re- ed to model accurately the seepage through dam and its foundation. (Baker-IVI)
5-02258

ERAL BULGING OF EARTH DAMS,
L. Waler, and J. M. Duncan.
nal of Geotechnical Engineering, Vol. 110, 7, p 923-937, July, 1984. 9 Fig, 5 Tab, 4 Ref.

criptors: *Earth dams, *Dam failure, *Defor- ion, *Stress, Dam construction, Safety, Embak- ts, Earthworks, Pressure.

ny earth dams exhibit lateral deformation ng construction. The extent is dependent on stress-strain characteristics of the embankment erial. Earth dams constructed exclusively of ervious fill have the capacity to exhibit exten- plastic deformation or bulging of the embank- t mass, caused mainly by molding water con- s in excess of optimum. The analyses of two ntly constructed earth dams and the review of ier constructed dams have led to the develop- t of a simplified procedure for predicting the nt of lateral bulging. The high degree of satu- on and the corresponding large horizontal de- nations seen at the embankments of Truscott, atook and Otter Brook Dams are a direct conse- nce of the placement of embankment material siderably wetter than the optimum compaction er content. The high degrees of saturation of embankment materials also resulted in excess e pressures with increased loading. At Skiatook n, the shear strength was so low that there was ous risk of embankment slope failure. At Trus- and Otter Brook Dams there was little risk of ability in spite of the large deformations of the ankments. The rigid, unyielding foundations at e dams were a precipitating factor for the ing. The cracking of the slope surfaces at scott and Skiatook Dams appeared to be nly a consequence of the air-dried surface sts that formed on these embankments. (Baker-
)
5-02259

OBLEMS WITH FARM DAMS BUILT IN OUGHTS,
Nelson.
ua, Vol. 23, No. 3, p 20-22, June, 1984. 11 Fig, 3

scriptors: *Droughts, *Dam construction, am stability, *Soil moisture, Stability, Dams, nstruction.

essential ingredient for good dam construction orrect moisture content of the soil. This allows ximum soil density to be achieved by compac- n. Dry soil resists compaction because of the tion between adjacent particles. The soil will refore remain brittle and liable to cracking. The iculty with adding water while building is that ensuring its even distribution within the soil. is is a special problem with clays. The main ses for failure are cracking, piping, slides and settlement. Cracking takes two forms, longitudinal and transverse. Longitudinal cracks develop roughly parallel to the length of the dam and penetrate the crest vertically. Transverse cracks are far more dangerous because they run straight through the dam. Another dangerous type of crack is the shrinkage crack. Sometimes seeping water creates a tunnel or pipe along a line of weakness through the dam commencing at the downstream side and working back to the reservoir. Another interesting piping failure is one which develops in the foundation, not in the bank. Piping can also occur along outlet pipes if inadequately constructed and bedded into the bank and foundations. Slides can be of the deep downstream, shallow downstream, and upstream varieties. All poorly compacted dams settle with time; the higher the earth fill, the greater the likely settlement. Remedial work for each of these problems is briefly discussed. (Baker-IVI)
W85-02359

DEFLECTION MEASUREMENTS OF THE UPSTREAM ASPHALTIC MEMBRANE OF MARCHLYN DAM,
A. D. M. Penman, and A. Hussain.
International Water Power and Dam Construction, Vol. 36, No. 9, p 33-37, September, 1984. 9 Fig, 8 Ref.

Descriptors: *Measuring instruments, *Deflection, *Marchlyn Dam, *Wales, *Asphaltic membranes, Membranes, Reservoirs, Pumped storage, Deformation.

Marchlyn dam forms the upper reservoir of the Dinorwic pumped-storage scheme in North Wales. It is one of the first British dams to use an upstream asphaltic membrane as the watertight element. As part of a study of its behavior under loading from the reservoir water, deflections were measured over its full height on the major section where the dam was 72 m high. The simple trolley device that was developed to measure membrane deflections is described and the results of these measurements are discussed. The observed deflections of the membrane have shown that the dam is stiffer than expected, and that the rockfill and moraine provided excellent support for the asphaltic concrete. The measured local deflection adjacent to the concrete plinth was expected but its small magnitude has provided evidence that the membrane was not overstrained at this critical position. The overall accuracy of the simple apparatus was not sufficient to provide a correct measurement of deformation at the crest and it was necessary to rely on independent measurement of crest movements by precise surveying. (Baker-IVI)
W85-02682

8E. Rock Mechanics and Geology

COMMENTS ON CALCULATION OF THE STRESS STATE IN AN ANISOTROPIC ROCK FOUNDATION,
V. P. Merzlyakov.
Hydrotechnical Construction, Vol. 17, p 615-617, December, 1983. 2 Fig, 9 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 12, p 19-20, December, 1983.

Descriptors: *Dam construction, *Mathematical equations, *Stress, *Foundation rocks, Rocks, Anisotropy, Hydraulic engineering.

Rock foundations of dams are often transversely isotropic. Some works recommend K. Wolf's now classical solution for calculating the stress state in this case. The formulas for stresses in this solution were obtained as a result of solving the equation of the two-dimensional problem of elasticity theory in the specified form. This equation is not applicable to foundations with inclined layers and the resultant of the internal forces obtained by integration of the formula is not equal to the vector of the external forces. To eliminate these shortcomings, the solution of the two dimensional problem in which the principal directions of elasticity can differ from the direction of the coordinate axes should be used. (Baker-IVI)
W85-02228

SEISMIC HYDRODYNAMIC FORCES ON ROCK SLOPES,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
J. Ghaboussi, and A. J. Hendron, Jr.
Journal of Geotechnical Engineering, Vol. 110, No. 8, p 1042-1058, August, 1984. 17 Fig, 1 Tab, 10 Ref.

Descriptors: *Finite element method, *Slopes, *Reservoirs, *Hydrodynamics, *Seismology, Earthquakes, Hydrodynamics.

A finite element method of analysis for seismic response of fluid structure problems is presented. Displacement model finite elements are used in the fluid region, leading to simple fluid-structure interface conditions. The method has been used in a parametric study of seismic hydrodynamic forces on rock slopes. Parameters considered are height of the slope, depth of water, slope of the rock face, and the earthquake base motion. A method for evaluation of seismically induced movements of submerged rock slope is presented. The compressibility of water, the fluid-structure interaction and the effect of the foundation have been included. The distribution of maximum hydrodynamic forces on the rock slopes is quite different than those predicted by the assumption of rigid wall and incompressible fluid. The coefficient of maximum hydrodynamic force is fairly insensitive to the height of the slope and the depth of the water in the reservoir. It is only affected to a certain extent by the angle of inclination of the rock face. The effects of the geometry and the earthquake input are briefly described. For complex geometries both magnitude and distribution of the hydrodynamic forces are affected and individual analyses may be required for each different geometry. The magnitude of the hydrodynamic forces can be strongly influenced by the earthquake input. In a limiting equilibrium analysis the peak values of the ground acceleration and the hydrodynamic forces are used to calculate a factor of safety. (Baker-IVI)
W85-02262

8F. Concrete

CRACKING IN REINFORCED CONCRETE ANALYSIS,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
A. K. Gupta, and H. Akbar.
Journal of Structural Engineering, Vol. 110, No.8, p 1735-1746, August, 1984. 5 Fig, 1 Tab, 12 Rf.
NSF grant DAR-8018554.

Descriptors: *Reinforced concrete, *Cracks, Mathematical analysis, Model studies.

An idealized simple model of forming cracks in reinforced concrete has been presented. It is assumed that the cracks are formed in the direction of the major principal tensile strain and the direction can change with the change in strains. It leads to crack directions which are consistent with the limit state. That the cracks would change directions is evident by the available experimental results. A numerical algorithm suitable for step-by-step finite element analysis has been developed. It is shown that the numerical algorithm gives results identical to the theoretical results, thus validating the algorithm. The algorithm is also applied to limited available experiments. The proposed crack model and the numerical algorithm have been successfully incorporated into a finite element program. (Baker-IVI)
W85-02273

8G. Materials

CALCULATION OF THE WATERTIGHT EFFICIENCY OF LINING WITH FILM MEMBRANE,
Yu. M. Kosichenko.

Hydrotechnical Construction, Vol. 17, p 640-647, December, 1983. 2 Fig, 2 Tab, 10 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 12, p 33-38, December, 1983.

Descriptors: *Linings, *Membranes, *Permeability, Canal linings, Design criteria, Tunnels, Coatings, Seepage, Mathematical equations.

Watertight linings and membranes with the use of polymer films are finding wide use to prevent seepage of water from canals and impermissible rise of the groundwater level in the near-canal zone. The most common are watertight linings of polymer film with a protective covering of concrete or soil, so-called concrete-film and soil-film linings, which are presently considered the most efficient with respect to watertight qualities. In general, the permeability of watertight linings should be calculated from the condition that the seepage flow rate through the lining is equal to the sum of the individual seepage flow rates through individual damages and defects of the film membrane on a given area of the lining. The performance of the calculations during design stages will make it possible to more correctly and validly select the type of watertight linings in relation to the particular hydrogeological conditions and to formulate the requirements imposed on the quality of their construction with a prediction of the expected efficiency of the canal. During operation of canals with watertight linings, one can calculate seepage losses and efficiency and give well-founded recommendations on the need to conduct repair works on individual stretches. (Baker-IVI)
W85-02232

8I. Fisheries Engineering

EFFECTS OF FEEDING RATES ON PRODUCTION OF COMMON CARP AND WATER QUALITY IN PADDY-CUM-FISH CULTURE,
Indian Council of Agricultural Research, New Delhi.
For primary bibliographic entry see Field 5B.
W85-02236

LERDERDERG RIVER FISH-LADDER,
J. P. Beumer.
Aqua, Vol. 23, No. 3, p 16-17, June, 1984. 8 Ref.

Descriptors: *Fish ladders, *Fish management, *Dams, *Weirs, *Lerderderg River, *Australia, Fish, Barriers, Design criteria, Evaluation.

A study was undertaken to examine the movement of fish through a fish ladder installed in a diversion weir on the Lerderderg River. The River is a 60 km long tributary forming part of the Werribee River coastal drainage. The Merrimu Reservoir Project providing a domestic water supply for Melton and Bacchus Marsh involved construction of diversion weirs on Goodman Creek and the Lerderderg River. The ladder incorporates 42 steps with a trap bay at step 36. It has a slope of 1:10. A Nylex plastic screen covering the ladder prevents fish escaping and reduces the amount of leaf-litter and other debris falling into the ladder. A two way trap covered by a fine mesh was installed in the trap bay to monitor fish usage of the ladder. Monitoring of the trap and electrofishing were carried out on a weekly basis for 21 weeks. A total of 69 specimens were taken in the trap during the monitoring period, about half in each trap section. While the fish ladder design was suitable for the larger river blackfish and larger brown trout, few smaller specimens of these two species were caught in the trap. The other three species, short-finned eel, roach and Australian smelt, were poorly represented in trap catches suggesting that they could not cope with the fish-ladder in its then existing design. A number of design modifications to the ladder and alterations to the flow pattern downstream of the spillway should improve the efficiency of the ladder. (Baker-IVI)
W85-02358

EXPERIENCES GAINED IN RESTORING A WILDERNESS RIVER,
Kuopio Water District Office (Finland).
For primary bibliographic entry see Field 5G.
W85-02386

HYDRAULICS OF DENIL FISHWAYS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnum, and C. Katopodis.
Journal of Hydraulic Engineering, Vol. 110, No. 9, p 1219-1233, September, 1984. 9 Fig, 1 Tab, 8 Ref.

Descriptors: *Fish management, *Fish ladders, *Denil fishways, Hydraulic engineering, Flow, Hydraulic structures, Design criteria.

An experimental study was performed on the hydraulics of simple Denil fishways. For the Standard Denil, the characteristic velocity profile that exists in the fully developed flow region is found. In the central region of the fishway the velocity increases from lower values in the bottom portion of the fishway to a high velocity surface stream. A rating curve is developed for the Standard Denil, which would be very useful in the design of Denils over a range of bed slopes and discharges. Some assessment has also been made of the effect of changing the width ratio and baffle spacing ratio from the standard values. (Baker-IVI)
W85-02451

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UNIVERSITY OF ILLINOIS-URBANA

SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
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VOLUME 18, NUMBER 6
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W85-02696 - W85-03217

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management ond Budget through September 30, 1985.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

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Information Center
U.S. Geological Survey
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SELECTED WATER RESOURCES ABSTRACTS

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2. General

...T HYDROGRAPH BASED FORECAST ...DEL,
...n Inst. of Tech., New Delhi. Dept. of Civil ...Engineering.
...S. ...hander, and H. Shanker.
...Hydrological Sciences Journal, Vol. 29, No. 3, p ...27...91, 1984. 5 Fig, 6 Tab, 4 Ref.

...Descriptors: *Hydrologic models, *Storms, *Rain...fall, Forecasting, Computers, Weather forecasting.

...The unit hydrograph method is an accepted proce...dure for transforming rainfall excess or effective ...rainfall to obtain the time distribution of runoff for ...catchments that are usually less than 5000 sq m in ...area. This method has not been used for operational ...forecasting work because of the difficulty in ...estimating rainfall excess as the rainstorm pro...gresses in time. A procedure is presented for on...-line estimation of the Phi-index and rainfall excess ...as storm progresses in time. Coupling this proce...dure with the unit hydrograph model can yield a ...procedure which will successfully allow real-time ...forecasting. Even in those storm events where the ...assumption unit hydrograph does not truly represent ...the response function, the forecasts have been ...found to be satisfactory. The forecasts deteriorate ...as lead time of the forecast increases partly because ...the assumption of no rainfall beyond the time of ...forecast is not valid in most of the events studied. ...(Baker-IVI)
...W85-02827

...LICATION OF MATHEMATICAL ...DELS TO LARGE AQUATIC ECOSYS...MS,
...Hydrochemical Inst., Rostov-na-Donu (USSR).
...A. ...Nikanorov, and W. R. Swain.
...Journal of Great Lakes Research, Vol. 10, No. 3, p ...329...339, 1984. 11 Ref.

...Descriptors: *International agreements, *United ...States, *USSR, *Lake Baikal, *Saginaw Bay, *Sea of ...Azov, *Mathematical models, Model studies, ...Ecosystems, Lakes, Bays.

...Within the framework of the US-USSR Joint ...Agreement on Environmental Protection, a step-...wise progression of increasing complexity of math...ematical modeling efforts has been used to identify ...specific problems, describe the parameters associat...ed with each, understand the extent of the prob...lem and define alternative management scenarios ...for each individual situation. In this way, each ...succeeding step was built on the solid scientific ...findings of the previous study. This approach was ...used in a variety of circumstances to identify po...tential solutions to such diverse problems as trans...port and circulation patterns critical to planning ...development adjacent to a large ultra-oligotrophic ...system, definition of the transport of contami...nants in a large eutrophic embayment essential to ...understanding the effects of remedial measures to ...control phosphate inputs, and definition of the ...nature of measures that were potentially applicable ...to hydrodynamic problem of saltwater intrusion ...which threatened to upset a well established eco...logical balance. It is clear that the mutual use of ...data based mathematical modeling by participating ...nations as an instrument for systems analysis of ...large aquatic ecosystems has provided a series of ...solutions to a wide range of problems which would ...otherwise not have been available (Baker-IVI)
...W85-02883

...ULATION MODELING AS A MEANS OF ...DYING LARGE AQUATIC ECOSYSTEMS,
...Rostovskii-na-Donu Gosudarstvennyi Univ. ...(USSR). Nauchno-Issledovatel'skii Inst. Mekhaniki ...Prikladnoi Matematiki.
...A. ...Gorstko, Y. A. Dombrovsky, A. A. ...Mikheyev, J. F. Paul, and W. L. Richardson.
...Journal of Great Lakes Research, Vol. 10, No. 3, p ...244...244, 1984. 5 Fig, 3 Ref.

Descriptors: *Model studies, *Simulation, *USSR, *Lake Baikal, *Sea of Azov, *Mathematical models, *Water quality control, Fish management, Ecosystems.

The concept of simulation modeling of large aquatic ecosystems is discussed with special reference to a conceptual framework incorporating a series of sub-models. Development and application of the Sea of Azov and Lake Baikal models have seriously influenced the organization, planning, and research conducted on all levels of these ecosystems. The results of the models indicated shortcomings of prior investigations. Demands for experimental data have increased during the development of the models, making investigation in the fields of marine hydrology, hydrochemistry, and biology more complex and goal oriented. The broad application of reliable mathematical methods for synthesizing the results of field observations from the Sea of Azov and Lake Baikal was found to be invaluable. As a result of the efforts, the reliability of the scientific investigations have increased considerably. (Baker-IVI)
W85-02884

ESTIMATION OF DAILY TEMPERATURE MEANS USING ELEVATION AND LATITUDE IN MOUNTAINOUS TERRAIN,
Agricultural Research Service, Beckley, WV. Appalachian Soil and Water Conservation Research Lab.
D. G. Boyer.
Water Resources Bulletin, Vol. 20, No. 4, p 583-588, August, 1984. 4 Fig, 4 Tab, 10 Ref.

Descriptors: *Temperature, *Elevation, *Latitude, *Mountains, *West Virginia, Prediction, Mathematical models, Hydrologic budget, Model studies.

Temperature information is commonly a primary component of water balance models; however, local temperature is often lacking. Most of the spatial variability of daily temperature means in the central Appalachian region can be accounted for by differences in elevation and latitude. A model was developed for predicting mean daily, mean daily minimum, and mean daily maximum temperatures in West Virginia. The model is easily used since the only inputs are elevation, latitude, and julian date. Since the input data are easily obtained, the model can be put to use quickly in a variety of resource management applications, including water budget modeling. With local calibration, the model is expected to apply to other areas in the Applachian region. (Moore-IVI)
W85-02986

ESTABLISHMENT AND SURVIVAL OF WOODY RIPARIAN SPECIES ON GRAVEL BARS OF AN INTERMITTENT STREAM,
California Univ., Berkeley. Dept. of Forestry and Resources Management.
J. R. McBride, and J. Strahan.
American Midland Naturalist, Vol. 112, No. 2, p 235-245, October, 1984. 4 Fig, 2 Tab, 19 Ref.

Descriptors: *Riparian vegetation, *Woody plants, *Gravel bars, *Dry Creek, *California, Seedlings, Sediment texture, Willow, Cottonwood, Baccharis, Drought, Scour, Sediment erosion, Vegetation establishment.

Factors influencing seedling establishment and survival were studied on gravel bars of lower Dry Creek, Sonoma Co., California. Gravel bars species became established from May to July. Seedling establishment was correlated with sediment texture. Salix spp. established preferentially on areas where surface sediment size was less than 0.2 cm. Populus fremontii established more densely of intermediate and large-sized sediments (0.2-1.0 cm). Baccharis viminea dominated on the larger sediment sizes. Drought-induced mortality of seedlings was highest on bars where the stream had dried up completely prior to 1 September 1981. The high winter flows of the 1981-1982 season scoured the sediments and killed the vast majority of remaining seedlings. Seedlings which established in areas protected from the swiftest current were, however, able to withstand the winter flows. At specific locations, changes of gravel bar landforms resulted in significant losses of established trees as well as young seedlings and saplings. (Author's abstract)
W85-03016

STANDARD HYDROLOGIC EXCHANGE FORMAT (SHEF),
National Weather Service, Portland, OR. Northwest River Forecast Center.
For primary bibliographic entry see Field 7C.
W85-03060

SIMPLIFIED HYDROLOGICAL RAINFALL-RUNOFF MODEL,
Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Travaux Hydrauliques.
W. H. Hager.
Journal of Hydrology, Vol. 74, No. 1/2, p 151-170, October, 1984. 14 Fig, 1 Tab, 9 Ref, 2 Append.

Descriptors: *Rainfall-runoff relationships, *Hydrological models, Catchment area, Overland flow, Stream flow, Kinematic waves, Mathematical models, Rainfall intensity.

The rainfall-runoff process is investigated for relatively small catchment areas (< 100 sq km) and for heavy rainfalls. It is assumed that: (1) the rainfall excess nearly equals the effective rainfall; and (2) the rainfall intensity function depends on time alone and is single-peaked. The catchment area is approximated by two rectangular planes of not necessarily equal width but with constant bottom slopes and constant roughness factors. A small stream runs where the two planes intersect each other. Both the overland and the stream flow are assumed to be fully turbulent; they are modelled using the Manning-Strickler formula. Kinematic wave theory serves as the mathematical model to compute the hydrographs at an arbitrary location in terms of the prescribed, basic parameters. The solutions are displayed graphically, which allows direct determination of the solution sought. Variations in the average bottom slope and the average friction coefficient are found to have little influence on the resulting hydrograph. Rough estimates of these parameters suffice to obtain fair results. The model is tested by comparing observations collected in western Switzerland with present predictions. Agreement between the computed and the observed hydrographs is fair, given the simplicity of the described hydrological model. A step-by-step procedure with examples illustrate the method in detail. (Author's abstract)
W85-03088

NEW GLOBAL ASSESSMENT OF THE STATUS AND TRENDS OF DESERTIFICATION,
New South Wales Univ., Kensington (Australia). School of Geography.
J. A. Mabbutt.
Environmental Conservation, Vol. 11, No. 2, p 103-113, Summer, 1984. 5 Fig, 2 Tab, 15 Ref.

Descriptors: *United Nations, *Desertification, Erosion control, Land use, Evaluation, Deserts, Arid lands, Dunes, Rangeland, Cropland, Irrigation, Salinization, Deforestation, Water supply.

An assessment of the status and trends of desertification was called for as part of a general assessment of progress in the implementation of the United Nations Plan of Action to Combat Desertification, seven years after the UN Conference on Desertification. Indicators of desertification include: growth and encroachment of mobile dunes and aeolian sand-sheets; deterioration of rangelands; degradation of rain-fed croplands; waterlogging and salinization of irrigated lands; deforestation and destruction of woody vegetation; and declining availability or quality of groundwater or surface-water supplies. Because of the inadequate data existing at the country or state level, the basic generalization has been set at a wider regional scale. The plan of action includes three components: assessment of the status and trend of desertification seven years after UNCOD, evaluation of progress in the implementation of the Plan of

Action to date, and an evaluation of the institutional and financial arrangements which supported the implementation of the plan. The first of these three parts is viewed in detail, including emphases on the defining of terms, global dimensions of the problem, regional impacts of desertification, desertification and land use, global trends, and projections to the year 2000. (Baker-IVI)
W85-03201

2B. Precipitation

PRECIPITATION IN THE CENTRAL AMAZON BASIN: THE ISOTOPIC COMPOSITION OF RAIN AND ATMOSPHERIC MOISTURE AT BELEM AND MANAUS,
E. Matsui, E. Salati, M. N. G. Ribeiro, C. M. Reis, and A. C. S. N. F. Tancredi.
Acta Amazonica, Vol. 13, No. 2, p 307-369, April, 1983. 9 Fig, 2 Tab, 6 Ref.

Descriptors: *Rainfall, *Belem, *Manaus, *Brazil, *Precipitation, Amazon Basin, Isotopic studies, Seasonal variation, Precipitation chemistry.

In order to improve the understanding of the water in the Amazon Basin, samples of rain and moisture were collected daily at Belem and Manaus from August 1978 to January 1980. All isotope data are presented. The most depleted values were encountered during the rainy season from January through April. During this season the events at Manaus closely followed those at Belem, on the average with a delay of a couple of days. This indicates the predominance of the east-to-west air motion, which sweeps across the basin from the Atlantic coast. The very low isotopic values have also been associated with the position of the ITCZ near the mouth of the Amazon. In spite of the isothermy of the area and lack of clearcut frontal systems, the data suggest that many of the rainy episodes are related to events imposed on the basin from outside and that only the winter period is predominantly influenced by the internal processes within the basin. Presumably then, winter is the season whose precipitation pattern would be most influenced by any deforestation program in the basin. (Baker-IVI)
W85-02816

FREQUENCY DISTRIBUTIONS FOR DURATIONS AND VOLUMES OF RAINFALLS IN THE EASTERN UNITED STATES IN RELATION TO ACIDIC PRECIPITATION,
Manhattan Coll., Bronx, NY. Lab. of Plant Morphogenesis.
L. S. Evans, G. S. Raynor, and D. M. A. Jones.
Water, Air, and Soil Pollution, Vol. 23, No. 2, p 187-195, August, 1984. 5 Fig, 1 Tab, 17 Ref. EPA contract IAG 81-D-X0533, DOE contract DE-AC02-76CH00016, and Associated Universities, Inc. contract 550925-S.

Descriptors: *Frequency distribution, *Rainfall, *Acid rain, *Long Island, *New York, *Seaside Park, *New Jersey, *Urbana, *Illinois, *Franklin, *North Carolina, *Coral Gables, *Florida, Acid precipitation, Chemical composition, Vegetation, Hydrogen ion concentration.

A significant percentage (between 17 and 40%) of all showers recorded on Long Island NY, Urbana, IL, Franklin, NC, and Seaside Park, NJ, had durations less than 20 min. Similarly, a large percentage had durations less than 40 min (50, 46, and 32% for 3 yr at Urbana, IL, 65% ar Coral Gables, FL, 50% at Franklin, NC and 54% at Seaside Park, NJ). When all data from the six growing seasons were pooled, over 88% of all rainfalls were less than 160 min. Similar results were observed when volume measurements were made. Between 38 and 57% of all recorded showers had less than 1 mm at all five stations in the eastern United States. When all data were pooled, over 65% of all rainfalls were less than 3 mm. These data demonstrate that plant foliage is wetted during the growing season by numerous showers which are of short duration and low volume. (Author's abstract)
W85-02926

ESTIMATION OF PROBABLE MAXIMUM PRECIPITATION: CASE STUDIES,
Harza Engineering Co., Chicago, IL.
B.-H. Wang.
Journal of Hydraulic Engineering, Vol. 110, No. 10, p 1457-1472, October, 1984. 11 Fig, 4 Tab, 15 Ref.

Descriptors: *Probable maximum precipitation, *Precipitation, *Estimation, Depth-area-duration analysis, Statistical studies, Mathematical models, Hurricanes, Maximum probable floods.

The probable maximum precipitation (PMP) is the estimated precipitation depth for a given duration, drainage area and time of year for which there is virtually no risk of being exceeded. The PMP used in the probable maximum flood (PMF) analysis may be a generalized estimate taken from publications, or estimated based on a site specific study by a hydrometeorological analysis, application of hurricane model or a statistical method. Case studies are presented for four projects, each of different nature and scope located in the area of different physiographic and climatic conditions. The amount and quality of data available for each project are also different. It is difficult to determine which of the procedures yields most reliable results because geophysical and meteorological conditions vary from one basin to another and data situations change from basin to basin. Any PMP estimate must be considered as an approximation which can vary over a range of values depending on input data used, and assumptions made in deriving the estimate. Some conservatism should be considered in the analysis depending on potential consequences of underestimating the PMP and therefore the PMF. (Moore-IVI)
W85-03012

SPECTRAL THEORY OF RAINFALL INTENSITY AT THE MESO-BETA SCALE,
Oregon State Univ., Corvallis. Dept. of Mathematics.
E. Waymire, V. K. Gupta, and I. Rodriguez-Iturbe.
Water Resources Research, Vol. 20, No. 10, p 1453-1465, October, 1984. 2 Fig, 2 Tab, 26 Ref.

Descriptors: *Rainfall intensity, *Storms, *Stochastic hydrology, Rainfall, Cyclones.

The available empirical descriptions of extratropical cyclonic storms are employed to formulate a physically realistic stochastic representation of the ground level rainfall intensity field in space and time. The stochastic representation is based on three-component stochastic point processes which possess the general features of the embedding of rain cells within small mesoscale areas within large mesoscale areas within synoptic storms. Certain scale idealizations, and assumptions on functional forms which qualitatively reflect the physical features, lead to a closed form expression for the covariance functions, that is, the real space-time spectrum, of the rainfall intensity field. Of particular interest and importance is an explanation of the empirical observation that the Taylorian propagation of the fine scale structure, via a transformation of time to space through the storm velocity, holds only for a small time lag and not throughout. The results indicate the extent of this lag in terms of the characteristic scales associated with cell durations and cellular birthrates and velocities. The present findings show the validity of Taylor's hypothesis holds only under restricted physical conditions, as when cells' speeds relative to the storm are zero, and holds only for time spans smaller than mean cell life rather than for all times. These important physical limitations on the validity of Taylor's hypothesis in rainfall have not been taken into account in other stochastic rainfall models. (Baker-IVI)
W85-03169

ELECTRICAL RESISTIVITY STUDIES TO DELIMIT ZONES OF ACCEPTABLE GROUND WATER QUALITY,
Geo-Recon International Ltd., Seattle, WA.
C. A. Ringstad, and D. C. Bugenig.
Ground Water Monitoring Review, Vol. 4, No. 4, p 66-69, Fall, 1984. 5 Fig, 2 Tab.

Descriptors: *Groundwater, *Water quality, *Resistivity, Permeability, Water analysis, Water sources development.

Four vertical electrical soundings were conducted in a layered andesitic rock aquifer known to yield ground water with total dissolved solids in excess of 2,000 milligrams per liter. The objective of the soundings was to determine if adequate supplies of good quality ground water could be derived from the volcanic rocks and to select sites for confirmatory drilling and testing. The resistivity of a geologic unit is a function that includes the quantity of total dissolved solids in the interstitial water and the distribution of the water within the unit. Thus, the resistivity of most granular soil and rocks is controlled more by porosity, water content and water quality than by the conductivity of the matrix materials. The electrical data delineated a drill site where it was believed that ground water of acceptable chemical quality could be expected. Two exploration wells confirmed the expectation. (Baker-IVI)
W85-03176

2C. Snow, Ice, and Frost

MODEL FOR PREDICTING ICE ACCRETION AND ABLATION IN WATER BODIES,
Atmospheric Dynamics Corp., Victoria (British Columbia).
M. Danard, M. Gray, and G. Lyv.
Monthly Weather Review, Vol. 112, No. 6, p 1159-1169, 4 Fig, 7 Tab, 44 Ref.

Descriptors: *Ice formation, *Ablation, *Model studies, Radiation, Cloud cover, Snow cover, Ice-water interfaces, Melting.

A model is presented for computing ice growth and ablation. Downward long- and shortwave radiation is computed for variable cloud amount and base. Surface albedo depends on snow cover and age of the snow or ice. Thermal inertia of the snow and ice is included. Sensible and latent heat fluxes are calculated using generalized similarity theory. The model is tested in Mackenzie Bay for the 1978-79 season and produces results in good agreement with observations. Perhaps the most surprising finding is the importance of longwave radiation. The variation in surface emissivity between accepted values can produce significant changes in computed melting dates. An increase in cloudiness during ablation actually accelerated melting, due to increased downward longwave radiation. Heat input from the water at the water-air interface is also important. This may be estimated from measurements of water currents and temperatures. (Baker-IVI)
W85-02797

HYDROTHERMAL PROCESSES BENEATH ARCTIC RIVER CHANELS,
National Hydrology Research Inst., Ottawa (Ontario).
A. Wankiewicz.
Water Resources Research, Vol. 20, No. 10, p 1417-1426, October, 1984. 10 Fig, 23 Ref.

Descriptors: *Hydrothermal studies, *Frozen ground, *Rengleng River, *Caribou Creek, *Northwest Territories, Groundwater flow, Dispersion, Heat flow, Physical properties.

Perennially unfrozen ground (river talik) exists beneath Rengleng River and Caribou Creek near Inuvik, Northwest Territories. Subchannel ground temperature observations to 13 meters depth were obtained in April, August, and November of 1978. These observations indicate several facts concerning heat transfer processes of importance to thermal modeling of Arctic stream crossings. The heat flow in sediments beneath Caribou Creek channel is due to simple conduction. The effective thermal conductivity of sediments beneath Rengleng River channel is more than an order of magnitude greater than simple conduction as a result of heat dispersion by flowing groundwater in the talik. Seasonal change in groundwater discharge beneath Rengleng River channel is apparently

sible for the four-fold variation in effective nal conductivity of the sediments. In late r, after the streams have frozen solid, frost lops in the streambeds; the frost thickness is as as 2 meters. Warming of the streambed by pring runoff is delayed by as much as 30 days, o the presence of bed-fast ice and streambed Predicting disturbance to the hydrothermal ne by engineering structures requires numeri- mulation using representative thermal param- . Where sediments at stream crossings are zen and highly permeable, a groundwater contribution to both convective heat trans- and effective thermal conductivity should be into account. (Baker-IVI)
-03165

UNDWATER HYDRAULICS OF SEASON- FROST MOUNDS, NORTH FORK PASS, ON TERRITORY,
wa Univ. (Ontario). Dept. of Geography.
. Pollard, and H. M. French.
dian Journal of Earth Sciences, Vol. 21, No. 1073-1081, October, 1984. 6 Fig, 4 Tab, 43 Natural Sciences and Engineering Research ncil of Canada grant A8367.

criptors: *North Fork Pass, *Yukon Territory, oundwater hydrology, *Frost mounds, Frost, raulic potential, Transmissivity, Springs.

onal frost mounds occur in the North Fork area in response to increased hydraulic poten- in perennial, spring-fed groundwater systems. chemical and isotope analyses indicate that precipitation is the source of water for flow ms discharging from the springs. While there importance attached to the role of ground- r under pressures as the dynamic component asonal frost mound growth in earlier studies of type, the present study confirms this assump- by documenting the existence and magnitude ese pressures. These observations also empha- the genetic differences between seasonal frost nds and other morphologically similar features as palsas. It is suggested that the processes mechanisms of palsa formation are consider- different from those associated with seasonal mounds. In the former, ice segregation and formation of ice lenses in the mineral soil core the primary growth mechanisms, and capillary and moisture migration during ice segregation he main hydrologic processes. In contrast with palsas and pingos, and also probably to the range of smaller tundra mounds, seasonal mounds are relatively short-lived phenomena form in early to mid-winter in response to a ease in hydraulic transmissivity and an in- se in hydraulic potential in the active layer. er-IVI)
-03198

. Evaporation and Transpiration

EM WATER FLOW IN A CRACK WILLOW E (SALIX FRAGILIS L.) IN RELATION TO RNAL CHANGES OF ENVIRONMENT,
oka Skola Zemedelska, Brno (Czechoslovakia).
of Forest Ecology.
primary bibliographic entry see Field 2I.
-02900

SIGN AND IMPLEMENTATION OF EVA- TRANSPIRATION MEASURING EQUIP- NT FOR OWENS VALLEY, CALIFORNIA,
R. Simpson, and L. F. W. Duell, Jr.
und Water Monitoring Review, Vol. 4, No. 4, -163, Fall, 1984. 6 Fig, 17 Ref.

criptors: *Evapotranspiration, *Rangeland, easuring instruments, *Owens Valley, *Califor- Model studies, Eddy correlation.

ipermanent installations are used to measure tinuous rangeland evapotranspiration in the ey's phreatophyte community as part of a plant ivability and ground water study in Owens ley, California. The semipermanent microme- rological station collects continuous data for solution of the Bowen ratio energy budget equation and the Penman combination equation. Three sites were chosen for this type of installation to provide a representative sampling of Owens Valley. The proposed mobile aerodynamic installation should be capable of calculating evapotranspiration by the eddy correlation method. This instrumentation will be used throughout the valley for short periods of time (up to five days). Many problems have been identified and resolved through improved calibration techniques, systematic error-removal techniques, reduced cycle times, modified equiment design and proper observer training. The collected evapotranspiration data will be instrumental in developing a one-dimensional evapotranspiration flux algorithm for a model of valleywide ground water flow. (Baker-IVI)
W85-03188

2E. Streamflow and Runoff

EFFECTS OF VISITATION FREQUENCY AND INSTRUMENT RELIABILITY ON THE ACCURACY OF ESTIMATION OF RIVER DISCHARGES,
Iowa Inst. of Hydraulic Research, Iowa City.
P. K. Kitanidis, O. G. Lara, and R. W. Lane.
Hydrological Sciences Journal, Vol. 29, No. 3, p 255-269, 1984. 2 Fig, 4 Tab, 7 Ref.

Descriptors: *Measuring instruments, *Streamflow, *Model studies, Probabilistic models, Flow discharge, Simulation.

The extent to which improved instrumentation and longer visitation periods result in improved accuracy of estimation of streamflow quantities is examined. A relatively simple probabilistic model of the process of gauging-station failures is developed, calibrated, and validated. This model can be used to derive the distributions of the number of failures and the length of missing records and, through simulation, to calculate the accuracy of daily or monthly streamflow values. The paper focuses on the description of the probabilistic model, on the derivation of the distribution of the number of failures and the length of missing record, and on the estimation of parameters from data. For illustration, the performance characteristics of 168 gauging stations are analyzed. (Baker-IVI)
W85-02825

ISOLATED EVENT MODEL BASED UPON DIRECT RUNOFF CALCULATIONS USING AN IMPLICIT SOURCE AREA CONCEPT,
Rhodes Univ., Grahamstown (South Africa). Hydrological Research Unit.
D. A. Hughes.
Hydrobiological Sciences Journal, Vol. 29, No. 3, p 311-325, 1984. 4 Fig, 5 Tab, 17 Ref.

Descriptors: *Floods, *South Africa, *Model studies, *Rainfall, *Runoff, Storm runoff, Seasonal variation, Hydrographs, Semiarid climates, Flood peak.

An isolated event flood model is described that is based upon the concept of expanding source areas using an S-curve function to relate the proportion of rainfall that becomes stormflow to the moisture status of the catchment. The results of calibrating the model using some storms drawn from semiarid and sub-humid South African catchments are encouraging and illustrate that the model can be used for complex storms with more than one flow peak. The antecedent rainfall function which determines the initial moisture status of the catchment is one aspect of the model where there is need for improvement. The relatively simple function used does not appear to be adequate to account for the variable moisture conditions that occur prior to storms. This conclusion is particularly relevant to the semiarid region of the Eastern Cape where there are very distinct seasonal differences in rainfall characteristics. The variation in parameter values between storms on the same catchment and between different catchments are broadly explicable in terms of catchment and storm characteristics. The question of parameter interpretation requires further research, involving the calibration and verification of the model on far more catchments. Only then will it be possible to consider whether the model will be truly flexible and applicable, to design situations when calibration using observed data is not possible. (Baker-IVI)
W85-02829

GEOMORPHIC AND VEGETATIVE CHARACTERISTICS ALONG THREE NORTHERN VIRGINIA STREAMS,
Geological Survey, Reston, VA.
W. R. Osterkamp, and C. R. Hupp.
Geological Society of American Bulletin, Vol. 95, No. 9, p 1093-1101, September, 1984. 7 Fig, 4 Tab, 43 Ref.

Descriptors: *Geomorphology, *Sediments, *Vegetation, *Streams, *Virginia, Topography, Species distribution, Bars, Floodplains, Shelf, Terraces, Flooding.

Bottomland features of three perennial northern Virginia streams include the depositional bar, the active-channel shelf, the flood plain, and sometimes one or more terraces. Excepting terraces, each surface is inundated through a narrow range of flow frequencies. Relative to discharge, shelf and food-plain areas, respectively, appear to vary directly and inversely with stream power. The consistency of these data, their agreement with results from other studies, and size data of surficial sediment indicate that bottomland alluvial estuaries are formed and maintained by hydraulically controlled sorting processes. Binary discriminant analysis suggests that bottomland woody-plant assemblages may be nearly specific for a given geomorphic surface, regardless of stream size or physiographic province. Correlation also is indicated between species distribution and sediment type, but this relation may result from distributions being indicative of the surfaces upon which they occur. Depth to saturation appears to be insignificant. It seems possible that species distributions on bottomland geomorphic surfaces are related to intensities, damage, and frequencies of flow events. Woody plants provide a convenient and dependable means of identifying and delineating lowland surfaces, regardless of the causes of the distributions. (Baker-IVI)
W85-02834

HYDRAULIC-RESISTANCE TERMS MODIFIED FOR THE DRESSLER CURVED-FLOW EQUATIONS,
George Washington Univ., Washington, DC. International Water Resources Inst.
R. F. Dressler, and V. Yevjevich.
Journal of Hydraulic Research, Vol. 22, No. 3, p 145-156, 1984. 3 Fig, 1 Tab, 11 Ref.

Descriptors: *Dressler equations, *Hydraulic resistance, *Saint-Venant equations, *Channel flow, Turbulent flow, Transition flow, Rough flow, Hydrodynamics, Hydraulics, Flow characteristics.

The well-known empirical hydraulic-resistance terms, in common use with the Saint-Venant equations, are here modified to the specific functional form necessary for their use with the Dressler equations for curved open-channel two-dimensional flow in rectangular channels. From the general resistance term three cases are considered for three regimes of turbulent flow: the Blasius 'smooth' flow, the Chezy 'transitional' flow; and the Manning 'rough' flow. These new functions are composed with the analogous terms in common use with the Saint-Venant equations. The modifications needed for the Dressler equations for the Chezy and Manning regimes are incorporated in two extra factors, am and av. The am factor is a given function of channel bottom curvature K and of flow perpendicular thickness N, expressing the mass change affected by a boundary drag when flow is over a convex or concave bottom. The av factor is a given function of K, N, and channel width w, expressing the modification required in bottom velocity C to adjust for the variable velocity profile in curved flow. For the Blasius regime, an additional function aq is required to adjust the

velocity near the bed to the average velocity over the profile. Each of the three functions ai reduces the unity when K = 0. An example is presented showing their numerical values for KN = -0.4 (convex) and + 0.4 (concave). Their behavior shows that the hydraulic resistance effect is decreased when the channel bottom is convex, but increased when concave, and these changes are greater in narrow channels than in wide channels. (Author's abstract)
W85-02929

DYNAMICS OF A RIVER-BAY-DELTA SYSTEM,
Louisiana State Univ., Baton Rouge. Dept. of Marine Science.
F. C. Wang.
Journal of Geophysical Research, Vol. 89, No. C5, p 8054-8060, September, 1984. 8 Fig, 1 Tab, 25 Ref. U.S. Army Engineer Waterways Experiment Station contract DACW-39-82-C-0004.

Descriptors: *Plane jets, *Bays, *River mouth, *Deltas, *Atchafalya River Delta, *Louisiana, Hydrodyamics, Flow continuity, Momentum balance, Mathematical equations, Mass transport.

An analysis has been made to aid our understanding of various phenomena associated with turbulent plane jets that issue from river outlets and discharge into quiescent bays. An integrated form of the hydrodynamic equations of flow continuity and momentum balance, coupled with advective-diffusion mass transport equations, has been formulated into a two-dimensional spatial domain. Closed-form analytical solutions are obtained with the aid of similarity functions for the velocity and sediment concentration profiles. A numerical procedure for estimating the areal and volume deposition of the delta sediments is presented. The Atchafalya River Delta, a newly developing delta in the south central Louisiana Coast, is used to illustrate analytical techniques. The results of analytical predictions are compared with the results predicted by other statistical and generic approaches; an agreement is found. A sensitivity analysis is performed to assess the relative importance of various parameters in the river-bay-delta system. (Author's abstract)
W85-02961

JUNCTION ANGLES IN DRAINAGE NETWORKS,
Jet Propulsion Lab., Pasadena, CA.
D. C. Pieri.
Journal of Geophysical Research, Vol. 89, No. B8, p 6878-6884, August, 1984. 6 Fig, 2 Tab, 24 Ref. NASA contract NAS 7-100 and grant NGL 33-010-082.

Descriptors: *Tributaries, *Junction angles, *Drainage patterns, Topology, Topography, Slope, Remote sensing, Drainage basins, Streams.

The systemics of tributary junction angles are an important link between the topology of a drainage network and its topography because the angle of junction depends on the relative slopes of the intersecting tributaries. A model is presented here for stream junction angle as a function of position (link magnitude) within the network which quantitatively predicts the observed down-network increase of junction angle for tributaries joining progressively larger recipient links. Good agreement between model and data exists for mature drainage networks mapped at varying scales. Additionally, the dependency of junction angle on relative tributary slopes suggests that as individual links within the network modify their slopes to evolve toward graded longitudinal profiles, there exists a central tendency within the network, modulated by structural and lithologic controls, for evolution to an equilibrium of 'graded' planimetric pattern. Extraction of process-related (as opposed to purely topological) information from network planimetric pattern is important in terrestrial and planetary remote sensing applications. (Author's abstract)
W85-02963

FLOOD WARNINGS AND FLOOD RESPONSES FOR THE RED RIVER OF THE NORTH,
Manitoba Univ., Winnipeg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6E.
W85-02988

COMPUTATION OF DYNAMIC WAVES IN CHANNEL NETWORKS,
For primary bibliographic entry see Field 8B.
W85-03007

REGULAR MEANDER PATH MODEL,
San Diego State Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W85-03009

BOUNDARY SHEAR IN SYMMETRICAL COMPOUND CHANNELS,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W85-03010

SECONDARY CURRENT AND RIVER-MEANDER FORMATION,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
P. K. Kitanidis, and J. F. Kennedy.
Journal of Fluid Mechanics, Vol. 144, p 217-229, July, 1984. 2 Fig, 29 Ref.

Descriptors: *Fluid mechanics, *Meanders, Perturbation, Water currents, Stability analysis, Mathematical studies.

A small perturbation stability analysis is presented for investigating the role of the secondary current which accompanies channel curvature in the initiation and early development of meanders of alluvial and ice- or rock-incised streams. A small sinusoidal perturbation is introduced in the channel alignment of an initially straight prismatic channel. The equation of the conservation of moment of momentum is applied to calculate the velocity of the secondary flow for uniform quasi-steady flow conditions. The formulation is then closed by introducing the assumption that the differential, between the outer and inner banks, rate of boundary erosion, dissolution or melting, or sediment discharge is proportional to the strength of the secondary flow. This formulation leads to a linear differential equation which is solved for its orthogonal components which give the rates of meander growth and downstream migration. The amplitude of the meanders tends to increase and the meanders migrate downstream. The dominant wavelength and the corresponding phase shift between channel meandering and the velocity of the spiral motion are calculated as those corresponding to the fastest growth rate. The results are in good agreement with data reported by other investigators. (Baker-IVI)
W85-03035

WIND-INDUCED ENTRAINMENT IN A STABLY STRATIFIED FLUID,
Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
C. Kranenburg.
Journal of Fluid Mechanics, Vol. 145, p 253-273, August, 1984. 9 Fig, 6 Tab, 23 Ref.

Descriptors: *Entrainment, *Stratification, *Streamflow, *Wind, Flumes, Turbulent flow, Coriolis Force, Richardson Numbers, Density, Velocity, Mixing.

Experiments were carried out on mixed-layer deepening in a straight wind flume initially containing a two-layer fluid. To simulate an effectively unlimited water body, or a situation where the presence of endwalls is not yet noticeable, the water from the upper layer was withdrawn at the downstream end, and supplied against the upstream end in part of the experiments. As a consequence curvature effects as encountered in an tanks were absent. While the additional m caused by recirculation was not negligible, extrapolation to the situation where recirculati absent was straightforward. Upper-layer de and mean-density and mean-velocity profiles measured for overall Richardson numbers ran from 22 to 1090 based on the surface fri velocity. Gradient Richardson numbers in the sition layer and in the mixed layer were estim The observed mean density and velocity profil well as visual observation showed the develop of a mixed layer with little density differences a transition layer with relatively large density velocity gradients. In all experiments the trans layer occupied a considerable part of the upper layer. The surface shear layer was les veloped than in the case of homogeneous flow judged from the gradient Richardson number, turbulence in the transition layer is on a critical condition when recirculation is absent. dowgraph images showed large-scale structur the transition layer, whereas the mixed layer peared more uniform. The entrainment pro seems to be dominated by mixing in boils, hi turbulent patches temporarily protruding into undisturbed layer. Intermittent small-scale breaking, producing filaments and small cl was observed under specific conditions. (Ba IVI)
W85-03037

TWO-STAGE URBAN RUNOFF FOREC MODEL,
McMaster Univ., Hamilton (Ontario). Dept. Civil Engineering and Engineering Mechanics.
G. G. Patry, and M. A. Marino.
Journal of Water Resources Planning and Man ment, Vol. 110, No. 4, p 479-496, October, 198 Fig, 6 Tab, 28 Ref, 1 Append. CSRS project D*-LAW-4254-H.

Descriptors: *Urban runoff, *Storm ru *Runoff forecasting, *Computer models, C bined sewer overflows, Storm wastewater, W pollution control, Automation.

Storm-related pollution in general, and combi sewer overflows in particular, have been found contribute significant amounts of pollutants to ceiving water bodies. Control of pollution f these nonpoint sources of pollution is very cos Accordingly, integrated real-time control of c bined sewer overflow is being considered a possible alternative to the more traditional form pollution control. The basic features of sugges control combined sewer overflow control str gies are reviewed, including simple local cont reactive control, and anticipatory control. Beca water quantity forecasts are essential to any i grated real-time control strategy, the applicatio a simple microcomputer-based two-stage ur runoff forecast model is examined. Runoff fo casts from this deterministic-stochastic model provided for lead times ranging from 1-12 t steps (5-60 min). The two-stage approach is fou to be particularly useful for lead times of up to min. (Author's abstract)
W85-03065

CHARACTERIZATION OF DRAINAGE RECLAIMED LAND MINED UNDER PUBL LAW 95-087,
Missouri Univ.-Rolla. Dept. of Geological En neering.
C. D. Elifrits.
Transactions of the Missouri Academy of Scien Vol. 17, p 155-162, 1983. 2 Fig, 1 Tab, 5 R

Descriptors: *Drainage patterns, *Land reclam tion, Infrared imagery, Aerial photography, St mines, Coal mines, Legislation, Erosion, Sedim tation.

Under Public Law 95-087, lands disturbed by s face coal mining must be reclaimed so as to hav surface which must have morphology similar the original landscape and be free of actively ero ing gullies. Drainage developed on terrain creat to conform with current reclamation regulatio

compared to that of adjacent undisturbed ter- subjected to similar land use. All drainage ures were mapped from color infrared aerial ography. On the reclaimed land, drainage den- were on the order of less than one half (50%) ose found on the adjacent undisturbed terrain. time this smooth surface will lead to erosion sedimentation problems once this land is no er maintained as required by regulation during bonding period. The current regulatory re- ements, while assuring minimum environmen- mpact of mining, produce a site which does not promise of being stable after the repair work ded. (Moore-IVI)
-03069

EAT SALT LAKE GETS GREATER EVERY
,
Vare.
ubon, Vol. 86, No. 5, p 118-131, September,
. 6 Fig.

criptors: *Great Salt Lake, *Utah, *Water l, Lakes, Flooding, Lake morphology, Evapo- n, Lake basins, Lake shores, Ecological ef- s, Land development.

ting snows in surrounding mountains have ght the water level in the Great Salt Lake h) to more than 9 ft above the 4200 ft level, ch has been the lake's approximate elevation 135 yr. Because of the low relief in the lake n, this comparatively small increase in depth caused an additional 267 square miles of land to me inundated. Highways, businesses, and llife management facilities have been damaged estroyed by flooding. In addition to the water melting snow, record rainfalls and reduced oration due to cooler weather have contribut- o a steadily increasing water level over the past r. Almost 90% of federally managed marsh- ls have been flooded, and about 50-60% of the e-managed marshes are inundated. Birds, in- ling coots, ducks, Canada geese, and phalar- s, have been forced to find other areas for overs; formerly tens of thousands of birds used at Salt Lake facilities. Further increases in lake ls will destroy many public facilities of consid- le economic value, as well as force retreating llife into close contact with human settlements. prevent future damage it may be necessary to rict development of lakeshore lands. Another roach would be to pump water out of the lake pipe it to the desert on the western side of the . Dams on feeder streams have also be consid- l as possible solutions; both schemes would be y expensive to implement. (Rochester-IVI)
5-03078

OTTING POSITIONS FOR PEARSON PE-III DISTRIBUTION,
ngtze Valley Planning Office, Wuhan (China).
i, J. Ding, H. W. Shen, and J. D. Salas.
rnal of Hydrology, Vol. 74, No. 1/2, p 1-29, ober, 1984. 1 Fig, 10 Tab, 24 Ref, 1 Append.

scriptors: *Hydrology, *Pearson type III distri- ion, Monte Carlo method, Mathematical stud- Statistical analysis, Skewness.

e Monte Carlo method is suitable for develop- plotting postion formulas under Pearson type- distributions. From the generation of a total of ,000 traces with sample sizes ranging from 30 to , it was found that the following properties re preserved: basic statistical characteristics; the ectation of frequencies of order statistics; and quencies of exceedance of order statistics. The culated b-values from the generated data in the tting position formulas agree with the b-values ained from direct numerical integration. A plot- g position formula is developed for P-III distri- ion based on the generated data for Cs coeffi- nts of skewness of parent distribution in the ge of between 0 and 2. The formula can be plied to both symmetrical and unsymmetrical ent distributions and will also provide unbiased l efficient estimations of quantiles. This formula mpares favorably with all currently available mulas. In order to use this developed plotting sition formula, a coefficient b must be deter- mined. These b-values are mainly dependent on the values of Cs and the order number of the arranged sample. (Moore-IVI)
W85-03079

EVALUATION OF TRACER DILUTION TECHNIQUES FOR GAUGING OF RIVERS IN FLOOD,
Australian Atomic Energy Commission Research Establishment, Sutherland.
P. L. Airey, G. E. Calf, A. Davison, J. F. Easey, and A. W. Morley.
Journal of Hydrology, Vol. 74, No. 1/2, p 105-118, October, 1984. 5 Fig, 16 Ref.

Descriptors: *Tracers, *Dilution, *River gauging, *Floods, Floodplains, Mixing, Turbulence, Velocity, Wave front.

The use of the tracer dilution technique to gauge flow over broad shallow floodplains is examined. Because of the long mixing lengths, it sometimes takes several days for the passage of the laterally dispersed pulse. Tracer methods can be used if the flow rates vary linearly during the passage of the pulse. The measured flow rate is related to the time at which the first moment of the concentration profile is zero. An experimental verification is presented. By analyzing the tracer pulse shapes before the establishment of complete mixing, it was demonstrated that the effective dispersion coefficients were independent of the scale of turbulence over the range 10 m to ca. 1 km. This is consistent with the establishment of isotropic turbulence on the floodplain in contrast to oceanic surfaces. The velocity of the tracer is a factor of 2 less than that of an advancing wave front, which is in acceptable agreement with prediction. It is concluded that the transport of a non-interacting contaminant across the flood-plain can be predicted from the wave front velocity and the dispersion coefficients measured close to the release point. (Author's abstract)
W85-03085

RESPONSE TO PRECIPITATION OF HEADWATER STREAMS IN HUMID AREAS,
Hull Univ. (England). Dept. of Geography.
R. C. Ward.
Journal of Hydrology, Vol. 74, No. 1/2, p 171-189, October, 1984. 8 Fig, 54 Ref.

Descriptors: *Humid areas, *Rainfall-runoff relationships, *Streamflow, Storm seepage, Infiltration, Quickflow, Overland flow, Saturated flow, Unsaturated flow, Matrix flow, Pipeflow.

In most humid areas the majority of precipitation infiltrates the soil surface and as a result quickflow may result from water entering the stream channels via subsurface flow paths and by overland flow from surface-saturated source areas of variable size. The distribution of variable source areas appears to be related strongly to the occurrence of subsurface flow convergence. The relative importance of saturated and unsaturated matrix flow and turbulent pipeflow are matters of continuing debate and investigation, although accumulated evidence indicates that all three subsurface flow paths may play an important role in the response of headwater streams to precipitation. Until it is possible to identify accurately and quantify the individual flow paths of water in the runoff process it will not be possible to predict satisfactorily the effects of pollution, agricultural practices, forest management techniques or land drainage improvements upon the quantity and quality of water in stream channels or to finalize models of erosion and slope development. (Moore-IVI)
W85-03089

INFILTRATION MEASUREMENTS IN A SMALL LOWLAND CATCHMENT,
New Univ. of Ulster, Coleraine (Northern Ireland). School of Biological and Environmental Studies.
D. N. Wilcock, and C. I. Essery.
Journal of Hydrology, Vol. 74, No. 1/2, p 191-204, October, 1984. 6 Fig, 4 Tab, 21 Ref.

Descriptors: *Infiltration, *Organic matter, *Northern Ireland, Soil water, Soil texture, Catchment area, Hydrographs, Slope, Infiltration rate, Infiltration capacity.

Infiltration rates into the glacial boulder clay of Northern Ireland, U.K., were determined from cylinder infiltrometers and from hydrograph analyses in a small instrumented catchment. Infiltrometer readings were made monthly at eleven sites in the catchment for a year. Organic matter appears to be the most important site factor controlling infiltration capacity with slope next in importance. Other factors investigated as site controls on infiltration capacity were soil texture and antecedent soil moisture. Infiltration capacity varied little from site to site at any time of year and was always very low, even in summer. Mean infiltration capacity determined from these site readings for the whole catchment varies from 0.6 mm/hr in January to about 9 mm/hr in June. Site variation was greatest in summer. The maximum site reading obtained was 19.7 mm/hr in June. 'Average infiltration' rates determined from conventional hydrograph analyses are very similar to the infiltration capacities determined for the whole catchment from the infiltrometer readings, especially in winter. The close similarity in winter between infiltration rates determined from the two independent methods suggests in fact that they each measure the same process (i.e. surface infiltration capacity) or that the process of infiltration is relatively uniform through the soil profile and proceeds at a rate close to the infiltration capacity. (Author's abstract)
W85-03090

DESIGN FOR A STABLE CHANNEL IN COARSE ALLUVIUM FOR RIPARIAN ZONE RESTORATION,
Bureau of Land Management, Denver, CO.
W. L. Jackson, and B. P. Van Haveren.
Water Resources Bulletin, Vol. 20, No. 5, p 695-703, October, 1984. 7 Fig, 2 Tab, 22 Ref.

Descriptors: *Alluvial channels, *Streams, *Rehabilitation, Stability, Riparian waters.

Geomorphic, hydraulic and hydrologic principles are applied in the design of a stable stream channel for a badly disturbed portion of Badger Creek, Colorado, and its associated riparian and meadow complexes. The Badger Creek watershed is 569 sq km with steep slopes and generally shallow soils. High rates of runoff and erosion occur during summer convectional storms. The lower Badger Creek project area was a broad, gently sloping alluvial meadow which had been eroded as a result of a stream channel system which became more active than its historic norm. This was probably caused by changes in watershed conditions due to overgrazing, timber harvest, road building and mineral exploration which resulted in increased sediment delivery, and possibly increased freqency of large peak flows. Channel geometry measurements describe the stream channel and the normal bankfull stage in relatively stable reaches. Critical shear stress equations were used to design a stable channel in noncohesive materials with dimensions which approximate those of less disturbed reaches. Gabion control, spaced at approximately 300 m intervals, are recommended to help reduce the chance of lateral migration of the newly constructed channel. Controls are designed to allow for some vertical adjustment of the channel bed following increased bank stability due to revegetation. The flood plain is designed to dissipate flood flow energy and discourage multiple flood channels. The channel has approximately a 90% chance of remaining stable the first two years following construction, the time estimated for increased stability to occur due to revegetation. (Baker-IVI)
W85-03135

FORESTS AND OTHER FACTORS ASSOCIATED WITH STREAMFLOWS IN EAST TEXAS,
Stephen F. Austin State Univ., Nacogdoches, TX. School of Forestry.
M. Chang, and S. P. Watters.
Water Resources Bulletin, Vol. 20, No. 5, p 713-719, October, 1984. 2 Fig, 4 Tab, 25 Ref.

Group 2E—Streamflow and Runoff

Descriptors: *Streamflow, *Forest watersheds, *Texas, Forests, Forest hydrology, Hydrologic cycle.

Effects of proportion of watersheds in forest and watershed physiographic factors on mean annual streamflow, median flow, and 12 flood flow characteristics were regionally analyzed for 19 unregulated streams in East Texas. Annual streamflow increases with decreasing percent forest area in these watersheds. Differences in annual streamflow between full forest cover and bare watersheds could be as much as 200 mm. Forests are also associated with flood flows in the study area, but the effect diminishes with storm duration and storm size. If a watershed shape parameter is equal to or greater than 0.565 and other things being equal, the minimum watershed area required to generate 0.142 cms, a criterion used by the US Corps of Engineers in regulating dredge or fill activity for water pollution abatement in the East Texas streams, is 70 sq km. (Baker-IVI)
W85-03137

NITRATE TRANSFORMATIONS IN SOUTHERN ONTARIO STREAM SEDIMENTS,
York Univ., Downsview (Ontario). Dept. of Geography.
M. D. Wyer, and A. R. Hill.
Water Resources Bulletin, Vol. 20, No. 5, p 729-737, October, 1984. 3 Fig, 5 Tab, 29 Ref.

Descriptors: *Nitrate, *Streams, *Sediments, Denitrification, Water quality, Eutrophication, Bacteria, Ammonium.

Sediments from diverse stream environments in Southern Ontario are shown to exhibit considerable nitrate removal potentials due to bacterial denitrification and nitrate reduction to ammonium. The data also suggest that ammonification and nitrification can occur concurrently with nitrate reduction in many stream sediments. Rates of NO3-N loss from aerated 5 mg/l nitrate-N solutions overlying 0.5 cm depth sediments ranged from 11171 mg/sq m/day for a 24 hr incubation period. Microbial nitrate removal also occurred in sediments from 5-10 cm depths, although losses were significantly lower than in the surface sediment layer. Rates of nitrate removal showed considerable variability within individual stream reaches; however, differences between most of the regions analyzed were relatively small. Nitrate loss from 0.5 cm depth sediments was positively correlated with sediment ammonium and to a lesser extent with organic carbon, total nitrogen and texture. These results suggest that a wide variety of stream sediments have a potential for nitrate removal from oxygenated streams draining forest and agricultural landscapes. (Baker-IVI)
W85-03139

FLOOD FREQUENCY CHARACTERISTICS OF SOME ARIZONA WATERSHEDS,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
W. C. Boughton, and K. G. Renard.
Water Resources Bulletin, Vol. 20, No. 5, p 761-769, October, 1984. 8 Fig, 4 Tab, 14 Ref.

Descriptors: *Flood frequency, *Watersheds, *Arizona, *Distribution, *Australia, Floods, Statistical analysis.

The flood frequency characteristics of 18 watersheds in southeastern Arizona were studied using the log-Boughton and the log-Pearson Type 3 distribution. Results showed an average relationship between frequency factor and the lnln(T/(T-1)) function of recurrence interval, which closely resembles the relationship for Australian data on which the log-Boughton distribution was originally based. Fitting techniques allow this distribution to overcome some peculiar fittings produced by one or more very low flood values; there is a systematic increase in the shape parameter with increase in watershed area in the study region. (Baker-IVI)
W85-03142

HEURISTIC METHOD FOR MEASUREMENT AND CHARACTERIZATION OF RIVER MEANDER WAVELENGTH,
Sandia National Labs., Albuquerque, NM.
S. Sinnock, and A. R. Rao.
Water Resources Research, Vol. 20, No. 10, p 1443-1452, October, 1984. 16 Fig, 1 Tab, 40 Ref. US Dept. of Energy DE-AC04-DP00789.

Descriptors: *Meanders, *Rivers, Streamflow, Model studies, White River, Indiana, Fourier analysis.

Meander wavelength was analyzed in the Fourier frequency domain by power spectral analysis in terms of hierarchical center lines as a reference geometry, eliminating some of the subjective bias associated with wavelength measurements. Equally spaced sampling points were located along the talweg of meandering streams. Sample values were measured as the perpendicular distance to a reference line connecting meander belt midpoints. This line, itself meandering, constitutes a river's second order meander frequency, which is analyzed with respect to a still higher order reference line. Sampling along the talweg attenuates the spectral estimates of natural frequencies of meanders. Corrections are obtained by multiplying frequency peaks by the sinuosity of the study reach. Power spectra obtained from hierarchical reference lines of first- and second-order meanders of the White River in southern Indiana indicate discrete frequencies in each order. First- and second-order harmonics are observed at high and low frequencis. Complex meandering along the Dolores River in western Colorado is characterized by very low-frequency energy in third-order meanders and successively higher frequency energy in second- and first-order meanders. A comparison of power spectra for hierarchical and arbitrary reference lines shows that arbitrary references condense spectral estimates of meander energy within artificially averaged frequency bands. Another comparison, using the theory of minimum variance for meander formation, confirms that hierarchical reference lines improve meander characterization. (Baker-IVI)
W85-03168

PROCESS AND DISCHARGE ESTIMATION IN EPHEMERAL CHANNELS, CANADIAN ROCKY MOUNTAINS,
British Columbia Univ., Vancouver. Dept. of Geography.
J. R. Desloges, and J. S. Gardner.
Canadian Journal of Earth Sciences, Vol. 21, No. 9, p 1050-1066, September, 1984. 5 Fig, 4 Tab, 35 Ref.

Descriptors: *Channels, *Canadian Rocky Mountains, *Discharge hydrographs, *Ephemeral streams, Tributaries, Streamflow, Mountains, Floods, Debris flows, Avalanches, Flow discharge.

Process determinations and discharge estimates are made for 10 steep alpine channels in the Front and Main ranges of the southern Canadian Rocky Mountains. The catchments, which range in size from 0.17 to 1.13 sq km are sufficiently small that their runoff patterns are dominantly ephemeral and are characterized by processes that include water floods, debris flows, and snow avalanches. Occurrence of dominance of a particular process is related to sources of water and the availability of weathered debris. Because of the lack of measured data and low frequency of events, information on peak discharges in the ephemeral channels must be derived by indirect means. Discharge estimates based on gross channel morphology probably result in overestimation if multiple processes occur in the channel. Thus reliable estimates of peak discharge require prior identification of channels or reaches of channels that are fluvially dominated. The slope-area method of discharge estimation may yield more representative results in the absence of significant channel widening. The multiple origin and reworking of sediments confuse estimates based on competence. (Baker-IVI)
W85-03196

2F. Groundwater

INVESTIGATION INTO THE EFFECT OF DIFFERENT PUMPING REGIMES ON DRAWDOWN IN LARGE DIAMETER WELLS,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W85-02826

MODELLING APPROACH TO ESTIMATING AQUIFER RECHARGE ON A REGIONAL SCALE,
Institute of Hydrology, Wallingford (England).
R. S. Wikramaratna, and C. E. Reeve.
Hydrological Sciences Journal, Vol. 29, No. 3, p 327-337, 1984. 5 Fig, 3 Ref.

Descriptors: *Aquifers, *Groundwater recharge, *Model studies, Hydrologic models, Mathematical studies,.

A method is proposed which is a generalization of the inferred recharge model developed by Smith and Wikramaratna (1981, Hydrol. Sci. Bul. 26(2), 113-136). Two of the proposed extensions to the original model, the fitting of water levels at data points and the weighting of errors to reflect the confidence in water level observations, are designed to make the model more directly applicable to field data. The third extension involves the introduction of the concept of recharge types. This makes the model more applicable to practical problems since it overcomes the major limitation of the original inferred recharge model and allows more direct comparison between model and water balance results. In most cases the variance of the recharge error is reduced by using the modified model. Where sufficient information is available concerning the recharge patterns, the modification may lead to an improvement in the recharge estimates. (Baker-IVI)
W85-02830

EFFECT OF URBANIZATION IN AN ARID REGION: FORMATION OF A PERCHED WATER TABLE THAT CAUSES ENVIRONMENTAL DAMAGES,
Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.
A. Karnieli, A. Issar, and M. Wolf.
Environmental Geology and Water Sciences, Vol. 6, No. 1, p 51-63, 1984. 13 Fig, 2 Tab, 19 Ref.

Descriptors: *Israel, *Dimona, *Urbanization, *Perched water table, Environmental effects, Groundwater, Flooding.

Construction in a new neighborhood in the Israeli town of Dimona, situated in an arid region in the south of the country (150 mm average annual rainfall), resulted in a rise in groundwater levels during the subsequent rainy seasons. This caused flooding of shelter basements, soil sliding, and sagging which permanently damaged walls and buildings. The neighborhood had been built on continental sands and marls blanketed by loess, on a valley slope near a rocky anticlinal dip-slope. Subsurface studies, using piezometer holes and groundwater analyses, revealed the presence of sand lenses alternating with plastic marls, which act as seasonal aquifers with perched water tables. Groundwaters obtain high SO4(-2) and Cl(-) corrosivity through contact with these nonflushed marls of the Neogene valley fill (Hazeva Formation). The reasons for the rising of groundwater were found to be: (a) artificial interference with the natural (pre-construction) drainage system-interception of the hillside runoff by building plots, roads, etc.; (b) partial denudation of the loess blanket, increasing the local infiltration and the build-up of local, perched water tables; and (c) corrosion of concrete and steel pipelines, as well as foundations, by prolonged contact with corrosive groundwater, resulting in haphazard but massive leakage. An environmental improvement plan was proposed which would include: terracing and planting of the watershed above town to increase evapotranspiration; lowering of the water table by pump-

and diverting the water to suburban parks
es of salt-resistant trees); and replacement of
and cement pipes by a non-corrodable plastic
ystem. (Author's abstract)
02862

OF PUMPING TESTS TO EVALUATE A
THERMAL RESERVOIR - THE TRIASSIC
OSTONES AT MARCHWOD, SOUTHAMP-

h Geological Survey, London (England). Aq-
Properties Section.
rice, and D. J. Allen.
edings of the Institution of Civil Engineers,
76, Part 1, p 697-711, August, 1984. 7 Fig, 1
7 Ref.

riptors: *England, *Southampton, *March-
, *Geothermal Resources, Gas lifts, Trans-
vity, Exploration.

first geothermal exploration borehole in the
was completed in March 1980. Preliminary
tigations using geophysical logging, laborato-
udies of cores, and drill-stem tests indicated
he borehole had encountered a potential geo-
nal reservoir in the Triassic sandstones. This
r describes the pumping tests which formed
ext stage in the evaluation of the reservoir. A
minary test, using gas lift, was carried out
the drilling rig still on site; the results indicat-
at a longer test was justified, and also provid-
ata with which a pump could be specified. The
n of the well, variations in the temperature
hence density) of the water column, and the
of observation wells provided an unusual set
onditions for a water-well test. The Paper
sses these conditions and the methods used to
with them. The reservoir was shown to have a
missivity of about 7 sq m/day, with leakage
ts and a hydraulic boundary present. (Au-
s abstract)
-02949

UTE TRANSPORT IN HETEROGENEOUS
OUS FORMATIONS,
Aviv Univ. (Israel). Faculty of Engineering.
agan.
nal of Fluid Mechanics, Vol. 145, p 151-177,
ust, 1984. 7 Fig, 20 Ref.

riptors: *Solute transport, *Porous media,
l mechanics, Permeability coefficient, Trans-
vity, Velocity, Groundwater movement, Hy-
lic head.

te transport in porous formations is governed
ae large scale heterogeneity of hydraulic con-
ivity. A first order perturbation approxima-
valid for small log-conductivity variance, is
in order to derive closed form expressions of
Eulerian velocity covariances for uniform av-
e flow. The variance of the space-averaged
entration over a volume V may be quite large
ss the length scale of the initial solute body or
/ is large compared with the conductivity
gral scale. This condition is bound to be
ed for transport at the local scale, in which
the concentration may be assumed to satisfy
rogodic hypothesis. This is not generally the
at the regional scale, and the solute concentra-
is subjected to large uncertainty. The useful-
of the prediction of the concentration expecta-
value is then quite limited and the dispersion
ficients become meaningless. The influence of
wledge of the conductivity and head at a set of
ts upon transport is also examined. The statisti-
moments of the velocity and concentration
s are computed for a subensemble of forma-
s and for conditional probability distribution
tions of conductivity and head, with measured
es kept fixed at the set of measurement points.
surements of transmissivity on a grid of points
be effective in reducing concentration vari-
, provided that the distance between the points
naller than two conductivity integral scales.
d conditioning has a lesser effect on variance
ction. (Baker-IVI)
5-03036

SIMILARITY AND ITERATIVE SOLUTION OF THE BOUSSINESQ EQUATION,
Thessaloniki Univ., Salonika (Greece). School of Technology.
E. G. Sidiropoulos, and P. K. Tolikas.
Journal of Hydrology, Vol. 74, No. 1/2, p 31-41, October, 1984. 4 Fig, 1 Tab, 6 Ref.

Descriptors: *Boussinesq equation, *Groundwater movement, Diffusion, Heat conduction, Mathematical equations, Differential equations, Surface-groundwater relations.

The one-dimensional Boussinesq equation is used to describe groundwater flow from a stream to an aquifer due to sudden raising of the stream level. Applications are also noted in diffusion and heat conduction problems with a step-function increase in their boundary values. Through the Boltzmann transformation an ordinary nonlinear differential equation and a two-point boundary value problem is obtained, which is solved by means of shooting iterations. Qualitative considerations permit the construction, through fitting, of an analytical curve that provides an estimate of the slope at the origin, needed for the first shooting iteration. A new formula is proposed for the slope needed in the second iteration. Finally, an algorithm is given that produces first- and second-order corrections to the previous slope estimates until the solution given by the Runge-Kutta scheme yields the desired value at infinity. The latter estimated combined with the iterative scheme remove the necessity of large numbers of shooting iterations. (Author's abstract)
W85-03080

RECHARGE TO AQUIFERS WITH MIXED BOUNDARIES,
Indian Agricultural Research Inst., New Delhi. Water Technology Center.
N. H. Rao, and P. B. S. Sarma.
Journal of Hydrology, Vol. 74, No. 1/2, p 43-51, October, 1984. 4 Fig, 8 Ref.

Descriptors: *Groundwater recharge, *Aquifers, Boundary conditions, Fourier analysis, Mathematical studies, Strip basin recharge, Surface-groundwater relations.

The response to unconfined aquifers to localized recharge is of importance in the evaluation and development of groundwater resources. The feasibility of solving directly the mixed-boundary problem of groundwater recharge processes is examined using extended finite Fourier transformation. The analytical procedure is developed for the one-dimensional problem of strip basin recharge to an unconfined aquifer bounded by an impermeable wall on one side and a stream at the other. The analytical problem was also solved by the method of images using the solutions derived earlier for finite aquifers with impermeable boundaries. The solutions resulting from the two procedures were identical. It is easy to extend the procedure to two- and three-dimensional problems. (Moore-IVI)
W85-03081

COMPUTATION OF THE UNSTEADY TWO-DIMENSIONAL FREE SURFACE OF GROUNDWATER BY THE FINITE-ELEMENT METHOD,
Thessaloniki Univ., Salonika (Greece). Dept. of General and Agricultural Hydraulics and Reclamation.
D. Karamouzis, and G. Terzidis.
Journal of Hydrology, Vol. 74, No. 1/2, p 53-65, October, 1984. 5 Fig, 33 Ref.

Descriptors: *Groundwater movement, *Aquifers, *Finite-element method, *Free surfaces, Artificial recharge, Pumping, Mathematical studies, Groundwater recharge, Anisotropic aquifers, Nonhomogenous aquifers, Boundary conditions.

A numerical solution of unsteady two-dimensional groundwater flow in unconfined aquifers with pumping and/or artificial recharge is presented. Problems of nonhomogeneous and anisotropic aquifers with pumping wells and/or artificial recharge and of various type of boundary conditions are considered. A governing equation is formulated in terms of the finite-element process using the Galerkin approach and triangular elements in the x-y plane. The continuous time Galerkin approximation is used for the time dimension. The obtained nonlinear system of algebraic equations is solved by a predictor-corrector approximation. The results of the numerical solutions are presented in diagrams from which useful observations, comparisons and conclusions can be drawn. (Author's abstract)
W85-03082

HYDROCHEMICAL BUDGETS FOR A MAGNESIAN LIMESTONE CATCHMENT IN LOWLAND ENGLAND,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2K.
W85-03083

BACTERIOLOGICAL STUDY OF GEOTHERMAL SPRING-WATERS DATING FROM DOGGER AND TRIAS PERIODS IN THE 'BASSIN PARISIEN' (ETUDE BACTERIOLOGIQUE DES EAUX GEOTHERMALES DU DOGGER ET DU TRIAS DU BASSIN PARISIEN),
Western Washington Univ., Bellingham. Inst. for Watershed Studies.
S. Daumas, O. Goyeneche, and A. Bianchi.
Comptes Rendus Hebdomadaires de l'Academie Seances Paris, Series III, Vol. 299, No. 9, p 343-345, September, 1984. 1 Tab, 15 Ref.

Descriptors: *Geothermal water, *Bacteria, *Parisian Basin, *France, Anaerobic bacteria, Groundwater, Salts, Thermophilic bacteria, Thermal water, Aquifers.

The geothermal waters of the Dogger and Triassic periods of the Parisian Basin constitute an anoxic environment which maintains a temperature on the order of 70 C. The four geothermal sites are Melun, Cergy-Pontoise and Meaux from the Dogger, and Melleray from the Triassic. The water, with a salinity of 20-35 g/l, contains primarily sodium chloride (80%) and sulfates and carbonates. The gaseous phase is principally composed of N2, CO2 and CH4. The conditions permit the survival and proliferation of various types of bacteria which may provide evidence on the source of the water. The enumeration of the different physiological types of microbial communities detected in the groundwaters of the four geothermal sites reveals a predominance of anaerobic and thermophilic bacteria. The anaerobic microflora, though adapted to high temperatures, could have an autochthonous origin and exercise a metabolic effect on the conditions of the aquifer. (Moore-IVI)
W85-03111

HYDROGEOLOGIC CHARACTERISTICS OF SHALLOW GLACIAL DRIFT AQUIFERS IN DISSECTED TILL PLAINS (NORTH-CENTRAL MISSOURI),
Texas Univ. at Austin. Dept. of Geological Sciences.
J. M. Sharp, Jr.
Ground Water, Vol. 22, No. 6, p 683-689, November-December, 1984. 5 Fig, 1 Tab, 42 Ref.

Descriptors: *Iowa, *Nebraska, *Kansas, *Missouri, *Hydrogeology, Permeability coefficient, Aquifer characteristics, Glacial drift, Iron, Recharge, Brackish water.

The dissected till plains comprise an extensive area of Iowa, Nebraska, Kansas, and Missouri. The area is important agriculturally and for its coal resources. Water from bedrock formations is frequently too brackish for domestic or agricultural use. Hydraulic conductivity values within glacial drift showed two log-normal distributions, comprising a nonuniform, heterogeneous medium. Specific storage for nine samples of glacial till averaged .00382/m. This is somewhat less than values reported for younger clay-rich tills and may represent the effects of time-dependent consolidation. Water budget calculations for small drift-covered

watersheds indicate that approximately 70% of the precipitation discharges by evapotranspiration and 30% by stream flow. Each watershed contains its own groundwater flow system. Recharge is concentrated on the nearly horizontal hill summits and discharge by base flow and evapotranspiration is concentrated in stream channels. Recharge rates are directly proportional to shallow drift hydraulic conductivity, but the low conductivities impede recharge on hill shoulders, fore slopes, and back slopes to create greater surface-water runoff. Local flow systems show only minimal hydraulic connection to underlying bedrock formations or adjoining shallow drift aquifers. Ground water in the shallow drift systems is generally potable but may be high in iron or locally-derived organic pollutants. (Baker-IVI)
W85-03147

HYDRAULIC PROPERTIES OF STONY VADOSE ZONES,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
H. Bouwer, and R. C. Rice.
Groundwater, Vol. 22, No. 6, p 696-705, November-December, 1984. 14 Ref, 1 Tab, 9 Ref.

Descriptors: *Vadose water, *Hydraulic properties, Soil properties, Saturated soils, Soil types, Unsaturated soils, Permeability coefficient.

Hydraulic properties of saturated and unsaturated stony soils were studied on a 3.35 m long column, 1.24 m in diameter, filled with alternating sand and boulder layers. The study showed that the saturated bulk hydraulic conductivity K of a stony soil can be calculated from the saturated K of the soil between the stones and the void ratios of the stony soil and the soil alone. The relation between the unsaturated K of stony soil and soil water pressure head h or bulk water content can be determined from the relation between K and h of the soil alone by moving the K vs. h curve of the soil alone down on the K vs. h graph on log-log paper until its saturated K coincides with the bulk saturated K of the stony soil. The bulk volumetric water content of the stony soil can be calculated by multiplying the volumetric water content of the soil alone by 1-Vr, where Vr is the volume fraction of the stones. The dispersivity Dy of a stony soil is greater than the dispersivity of the soil fraction alone. For the boulder-sand column, Dy was 18 times the Dy-value for the sand alone. Pore velocities or macroscopic velocities in stony soils can be calculated as the Darcy velocity divided by the volumetric water content. (Baker-IVI)
W85-03149

AQUIFER CLASSIFICATION FOR THE UIC PROGRAM: PROTOTYPE STUDIES IN NEW MEXICO,
Wilson (Lee) and Associates, Inc., Santa Fe, NM.
L. Wilson, and M. T. Holland.
Groundwater, Vol. 22, No. 6, p 706-716, November-December, 1984. 8 Fig, 17 Ref.

Descriptors: *Groundwater, *Aquifer characteristics, *New Mexico, *Underground injection, Geothermal studies, Model studies, Permeability coefficient, Evaluation.

Three case studies from New Mexico illustrate methods by which aquifers can be classified for purposes of the Federal Underground Injection Control program. The three studies demonstrate that it is practical but not simple to implement the aquifer classification component of the UIC regulations. Aquifer classification involves determining answers to the following questions: whether injection will be into or above the rock unit; whether the rock unit is now used as an USDW; whether the water in the rock unit contains less than 10,000 mg/l dissolved solids; whether the rock unit is an aquifer capable of yielding a sigificant amount of water to a well or spring; whether the aquifer is unusable as an USDW because it is mineral, hydrocarbon or geothermal energy producing, or because it is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical, or because it is so contaminated that it would be economically or technologically impractical to render it fit for human consumption, or because it is located over an area of in-situ mining subject to subsidence or catastrophic collapse; and whether the water in the aquifer contains more than 3,000 mg/l dissolved solids. Thus the classification relies upon hydrogeologic cross sections which reflect understanding of regional hydrology and geology and which use data obtained from well records and geophysical logs. The cost of a UIC aquifer classification should be in the range of $0.50 to $1.00 per square mile. (Baker-IVI)
W85-03150

ROLE OF GEOLOGICAL AND GEOPHYSICAL DATA IN MODELING A SOUTHWESTERN ALLUVIAL BASIN,
Stone and Webster Engineering Corp., Boston, MA.
K. M. O'Brien, and W. J. Stone.
Groundwater, Vol. 22, No. 6, p 717-727, November-December, 1984. 12 Fig, 27 Ref. US Geological Survey Agreement No 14-08-00001-18812.

Descriptors: *Alluvial aquifers, *Model studies, *New Mexico, *Animas Valley, Transmissivity, Gravity groundwater.

A parameter estimation technique based on existing hydrological, geophysical and geological data was developed to approximate transmissivity values for use in a ground water flow model of the Animas Valley, southwest New Mexico. Complete Bouguer gravity anomaly maps together with Seismic-refraction profiles, geologic maps, geologic, geophysical, and drillers' logs, water levels, and pumping test data provide insight into the transmissivity of bolson deposits throughout the basin. The transmissivity distribution was primarily based on reported pumping and specific-capacity tests in conjunction with complete Bouguer gravity anomaly maps and well log data. The relationship between gravity data and transmissivity data was used to approximate transmissivity values in grid blocks where transmissivity values are not available. A two-dimensional, finite-difference, groundwater flow computer code was used to evaluate the effectiveness of the parameter-estimation technique. The conceptually straightforward approach for parameter estimation using existing hydrological, geophysical, and geological data provided realistic parameter estimates. (Baker-IVI)
W85-03151

EXPLICIT FINITE DIFFERENCE MODEL FOR UNCONFINED AQUIFERS,
Washington Univ., Seattle. Dept. of Civil Engineering.
W.-S. Chu, and R. Willis.
Groundwater, Vol. 22, No. 6, p 728-734, November-December, 1984. 9 Fig, 1 Tab, 17 Ref.

Descriptors: *Unconfined aquifers, *Model studies, *Groundwater flow, Finite difference methods, Mathematical studies.

A simulation model for transient two-dimensional vertically averaged flow in an unconfined aquifer was successfully developed. The model solves the Boussinseq equation governing the water table variation in the aquifer. The nonlinear partial differential equation is solved by the simplest finite difference scheme - the forward in time, central in space explicit method without any matrix solver. Although the method is known to have a fairly restrictive stability condition, it was shown that the condition is not a significant limiting factor for short-term real-time simulations. The accuracy of the code was tested by comparing results with an analytical solution. All of the head values predicted by the model compared closely to the analytical solution. The model was also tested using realistic data for Blue Lake Aquifer in Northern California. The aquifer parameters are determined partly from a small number of well logs and cross-sectional surveys, and partly from water-level data taken from small, privately-owned service wells. Through the comparison of model simulation results and limited observations, it was possible to identify certain trouble spots in the aquifer. The results indicate that besides the river stage and water table information, special attention should be directed toward data collection in the southeastern portion of the aquifer. This exercise showed that the use of simulation models does not have to be constrained by limited data, and that models can be used as an aid to identify locations where additional data should be collected. (Baker-IVI)
W85-03152

INTEGRATED HYDROCHEMICAL APPROACH TO DEDUCE THE RESPONSE OF AN AQUIFER SYSTEM DURING ITS HISTORY OF ABSTRACTION,
Birmingham Univ. (England). Dept. of Civil Engineering.
D. Jackson, and J. W. Lloyd.
Groundwater, Vol. 22, No. 6, p 735-745, November-December, 1984. 6 Fig, 6 Tab, 7 Ref.

Descriptors: *Aquifer characteristics, *Groundwater flow, Isotope studies, Chalk aquifer, England, Chemical analysis, Water analysis.

The investigation of the regional flow characteristics of aquifers is important with respect to aquifer management. To determine regional flows, use can be made of hydraulic and hydrochemical data. In a study of a Chalk Aquifer System in the south of Lincolnshire, England, a combined hydrochemical approach using major, minor and isotope chemistry is described. In the north, two preferential replenishment flow paths are operative on either side of a low flow zone of high iodide, relatively old ground waters. These ground water flow paths are contributing ground water to the abstraction area. The buried cliff in the central area acts as a very effective barrier to east-west flow restricting any movement of modern recharge water into the abstraction area. In the south, replenishment to the abstraction by ground-water flow from the Carstone appears dominant. This case study provides a good example of the use of multiparameter chemical interpretation in hydrogeological studies. The approach has particular advantages where hydraulic data are limited, groundwater head data show little variation, and/or complex hydrogeology occurs. (Baker-IVI)
W85-03153

COMPARATIVE STUDY OF SPECIFIC YIELD DETERMINATIONS FOR A SHALLOW SAND AQUIFER,
Waterloo Univ. (Ontario). Dept. of Earth Sciences
G. I. Nwankwor, J. A. Cherry, and R. W. Gillham.
Groundwater, Vol. 22, No. 6, p 764-772, November-December, 1984. 8 Fig, 1 Tab, 20 Ref.

Descriptors: *Sand aquifers, *Specific yield, Unconfined aquifers, Pumping, Hydraulic gradient, Water table, Drawdown.

Using the type-curve methods of Boulton (Boulton, N.S., 1963. Proc. Inst. Civil Engr. V. 26, p 469-482) and Neuman (Neuman, S.P., 1972. Water Resourc. Res. V. 8, No. 4, p 1031-1044.), and comparisons, at various times, of the cumulative volume of water pumped to the volume of the water-table drawdown cone, values of specific yield were obtained from pumping test data from numerous piezometers in an unconfined sand aquifer. The long term value of specific yield for the aquifer was determined from measurements of the laboratory drainage curve of the aquifer material. The values of specific yield and volume balances show large differences. The laboratory drainage curve indicates that the long term specific yield of the aquifer is about 0.30. The volume-balance method provided values of specific yield that are much lower than the long term value. However, the values increase with increasing duration of pumping, and closely approach the laboratory-determined value after two and one-half days. This trend indicates that delayed drainage from above the water table is an important process influencing the response of the aquifer system. The Boulton and Neuman type curve methods give almost identical results, and although the computed values of transmissivity are reasonable, the values of specific yield are about one-third the late time values ob-

l from the volume-balance and laboratory
ods. Thus is appears that the type curve
ls provide values of specific yield that are not
le for use in the context of long term aquifer
analysis, and that using the volume-balance
od at late time or the laboratory method
des a more reasonable estimate of the long
specific yield of this aquifer. However, the
on and Neuman models lack an apparently
tant process, either vertical flow in the satu-
zone which is not included in the Boulton
l, or delayed drainage from above the water
which is not accounted for in the Neuman
l. (Baker-IVI)
03156

PUTING DRAWDOWN DISTRIBUTION
G MICROCOMPUTERS,
Consultants, Inc., Monroeville, PA.
King.
ndwater, Vol. 22, No. 6, p 780-784, Novem-
December, 1984. 3 Fig, 2 Tab, 8 Ref.

riptors: *Drawdown, *Computers, Micro-
uters, Transmissivitiy, Storativity, Data proc-
g, Groundwater management, Groundwater
ment.

g known or estimated values of transmissivity
storativity, the distribution of drawdowns at
time within a discretized flow field can be
rated by applying simple trigonometry and
rical approximations of the exponential inte-
to the Theis equation. Single- and mutiple-
systems, as well as image boundaries, are
ly simulated with this method. An interactive
IC program is described with a great deal of
y for examining pumping and boundary ef-
in studies which do not warrant a more
lex numerical model. The program uses
n or estimated aquifer parameters to compute
rawdown at every point in a grid representing
area of influence in a confined aquifer. It
mines the drawdown distribution resulting
a single well or the combined effects of
al interfering wells and is capable of simulat-
noderately complex combinations of recharge
lischarge boundaries using image-well theory.
rsion of the code is listed in the Appendix
h is efficient, has minimal memory require-
s, and is fully compatible with TRS-80 Model
nd Model 4 microcomputers. It is useable with
y other small computers in its present form or
be made so with only slight modifications.
er-IVI)
-03157

LYSIS OF DISPERSION IN A STRATI-
D AQUIFER,
urn Univ., AL. Dept. of Civil Engineering.
liuven, F. J. Molz, and J. G. Melville.
er Resources Research, Vol. 20, No. 10, p
-1354, October, 1984. 14 Fig, 1 Tab, 43 Ref.

riptors: *Permeability coefficient, *Disper-
*Stratified aquifer, Aquifers, Aquifer charac-
tics, Groundwater flow.

dispersion of a conservative solute produced
result of vertical variations of hydraulic con-
ivity in a horizontal stratified aquifer of finite
ness is analyzed by applying the moment
od of Aris to solve the governing advection-
rsion equation describing mass transport. It is
med in the analysis that the aquifer is of con-
thickness and of infinite lateral extent, the
aulic conductivity is a known function of the
ical coordinate only, and the flow is unidirec-
al, parallel to the stratification. The applicable
moment equations are developed in a suitable
dimensional form. Analytical solutions are ob-
ed for the zeroth and first moments and for the
derivative of the second moment of the longi-
nal concentration distribution for the case of an
ntaneous plane source for several idealized
aulic conductivity profiles. The analysis gives
time-dependent variation of the longitudinal
rodispersivity for these idealized cases
ughout the transient development of the dis-
ion process. The results of the analysis are
ied to a field-measured hydraulic conductivity profile, and predicted values of the longitudinal macrodispersivity are compared with field results. An important conclusion from the analyses is that nonuniformities in the hydraulic conductivity profile which persist over long distances may produce rather large values of longitudinal macrodispersivity which compared to those observed in some aquifers and which are much larger than those predicted by some previous stochastic analyses. The present results support that the vertical profile of hydraulic conductivity is a very important factor in the determination of longitudinal macrodispersivity and of the transient development of the dispersion process in general. Hence, in any major field study involved with contaminant transport in an aquifer, an effort should be made to obtain detailed measurements of the vertical profiles of hydraulic conductivity at several locations in the aquifer. (Baker-IVI)
W85-03160

MODEL FOR INVESTIGATING MECHANICAL TRANSPORT IN FRACTURE NETWORKS,
California Univ., Berkeley. Lawrence Berkeley Lab.
H. K. Endo, J. C. S. Long, C. R. Wilson, and P. A. Witherspoon.
Water Resources Research, Vol. 20, No. 10, p 1390-1400, October, 1984. 14 Fig, 2 Tab, 18 Ref.

Descriptors: *Fracture permeability, *Geologic fractures, *Path of pollutants, Permeability, Porosity, Groundwater flow, Transport.

Directional mechanical transport properties for anisotropic fracture systems were investigated. A determination was sought of when fracture systems can be treated like equivalent porous media in transport studies and a model that simulated mechanical transport in networks of fractures is introduced. The two important conditions necesary for measuring directional mechanical transport for an equivalent porous medium are a uniform flow field and a test section where the linear path length is constant. With these two conditions satisfied, mechanical transport parameters can be measured from the breakthrough curve for the fluid that flows within the test section. The hydraulic effective porosity was defined as the ratio of specific discharge to average linear velocity. In porous media transport studies, hydraulic effective porosity is directionally stable. Thus the shape of the polar plot of hydraulic effective porosity was used to test whether a fracture system behaved like an equivalent porous medium for transport. A numerical model was developed to simulate mechanical transport under steady flow in a network of fractures. The model incorporated the principles of laminar flow to calculate the location of streamtubes for fluid flowing from one side of a flow region to another. The model has been used to simulate mechanical transport in regular, anisotropic systems of continuous fractures. The results demonstrated that a fracture system which behaves as a continuum for fluid flux may not behave as a continuum for mechanical transport. (Baker-IVI)
W85-03163

INTERPRETATION OF DOWNHOLE DATA AND DEVELOPMENT OF A CONCEPTUAL MODEL FOR THE REDONDO CREEK AREA OF THE BACA GEOTHERMAL FIELD,
Department of Scientific and Industrial Research, Wellington (New Zealand). Applied Mathematics Div.
For primary bibliographic entry see Field 6B.
W85-03164

UNSTEADY SHALLOW GROUNDWATER FLOW OVER A CURVED IMPERMEABLE BOUNDARY,
New South Wales Univ., Kensington (Australia). Dept. of Civil Engineering.
T. G. Chapman, and R. F. Dressler.
Water Resources Research, Vol. 20, No. 10, p 1427-1434, October, 1984. 7 Fig, 12 Ref. US National Science Foundation Grant CEE-8210793.

Descriptors: *Groundwater flow, *Mathematical equations, Permeability, Porosity, Diffusion.

The asymptotic method which produced the new Dressler equation for curved open channel hydraulic flow is employed here to obtain analogous equations for unsteady, two-dimensional, free surface groundwater flow over an arbitrarily curved bed. The result is a pair of partial differential equations: the first linear, stemming from Darcy's Law, and the second nonlinear, expressing mass conservation. The hydraulic conductivity and porosity can be functions of position. The flow component above and parallel to the bed behaves as a vortex in the small with centrifugal acceleration but with no centrifugal term in the pressure. For the special case of a plane sloping bed these equations reduce to the Wooding-Chapman extension of the Dupuit-Forchheimer equations. The two-dimensional flow equations are generalized to a special case of a nonisotropic medium and to include the effect of a variable recharge rate. All the systems are parabolic, thus describing diffusion, and can be integrated numerically as readily as the simpler equations for plane beds. (Baker-IVI)
W85-03166

MIGRATION OF RADIONUCLIDES IN FISSURED ROCK: ANALYTICAL SOLUTIONS FOR THE CASE OF CONSTANT SOURCE STRENGTH,
Royal Inst. of Tech., Stockholm (Sweden). Dept. of Chemical Engineering.
A. Rasmuson.
Water Resources Research, Vol. 20, No. 10, p 1435-1442, October, 1984. 7 Fig, 2 Tab, 12 Ref.

Descriptors: *Groundwater flow, *Radionuclides, *Migration, *Geologic fractures, Permeability coefficient, Model studies, Transport.

An analytical solution has been developed for the migration of radionuclides in fissured rock. The solution differs from a previously derived solution in the inlet boundary condition. The solution developed here is considerably more complicated. Processes that are accounted for are advection and longitudinal dispersion in the fissures, external and internal diffusion into spherical rock blocks, sorption onto the fissure surfaces, and sorption within the matrix and radioactive decay. The solution is obtained in the form of an infinite single integral depending in general on six dimensionless parameters. After long times a steady state condition is obtained, which in general includes five dimensionless quantities. A comparison with previously published results for a system of parallel fractures is made. It is shown that if the area to volume ratio of the slabs and the spherical rock blocks are the same, identical breakthrough curves are produced for short and long contact times. In the intermediate range the solution with spherical rock blocks will give earlier breakthrough and higher steady state concentrations. (Baker-IVI)
W85-03167

REINVESTIGATION OF THE ANALYTICAL SOLUTION FOR DRAWDOWN DISTRIBUTIONS IN A FINITE CONFINED AQUIFER,
Wisconsin Univ.-Milwaukee. Dept. of Civil Engineering.
C.-S. Chen.
Water Resources Research, Vol. 20, No. 10, p 1466-1468, October, 1984. 1 Fig, 10 Ref.

Descriptors: *Confined aquifers, *Drawdown, Aquifers, Mathematical equations, Laplace equation.

A finite aquifer is an aquifer in which drawdown variations reflect the influence of the exterior boundary. On the basis of a number of relations existing in groundwater hydraulics the analytical solution for drawdown distributions in a finite confined aquifer is reinvestigated and obtained. The development of the solution was facilitated by using the available steady state solution for drawdown distributions in a leaky artesian aquifer with constant leakage. A time relation is determined identifying the duration during which an ideal aquifer (that is, an aquifer which is homogeneous, isotropic, and of uniform thickness) can be approached as an infinite one. The solution obtained

consists of the Theis solution and other functions which are responsible for the influence of the exterior boundary. Methods of evaluating the solution are given, and results are presented in type curves. (Baker-IVI)
W85-03170

ELECTRICAL RESISTIVITY STUDIES TO DELIMIT ZONES OF ACCEPTABLE GROUND WATER QUALITY,
Geo-Recon International Ltd., Seattle, WA.
For primary bibliographic entry see Field 2B.
W85-03176

SEISMIC AND RESISTIVITY INVESTIGATIONS NEAR NORWAY, MICHIGAN,
J. E. Underwood, K. J. Laudon, and T. S. Laudon.
Ground Water Monitoring Review, Vol. 4, No. 4, p 86-91, Fall, 1984. 8 Fig, 1 Tab, 6 Ref.

Descriptors: *Groundwater, *Monitoring, *Michigan, *Maps, Topography, Menominee River, Floodplains, Cost analysis.

Reconnaissance geophysical surveys of a small area near Norway, Michigan were conducted on April 24 and 25, 1982, using seismic refraction and electrical resistivity methods. Information gained from these surveys was used to evaluate the ground water supply potential of a specific site selected by the Norway, Michigan Water Commission. The specific objectives of the study were to collect seismic refraction data and electrical resistivity data, interpret the data when possible to delineate the configuration of the bedrock surface, the thickness and charactistics of the overlying sediments, the depth to the water table, and other vertical and lateral variations within the sediment column that have either electrical or seismic expression. Groundwater flow in the area interpreted from the contour map of water table elevations is toward the south-southeast. This geophysical survey proved to be a cost-effective tool in siting a municipal well for the city of Norway. Considerable time and money were saved by conducting the test drilling program based on the results of the geophysical investigation. (Baker-IVI)
W85-03179

TESTING AND SAMPLING OF DEEP BRINE AQUIFERS IN THE PALO DURO BASIN, WEST TEXAS,
Battelle Project Management Div., Columbus, OH. Office of Nuclear Waste Isolation.
M. A. Deyling.
Ground Water Monitoring Review, Vol. 4, No. 4, p 147-151, Fall, 1984. 8 Fig, 5 Ref.

Descriptors: *Aquifers, *Water analysis, *Brine, *Texas, *Palo Duro Basin, Aquifer properties, Hazardous materials, Underground storage, Nuclear wastes, Test wells, Sampling.

The US Department of Energy is investigating the Palo Duro Basin of West Texas along with locations in Nevada, Washington, Utah, Mississippi and Louisiana as potential sites for storage of high-level nuclear waste. Ten wells have been drilled to depths between 3,000 and 8,300 feet. Testing and sampling of deep test zones requires advance planning and analysis of what must be obtained from the well. Various alternatives are available depending on data needs. In this particular instance, both hydrologic and geochemical data were required. The methods chosen were field proven methods used in the oil field industry for many years. Short term testing has included conventional oil-field-type drill stem tests and drill stem equipment with surface pressure readout. Long term testing has consisted of a series of production and recovery tests. Fluid sampling was performed in two stages. The first was at the well head under an imposed pressure of several hundred psi. The second fluid samples were collected downhole at the production zone under pressures close to ambient pressure. The geochemical data and hydrologic data can be used as independent checks on each other in many cases. Test results from the well along with examination of recovered core provided maximum data for each well. (Baker-IVI)
W85-03187

SURFACE AND BOREHOLE GEOPHYSICAL METHODS IN GROUND WATER INVESTIGATIONS,
O'Brien and Gere Engineers, Inc., Syracuse, NY
J. T. Mickam, B. S. Levy, and G. W. Lee, Jr.
Ground Water Monitoring Review, Vol. 4, No. 4, p 167-171, Fall, 1984. 3 Fig, 2 Tab.

Descriptors: *Groundwater, *Monitoring, *Geophysics, Groundwater flow, Boreholes, Geological fractures, Karst hydrology, Gamma ray logs, Borehole caliper logs.

Natural gamma ray and hole caliper borehole logs appear to be effective tools enhancing the geologist's understanding of the subsurface. They can be effective in karst terranes because they have the ability to discriminate between the primary limestone formation and the less abundant shale and clay horizons as well as being able to detect fractures and solution features. The use of natural gamma ray and hole caliper borehole logs is advantageous because the associated equipment is portable and, therefore, does not limit the operation to vehicle accessible sites; they supply an alternative means of acquiring data and thus enable the investigator to employ a drilling method less costly than continuous coring; the interpretation is direct and qualitative, which avoids complicated data reduction. Four general log signature deviation patterns can be identified and modeled to interpret: clay lined fractures and solution channels or washed-out clay or shale horizon, hydrated shale or clay horizons, open fractures or solution channels, and solution development along lithologic change contacts. (Baker-IVI)
W85-03189

APPLICATION OF TELEVISION BOREHOLE LOGGING TO GROUND WATER MONITORING PROGRAMS,
Hart (Fred C.) Associates, Inc., New York.
T. Morahan, and R. C. Dorrier.
Ground Water Monitoring Review, Vol. 4, No. 4, p 172-175, Fall, 1984. 5 Fig.

Descriptors: *Boreholes, *Groundwater, *Monitoring, *Television, Borehole logging, Geophysics, Wells, Groundwater pollution, Water pollution control, Geological fractures.

Borehole television surveys have recently been used to gather in situ information on boreholes and wells in subsurface investigation phases of ground water monitoring programs. Recent high tech developments have led to the miniaturization of the borehole television camera. The lens attachments in the system described are capable of looking sideward or downward and include built-in lighting assemblies. Use of the camera, lenses and various support equipment are discussed. The in situ characterization of fractures that can provide pathways for contaminant migration poses a significant challenge. Borehole television inspection can provide information on the frequency, size and orientation of these fractures. Vertical correlations of rock cores in areas where voids are present can also be simplified by this technique. In addition, borehole television can also be used to check monitoring well integrity. Casing inspections are especially useful where construction details are not known. Well screens may be inspected in place to determine if rusting has enlarged the screen openings or if screens have been damaged during emplacement or well development operations. This information may be valuable in the decision to decommission a well. This has been successfully applied in ground water monitoring programs at several Superfund hazardous waste sites. (Baker-IVI)
W85-03190

MONITORING IN THE VADOSE AND SATURATED ZONES UTILIZING FLUOROPLASTIC,
Timco Mfg., Inc., Prairie du Sac, WI.
For primary bibliographic entry see Field 7B.
W85-03192

DARCIAN FLOW CHARACTERISTICS UPGRADIENT OF A KETTLE POND DETERMINED BY DIRECT GROUND WATER FLO MEASUREMENT,
K-V Associates, Inc., Falmouth, MA.
W. B. Kerfoot.
Ground Water Monitoring Review, Vol. 4, No p 188-192, Fall, 1984. 5 Fig, 3 Tab, 7 Ref.

Descriptors: *Groundwater movement, *Monit ing, *Flax Pond, *Massachusetts, *Darcy's La Flow, Kettle ponds, Surface-groundwater re tions.

The study of the upgradient region of Flax Po Cape Cod, Massachusetts, and its immediate sho line demonstrates that the zone of contribution c be accurately determined by direct ground wa flow measurement combined with head gradi determinations. The components of the Dac equation can also be conveniently plotted on triaxial graph for measurements of velocity a head potential observed between wells across t region. The total volume of ground water c charged to the lake must be determined by verti profiling since the velocities are highest at sh lower depths. The immediate boundary conditi of rapid change of head gradient at the shoreli combined with some sealing of the bottom depos with fine sediments probably contributes to t inching of flow toward the shallow elevation Linear projections of the rate of vertical mov ment, based upon a field porosity of 25% and recharge rate of 18 inches of rainfall per yea combined with a horizontal transport velocity o tained from direct flow measurements can be us to define the zone of contribution. Shallow mea urements of the direct and rate of ground wat flow around the shoreline serve to define the loc tions of recharge and discharge. The area of th zone of contribution determined from volume di charge corresponds to that projected from dire shoreline flow measurements when the mean flo is adjusted to the mean depth of the pond. (Bake IVI)
W85-03193

DIRTY-WATER EVENTS AT ROCKY MOUN TAIN HOT SPRINGS AND THEIR CORRELA TION WITH OTHER SHORT-LIVED PHE NOMENA,
National Hydrology Research Inst., Calgary (Al berta).
R. O. van Everdingen.
Canadian Journal of Earth Sciences, Vol. 21, No 9, p 997-1007, September, 1984. 7 Fig, 5 Tab, 1 Ref.

Descriptors: *Earthquakes, *Storms, *Dirty-wate events, *Radium Hot Springs, *British Columbia *Miette Hot Springs, *Alberta, Hot springs, Hy drogen sulfide, Suspended solids, Rainfall, Dis solved solids, Sulfur.

Earthquakes in Montana, Idaho, and Alaska may trigger dirty-water events at both Miette and Radium hot springs. Earthquakes on the Pacific side of the cordillera apparently require larger magnitudes to trigger such events. The earthquake triggered events are primarily characterized by the occurrence of sediment in the spring waters. Rain fall of 34 mm or more within 48 hr may induce a dirty-water event at Miette Hot Springs; however precipitation exceeding this rate will not necessarily produce such an event. The rainfall-induced events are characterized by the occurrence of sediment contamination and by decreases in spring-water temperatures and changes in dissolved-solids content. The latter effects reflect mixing of thermal water with cooler, near-surface water with a lower mineral content and different composition. Associated decreases in water temperatures and dissolved-solids concentrations and changes in the ionic and isotopic compositions of the spring waters result from mixing of deep thermal water with cooler, less mineralized shallow water. By contrast, the earthquake-triggered events did not have significant thermal or geochemical effects. Suspended solids in the dirty waters represent surficial material and possibly residues from dissolution of carbonate rocks. At Miette Hot Springs the dirt contains secondary sulfur species (native sulfur

ypsum) derived from the hydrogen sulfide
it of the spring water. (Baker-IVI)
03194

JNDWATER HYDRAULICS OF SEASON-
ROST MOUNDS, NORTH FORK PASS,
)N TERRITORY,
a Univ. (Ontario). Dept. of Geography.
rimary bibliographic entry see Field 2C.
03198

ER-ROCK INTERACTION AND CHEMIS-
OF GROUNDWATERS FROM THE CA-
IAN SHIELD,
rloo Univ. (Ontario). Dept. of Earth Sciences.
rimary bibliographic entry see Field 2K.
03205

IUM AND NEON ISOTOPE GEOCHEMIS-
OF SOME GROUND WATERS FROM
CANADIAN PRECAMBRIAN SHIELD,
nal Hydrology Research Inst., Ottawa (On-

rimary bibliographic entry see Field 2F.
03210

IUM AND NEON ISOTOPE GEOCHEMIS-
OF SOME GROUND WATERS FROM
CANADIAN PRECAMBRIAN SHIELD,
nal Hydrology Research Inst., Ottawa (On-

Bottomley, J. D. Ross, and W. B. Clarke.
himica et Cosmochimica Acta, Vol. 48, No.
ctober, 1984. 10 Fig, 4 Tab, 36 Ref.

riptors: *Isotope studies, *Groundwater
g, *Helium isotopes, *Neon isotopes, *Pre-
rian Shield, Porosity, Uranium, Thorium,
hemistry, Geological fractures.

es which have applied several groundwater
lating techniques simultaneously report that
elium technique often appears to overestimate
ge of groundwater. The origins of noble gas
collected from boreholes during the course of
ogeochemical investigations at two of the sev-
research areas on the Canadian Precambrian
d are considered. Large concentrations of
m are present in all the area groundwaters.
highest helium concentrations are accompa-
by radiogenic Ne-21 and Ne-22. Since U
hment exists on at least some fracture surfaces
e flow porosity in the Lac du Bonnet batholith
suspected that most of the He and Ne is
uced in or immediately adjacent to the flow
sity. Helium and neon ages calculated by sub-
tion of total porosity and bulk rock uranium
thorium concentrations into the helium age
g equation yield unreasonably high ages.
um dating of ground waters in fractured igne-
rocks will rarely be straightforward. In areas
re uranium enrichment is present in the sec-
ry minerals of water transmitting fractures,
porosity and representative U and Th concen-
ons in the fractures must be used in the helium
dating equation. In other areas primary urani-
mineralization in pegmatitic veins and dikes
enhance production in otherwise average gra-
rocks. Failure to consider either source of
ium enrichment could result in gross overesti-
ons of groundwater ages. (Baker-IVI)
5-03210

. Water In Soils

ASUREMENT OF SOIL WATER CONTENT
NG A PORTABLE TDR HAND PROBE,
artment of Agriculture, Ottawa (Ontario).
d Resource Research Inst.
C. Topp, J. L. Davis, W. G. Bailey, and W. D.
chuk.
adian Journal of Soil Science, Vol. 64, No. 3, p
-321, August, 1984. 5 Fig, 2 Tab, 9 Ref.

criptors: *Soil water, *Measuring instruments,
me-domain reflectrometry, Volumetric analy-
Gravimetry.

The time-domain reflectrometry (TDR) technique had previously been shown to measure the volumetric water content of soil accurately when applied to long-term installations of parallel transmission lines. In this study a hand probe was used with a portable TDR instrument to measure water content of soil down the wall of soil pits to a depth greater than 1 m. For the data from the soil pits there is no measurable difference between TDR measured water content and those measurements from gravimetric samples. There is a slight indication of location dependence. In a separate experiment the water content of the surface soil at two sites was measured repeatedly in increasing depth increments of 50 mm to 300 mm. The TDR measured values were compared with values obtained by a gravimetric determination on a sample of soil. The TDR gave values that were calculated at the time of measurement in the field. TDR measured values were as accurate and precise as those from gravimetric samples. A portable TDR instrument applied to a hand probe in the form of a parallel pair transmission line apparently gives an accurate and rapid measurement of soil-water content. For lengths of probes 10 mm or more the TDR and gravimetric method gave equal values. The TDR values were available immediately for improved interpretations of the soil properties and for guiding other experimental procedures. (Baker-IVI)
W85-02801

INFLUENCE OF WATER TABLE AND ATMOSPHERIC CO2 CONCENTRATION ON THE CARBON BALANCE OF ARCTIC TUNDRA,
Clemson Univ., SC. Dept. of Biological Sciences.
K. M. Peterson, W. D. Billings, and D. N. Reynolds.
Arctic and Alpine Research, Vol. 16, No. 3, p 331-335, August, 1984. 3 Tab, 16 Ref. NSF grant DEB-8193490 and DEB-8021312.

Descriptors: *Carbon balance, *Tundra, *Water table, *Carbon dioxide, Grasses, Cycling nutrients, Peat, Microbial degradation.

Carbon balance of intact arctic tundra microcosms (soil cores with vegetation) has been shown to be sensitive to small changes in water table. The persistence of the effect of water table on CO2 flux in darkness, and the large reduction of such an effect in sand-culture microcosms without peat-degrading microorganisms have led to the conclusion that rates of microbial degradation of peat are most likely responsible for the bulk of previously observed effects of water table on net ecosystem CO2 flux of arctic tundra microcosms. In an experiment using sand cultures, no significant effects of changes in water table or of increasing the atmospheric CO2 concentration on the growth of plants was detected in two dominant graminoid species (Dupontia fisheri and Carex aquatilis). (Author's abstract)
W85-02857

DEVELOPMENT AND VALIDATION OF A NUMERICAL MODEL SIMULATING EVAPORATION FROM SHORT CORES,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
W. D. Reynolds, and G. K. Walker.
Soil Science Society of America Journal, Vol. 48, No. 5, p 960-969, September/October 1984. 5 Fig, 3 Tab, 47 Ref.

Descriptors: *Model studies, *Evaporation, *Soil moisture, Evaporimeter, Soil surfaces, Soil drying, Mathematical analysis.

A theoretically-based assessment of the short core evaporimeter technique for measuring evaporation from the soil surface can be conducted using numerical simulation. As an initial step, a numerical model is developed that simulates evaporation from isothermal, homogeneous, finite soil columns with a specified initial water content profile. Features of this model include nonlinearized solution of the highly nonlinear surface boundary condition, automatic adjustment of time-step size according to a mass balance criterion, remaximization of program efficiency at each time-step, and the use of soil surface temperature as the primary forcing function. The validity of the model was established through its ability to realistically simulate the constant and falling rate stages of soil drying, including root-time behavior, and by its good mass conservation and stability characteristics. Drying of a clay soil with an initial uniform water content of 0.40 (cu cm sub w)/(cu cm sub pm) for 12,000 min under a constant evaporative demand of 0.00044 (cu cm sub w)/(sq cm sub pm)/min could be simulated with a time-step size ranging from 10 to 13.7 min, a specific mass (i.e. flux) balance of $< 3\%$, a cumulative mass balance of $< 0.3\%$, and with generally $<$ five iterations per time-step. A discretization analysis revealed that for the first centimeter below the soil surface a 0.2-cm nodal spacing was required to obtain accurate estimates of the evaporative flux and the near-surface water content profile. Below that depth, however, nodal spacing can be greatly increased without serious reduction of accuracy. Successful validation of the model supports extension to field conditions. (Author's abstract)
W85-02866

SCALING SOIL WATER PROPERTIES AND INFILTRATION MODELING,
Agricultural Research Service, Durant, OK. Water Quality and Watershed Research Lab.
L. R. Ahuja, J. W. Naney, and D. R. Nielsen.
Soil Science Society of America Journal, Vol. 48, No. 5, p 970-973, September/October 1984. 4 Fig, 1 Tab, 14 Ref.

Descriptors: *Scaling factors, *Soil water, *Infiltration, Permeability coefficient, Wetting-front pressure head, Model studies.

We examined variability and interrelation of the scaling factors for Green-Ampt infiltration parameters of saturated hydraulic conductivity (K sub s) and wetting-front pressure head (h sub f) in a 9.6-ha grassland watershed, containing three hydrologically similar silt loam Mollisols. Scaling factors for different depths at a given site appeared to be related. The scaled mean K sub s decreased with depth, while the scale mean h sub f showed no trend. The K sub s scaling factors had greater variability between sites than the h sub f factors, and the relationship between the two sets of factors deviated appreciably from a 1:1 line. However, there was a linear relationship between them, which was utilized in modeling infiltration. The composite infiltration for the watershed calculated by using different, but related, scaling factors for K sub s and h sub f was very close to that obtained by using the same scaling factors, derived from either K sub s or h sub f for both. However, the distribution and range of the predicted infiltrations were greatly different. (Author's abstract)
W85-02867

INFILTRATION RATE OF SLOT MULCHES: MEASUREMENT AND NUMERICAL SIMULATION,
Washington State Univ., Pullman. Dept. of Agronomy and Soils.
G. J. Redinger, G. S. Campbell, K. E. Saxton, and R. I. Papendick.
Soil Science Society of America Journal, Vol. 48, No. 5, p 982-986, September/October 1984. 6 Fig, 14 Ref.

Descriptors: *Infiltration rate, *Slot mulches, *Numerical analysis, Mathematical studies, Mulching, Surface runoff, Erosion control, Permeability coefficient, Saturated flow.

Mulched soil slots may be used to increase infiltration and reduce runoff and erosion on land where infiltration is restricted by soil freezing or low soil permeability. To establish optimum slot dimensions and spacing, the effect of slot width, slot depth, and saturated hydraulic conductivity on infiltration must be determined. A numerical solution to the soil water flow equation in two dimensions was used to simulate slot mulch infiltration. The Kirchhoff integral transform was used to reduce the nonlinearity of the coefficients, and the finite difference equations were solved using a Newton-

Raphson procedure. Simulations were in reasonable agreement with field measurements. A sensitivity analysis was used to show the effect of simulated changes in saturated condutivity, slot dimensions, and slope on water infiltration into the slots. The effect of slope on infiltration was negligible. A function was derived which predicts steady infiltration rate, given values for saturated conductivity, slot depth, and slot width. (Author's abstract)
W85-02868

EVALUATION OF SOME NEW TRACERS FOR SOIL WATER STUDIES,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
R. S. Bowman.
Soil Science Society of America Journal, Vol. 48, No. 5, p 987-993, September/October 1984. 10 Fig, 2 Tab, 30 Ref.

Descriptors: *Soil water, *Tracers, *Solute transport, Iodide, Thiocyanate, Fluorobenzoates, Bromide, Fluorinated hydrocarbons, High performance liquid chromatography, Chromatography.

Six anions which showed potential as tracers of soil water movement were evaluated in laboratory and field experiments. The anions included iodide (I(-)), thiocyanate (SCN(-)), and four fluorobenzoates: m-(trifluoromethyl)benzoic acid (m-TFMBA), o-(trifluoromethyl)benzoic acid (o-TFMBA), pentafluorobenzoic acid (PFBA) and 2,6-difluorobenzoic acid (2,6-DFBA). The sorption and mobility characteristics of the six potential tracers were compared to those of bromide (Br(-)), which served as an index tracer in all experiments. Initial tracer concentrations ranged from 20 to 100 mg/L. The anions were quantified simultaneously in sub-mL samples of soil solution using a high performance liquid chromatography technique. Batch equilibrations (28 d), and breakthrough curves (7 to 10 d) in a 2.5-m column of loamy sand, under both ponded and trickle-irrigated conditions, indicated that all the tracers except SCN(-) were conservative and were not sorbed. SCN(-) was not retarded in the column studies but did show a negative mass balance, most likely due to chemical and/or biological transformation. Distribution of a tracer solution applied to a field soil was monitored for 69 d in soil water from suction samplers (1.0- and 1.8-m depth) and in extracts from core samples. SCN(-), I(-), and m-TFMBA showed reduced concentrations relative to Br- at all sampling times and depths; o-TFMBA, PFBA, and 2,6-DFBA had distributions similar to that of Br(-). These latter three fluorobenzoates show promise as laboratory and field tracers of soil water, particularly where multiple tracing tests or totally exotic tracers are required. (Author's abstract)
W85-02869

PREDICTOR-CORRECTOR METHOD FOR MEASUREMENT OF HYDRAULIC CONDUCTIVITY AND MEMBRANE CONDUCTANCE,
Hebrew Univ., Rehovoth (Israel). Faculty of Agriculture.
Y. Mualem, and A. Klute.
Soil Science Society of American Journal, Vol. 48, No. 5, p 993-1000, September/October 1984. 12 Fig, 2 Tab, 5 Ref. NSF project ENG7-800845.

Descriptors: *Permeability coefficient, *Membrane conductance, *Soil water, *Capillary head, Hysteresis, Unsaturated flow, Flow cells, Hydraulic properties.

The hydraulic conductivity, K, of unsaturated soil as a function of water content, Theta, or capillary pressure head, Psi, is of fundamental importance in the analysis and prediction of water flow in unsaturated soils. The K(Psi) relationship is strongly hysteretic; the K(Theta) relationship is much less so. Variability in results on the hysteresis of K(Theta) may be due to lack of control of the flow conditions in the measurement of the conductivity, so that the hysteresis was involved in an unknown manner. A procedure was developed for measurement of the hydraulic conductivity of unsaturated soil on wetting and drying processes taking into account the hysteresis phenomenon. The method expedites the measurement of the hydraulic properties, minimizes experimental errors, and avoids ambiguity due to hysteresis. As the soil was rewetted and its conductivity increased, the membrane conductances also increased. This suggests that the conductances are dependent on the water content of the soil. The membrane conductance decreases by several orders of magnitude as the soil dries, and increases following a wetting process. The decrease in conductance did not seem to be caused by blockage of the membrane by suspended matter. A power function seems to represent quite well the relationship between the membrane relative conductance and the soil relative hydraulic conductivity. (Collier-IVI)
W85-02870

SOIL COHESION AS AFFECTED BY TIME AND WATER CONTENT,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
W. D. Kemper, and R. C. Rosenau.
Soil Science Society of America Journal, Vol. 48, No. 5, p 1001-1006, September/October 1984. 8 Fig, 8 Ref.

Descriptors: *Cohesion, *Soil water, *Water content, *Bonding, Soil physics, Soil structure, Cohesive soils.

Cohesion increased for several months after disruption in moist soils. Rate at which cohesion increased was slower in airdry soil, but continued for years. Moduli of rupture of soils also increased with time. Effects of water content on the rate at which cohesion increases are compatible with an explanation of the bonding mechanism in terms of slightly soluble components diffusing to and cementing points of contact between particles. Cohesional forces due to water are estimated and found to be large enough to provide a major portion of the cohesion measured in soils. These estimates are supported by decreased cohesion of a silty soil when dried. However, cohesion of soils with larger amounts of clay generally increases when they are dried, indicating that other bonding mechanisms predominate. (Author's abstract)
W85-02871

CALCULATION OF INTERNODAL CONDUCTANCES FOR UNSATURATED FLOW SIMULATIONS: A COMPARISON,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
R. R. Schnabel, and E. B. Richie.
Soil Science Society of America Journal, Vol. 48, No. 5, p 1006-1010, September/October 1984. 3 Fig, 2 Tab, 15 Ref.

Descriptors: *Unsaturated flow, *Soil water, *Internodal conductance, Richards equation, Infiltration, Conductance, Conductivity.

Five techniques for calculating internodal conductance were compared during a finite-difference solution of the Richards equation. Arithmetic, geometric, and harmonic means as well as integrated and upstream weighted conductances were used to calculate steady-state water content distributions and infiltration into three soils. The water content distributions simulated using the integrated conductance resulted in distributions equivalent to those calculated analytically. Simulation results of infiltration most closely matched literature data when the integrated or geometric mean conductances were used. The harmonic mean conductance gave unacceptable results for all situations simulated. (Author's abstract)
W85-02872

FLUORITE PRECIPITATION IN A CALCAREOUS SOIL IRRIGATED WITH HIGH FLUORIDE WATER,
Colorado State Univ., Fort Collins.
P. W. Tracy, C. W. Robbins, and G. C. Lewis.
Soil Science Society of America Journal, Vol. 48, No. 5, p 1013-1016, September/October 1984. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Fluorites, *Fluorides, *Calcareous soils, *Irrigation water, *Chemical precipitation, Lysimeters, Alfalfa, Idaho, Water pollu sources, Groundwater pollution.

Lysimeters filled with Freedom silt loam soil (f silty, mixed, mesic, Xerollic Calciorthids) w irrigated with geothermal well water from s central Idaho. The water contained 7 mg F Alfalfa (Medicago sativa L.) was grown in lysimeters and the water was applied at a rat give either a 0.30 or 0.15 leaching fraction. A irrigating the 1.0 m deep soil samples for 60 over 98% of the added F remained in the soil. extract and lysimeter leachate analysis showed fluorite precipitation was occurring in the up profile, but only after another fluoride adsorpt mechanism was saturated and the fluoride calcium ion activities exceeded the CaF2 ion ac ity product. The F concentration in the up profile extracts exceeded 20 mg F/L and with additional high F water irrigation, the soluble would be expected to leach deeper in the s Under field conditions the F would be expected eventually move into the groundwater with c tinued irrigation with high F water. (Author's stract)
W85-02873

STORED AVAILABLE SOIL WATER AND TH FALLOW/RECROP DECISION-CRITIC LEVEL APPROACH,
North Dakota State Univ., Fargo. Dept. of S Science.
For primary bibliographic entry see Field 2I.
W85-02874

SCANNING ELECTRON MICROSCOPE STU IES OF SURFACE CRUSTS FORMED BY SI ULATED RAINFALL,
California Univ., Davis. Dept. of Land, Air a Water Resources.
O. Onofiok, and M. J. Singer.
Soil Science Society of America Journal, Vol. 4 No. 5, p 1137-1143, September/October 1984. Fig, 1 Tab, 13 Ref.

Descriptors: *Soil physical properties, *Scannin electron microscopy, *Rainfall penetration, *So surfaces, Soil porosity, Pore size, Crusts.

The micromorphology of the surface layer of thre California soils, Columbia fine sandy loam, Wy clay loam, and Yolo silt loam, undergoing cru formation by simulated rainfall was studied usin the scanning electron microscope (SEM). Crust formed at the time of ponding (early crust) an after 60 min rainfall were examined. At the earl crust stage, crusts on all soils comprised a ver thin compact surficial layer, about 0.05 mm thick and a more open underlying layer of uniform por and particle size distributions comparable to thos of the undisturbed soil. At a later stage, the crust on Yolo and Wyo soils consisted of an upper laye (about 0.1 mm thick) of high porosity, composed predominantly of individual sand grains and lower layer of considerably reduced porosity composed of a higher concentration of clay and sil sized particles. The lower layer, called the 'washed-in' zone, results from the accumulation o fine materials washed out in the upper layer. Columbia later crust also comprised an upper com pact surface layer (about 0.05 mm thick) of well oriented platy particles, and a lower more open layer with particles uniformly reduced in size. Decreased apparent porosity at 0.3- to 0.8-mm depth, measured directly on the SEM photomontages, indicated the presence of the 'washed-in' zone in the Yolo and Wyo late crusts and its absence in the Columbia. Mean pore size of the later crust Yolo sample was significantly reduced compared to the no-crust treatment. Small changes in mean pore size were also observed for the other two soils. (Author's abstract)
W85-02875

ALFALFA GROWTH AND SOIL OXYGEN DIFFUSION AS INFLUENCED BY DEPTH TO WATER TABLE,

gultural Research Service, Orono, ME. New and Plant, Soil and Water Lab.
rnstein, G. R. Benoit, F. R. Scott, P. R.
er, and W. E. Hedstrom.
Science Society of America Journal, Vol. 48, 5, p 1165-1169, September/October 1984. 7 4 Tab, 17 Ref.

riptors: *Alfalfa, *Oxygen diffusion, *Soil erties, *Water table, *Crop growth, Crop , Soil water, Drainage.

vth and yield of alfalfa and oxygen diffusion (ODR) as influenced by excess water were tigated via three depth to water table (WT) nents, through two different falling water sequences. The environment for the study a simulated profile of a Munson silty clay , mesic frigid Aeric Haplaquepts, placed in 12 cylinders 0.61-m diam by 1.52 m deep each d to Iroquois alfalfa (Medicago sativa L.). sequence was run through three consecutive growth cycles. The first sequence was one ing-recession per growth cycle while the d sequence included three floodings at two- intervals during each cycle. Each cycle immediately after previous crop harvest, 3-d saturation followed by lowering the WT ed 0.15-, 0.45-, and 0.75- m depths, respective- DR values at a 0.075-m depth averaged over growth cycles from the single falling water treatment showed little change during the ation to drawdown period for the 0.15-m WT ughly significant variation for the 0.45- and m WT treatments. Growth rates for all treat- s followed a pattern of two weeks of rapid th followed by a declining growth rate to st. For the sequence having three flooding- downs per cycle, crop growth and yield in- ed significantly as a linear function of WT from 0.15 to 0.75 m. The soil water system ed a 3- to 4-d drawdown after each flooding WT drawdown having a positive effect to a m depth. (Author's abstract)
-02877

GHING LYSIMETERS FOR LONG-TERM ER BALANCE INVESTIGATIONS AT OTE SITES,
lle Pacific Northwest Labs., Richland, WA.
Kirkham, G. W. Gee, and T. L. Jones.
Science Society of America Journal, Vol. 48, 5, p 1203-1205, September/October 1984. 4 7 Ref.

riptors: *Lysimeters, *Water balance, *Soil r, Evaporation, Evapotranspiration, Drainage, ord, Washington, Automation.

weighing lysimeters were installed at a te location on the Department of Energy's ord Site in Washington State in 1978 and Platform-type electronic scales were placed the soil surface to measure the weight ges of a large (approximately 7 Mg) container il. The load cells of the scales have been ed to high humidity and to periodic contact drainage water, but have operated without e since installation (over 5 years). Weight ges are continuously recorded, with hourly ges transmitted by phone line directly to the atory. The sensitivity of the scale is 50 g, alent to 0.02 mm of H2O. (Author's abstract)
-02879

RIBUTION OF DEUTERIUM AND 18O IN SOILS; 3. THEORY FOR NON-ISOTHER- . WATER MOVEMENT,
monwealth Scientific and Industrial Research nization, Canberra (Australia). Div. of Water and Resources.
Barnes, and G. B. Allison.
al of Hydrology, Vol. 74, No. 1/2, p 119-135, ber, 1984. 1 Fig, 24 Ref.

riptors: *Soil water, *Evaporation, *Deuteri- *Oxygen isotopes, Diffusion, Convection, Soil erature.

del is developed which predicts the shape of -18 and HDO depth profiles which result from evaporation of water from a soil under non-isothermal and quasi-steady-state conditions. The profiles have similar form to those which develop under isothermal conditions. When the soil at depth is cooler than the soil surface - the condition under which most evaporation takes place - a minimum develops in the isotope profile some distance beneath the evaporating front. This is due to the diffusive flux of isotopes in the vapor phase partially offsetting the convective isotope flux in the liquid phase. For coarse-textured soils under isothermal conditions the diffusive vapor flux of isotopes may be the dominant mechanism in balancing convective effects in the liquid phase, even when no net movement of water vapor occurs. The theory is extended to enable partitioning of the water flux into liquid and vapor components under both isothermal and non-isothermal conditions. (Author's abstract)
W85-03086

INFILTRATION MEASUREMENTS IN A SMALL LOWLAND CATCHMENT,
New Univ. of Ulster, Coleraine (Northern Ireland). School of Biological and Environmental Studies.
For primary bibliographic entry see Field 2E.
W85-03090

EFFECTS OF MAGNETIC PARTICLES ON THE UNFROZEN WATER CONTENT OF FROZEN SOILS DETERMINED BY NUCLEAR MAGNETIC RESONANCE,
Cold Regions Research and Engineering Lab., Hanover, NH.
A. R. Tice, and J. L. Oliphant.
Soil Science, Vol. 138, No. 1, p 63-73, July, 1984. 7 Fig, 1 Tab, 14 Ref.

Descriptors: *Soil water, *Nuclear magnetic resonance, *Frozen soils, *Magnetic particles, Magnetite, Ferromagnetic particles.

When small numbers of ferromagnitic particles exist in the soil matrix, the magnetic field is altered on a local level around the magnetic particles, and any liquid water protons in this altered magnetic field will not absorb RF energy at the same frequency as those in the unaltered field. Liquid water protons in the locally altered magnetic field do not contribute to the nuclear magnetic resonance (NMR) signal intensity. This causes a decrease in the NMR signal intensity when NMR is being used to measure unfrozen water contents in partially frozen soils or total water contents in thawed soils. Tutc clay, a soil containing no magnetic particles, was mixed with various small amounts of pure powdered magnetite, and the NMR signal intensity was determined while the samples were both thawed and partially frozen. An equation that correlates the thawed sample signal intensity with the weight percent of powdered magnetite added was derived. The unfrozen water content of the partially frozen samples could be determined accurately for samples containing up to 0.2 to 0.3% magnetite. Several methods for demagnetizing soils containing large amounts of magnetic particles were tried, with the most effective found to be stirring a slurry of the soil over a powerful permanent magnet. Accurate unfrozen water contents could be determined for all the partially frozen samples if some form of demagnetizing procedure was used on those samples containing the most magnetic particles. Exactly what the relationship is between soils containing natural magnetic particles and those containing pure magnetite is still uncertain. (Moore-IVI)
W85-03093

WATER AND AIR MOVEMENT IN SOILS: AN APPLICATION OF BRUTSAERT'S AND OPTIMIZATION TECHNIQUES,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
G. Sander, and J.-Y. Parlange.
Soil Science, Vol. 138, No. 3, p 198-202, September, 1984. 1 Fig, 18 Ref.

Descriptors: *Soil water, *Infiltration, *Air effects, *Brutsaert's technique, Optimization, Diffusivity, Soil water potential, Water pressure.

The process of infiltration into a soil profile is one of simultaneous flow of two phases, air and water. For infiltration into an unbounded soil profile, the generally accepted assumption that Richard's equation describes the infiltration process is not strictly correct. An accurate analytical approximation for the water profile in a soil is presented which takes into account small but nonnegligible air effects. The method relies on using a Brutsaert-type profile and an optimization condition. The approximation is accurate enough for any practical purpose, but an iterative scheme can also be used if more accuracy is needed. Precision of the method for an exponential law diffusivity is assessed, and a simpler but still accurate approximation is presented. Water intake for constant soil water potential at the surface increases with air effects, but it decreases for constant water pressure, as expected. (Moore-IVI)
W85-03094

CALIBRATION OF SOIL SURFACE NEUTRON MOISTURE METER,
S. M. Farah, R. J. Reginato, and F. S. Nakayama.
Soil Science, Vol. 138, No. 3, p 235-239, September, 1984. 5 Tab, 18 Ref.

Descriptors: *Soil moisture meters, *Neutron probes, Soil water, Irrigation, Water management, Calibration.

Accurate information on the soil water content of both the surface and deeper layers is indispensable for reliable water management in crop production. Two types of lightweight neutron surface moisture probes built for testing leaks in roofs were adapted to measure surface soil water content. The introduction of dual detector tubes is one of the primary differences from the older surface moisture probes. The probes were calibrated as a function of soil water content under field conditions with an Avondale loam soil. Calibration curves were obtained for both probes to a depth increment of 30 cm. There is no unique pattern in the data to indicate the superiority of one meter over the other to determine the soil water content for all depth increments. The probes can be used to monitor surface soil water content and its changes, and they complement the depth probes whose accuracy fails at depths shallower than 20 cm. The surface neutron meter could be applied where shallow-rooted crops were being irrigated frequently. (Moore-IVI)
W85-03096

2H. Lakes

OXYGEN DEMAND AND LONG TERM CHANGES OF PROFUNDAL ZOOBENTHOS,
Copenhagen Univ., Hilleroed (Denmark). Det Ferskvands-Biologiske Lab.
For primary bibliographic entry see Field 5C.
W85-02770

EUTROPHICATION OF LAKES LEMAN AND NEUCHATEL (SWITZERLAND) INDICATED BY OLIGOCHAETE COMMUNITIES,
Conservation de la Faune, Saint-Sulpice (Switzerland).
C. Lang.
Hydrobiologia, Vol. 115, p 131-138, August, 1984. 4 Tab, 23 Ref.

Descriptors: *Lake Leman, *Lake Neuchatel, *Switzerland, *Eutrophic lakes, *Oligochaetes, Lakes, Annelids, Bioindicators, Population density, Species diversity.

In 1978-80, oligochaete communities of meso-eutrophic Lake Leman (Lake of Geneva) were compared to those of mesotrophic Lake Neuchatel. Worm species were classified into three groups corresponding to their increasing tolerance to eutrophication: (1) oligotrophic species, mostly Peloscolex velutinus, Stylodrilus heringianus; (2) mesotrophic species, mostly Potamothrix vejdovskyi, P. bedoti; (3) eutrophic species, mostly Potamothrix hammoniensis, P. heuscheri, Tubifex tubifex. In both lakes, eutrophic species constituted the bulk

of the communities in terms of absolute abundance. However, relative abundance of mesotrophic and eutrophic species was higher in Lake Leman; oligotrophic species were more important in Lake Neuchatel. These data confirmed the trophic classification of lakes based on chemical parameters. The number of zero values, which perturbated statistical analysis, was reduced by using species groupings instead of isolated species. Thus, making the lakes more comparable even if different species were present in each one. Relative density values based on all samples were distributed among 4 density classes for the 3 species groupings. The 12 resulting frequencies described the community structure expressed in terms of eutrophication. Furthermore, these frequencies may be used for comparison of eutrophication levels in several lakes. (Author's abstract)
W85-02772

OLIGOCHAETA OF THE MIDDLE PO RIVER (ITALY): PRINCIPAL COMPONENT ANALYSIS OF THE BENTHIC DATA,
Milan Univ. (Italy).
A. Paoletti, and B. Sambugar.
Hydrobiologia, Vol. 115, p 145-152, August, 1984. 5 Fig, 1 Tab, 16 Ref.

Descriptors: *Middle Po River, *Italy, *Oligochaetes, *Principle component analysis, *Benthos, Aquatic habitats, Macrophytes, Sediments, Water temperature, Dissolved oxygen, Seasonal variation.

The application of principal component analysis to two types of habitat (the benthos of macrophytes and of central river bed) enabled us to single out some of the factors that affect the dynamics and the structure of the oligochaete population and its various reactions to environmental conditions. As regards macrophytes, the distribution of the variables on the basis of the first component is correlated, to a certain extent, with a seasonal factor without any significant differences among sites. The largest population is most closely correlated with the summer months. In fact, we found that the Naididae and Tubificidae species generally develop in larger numbers at higher temperatures. For the Tubificidae, we could detect a precise seasonal cycle. In the central river bed habitat, the first component was correlated with the river discharge, which determines the granulometric characteristics of the sediment; we noticed a correlation among the sites that have the same characteristics, regardless of sampling site or date. The species which correlate most closely among themselves are the Tubificidae Limnodrilus hoffmeisteri, Tubifex tubifex, L. udekemianus and L. profundicola, which are very characteristic of environments that contain abundant organic matter. The second component is correlated with temperature, and hence with the availability of oxygen, which determines the presence and the abundance of more sensitive species. (Author's abstract)
W85-02774

COMPARISON OF DIFFERENT METHODS OF WATER QUALITY EVALUATION BY MEANS OF OLIGOCHAETES,
Akademiya Nauk SSSR, Leningrad. Inst. Ozerovedeniya.
For primary bibliographic entry see Field 5C.
W85-02775

RESPONSES OF PHYTOPLANKTON TO EXPERIMENTAL NUTRIENT ENRICHMENT IN AN AMAZON FLOODPLAIN LAKE,
California Univ., Santa Barbara. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W85-02785

CARBON AND HYDROGEN ISOTOPIC COMPOSITION OF BACTERIAL METHANE IN A SHALLOW FRESHWATER LAKE,
Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hanover (Germany, F.R.).
I. Woltemate, M. J. Whiticar, and M. Schoell.
Limnology and Oceanography, Vol. 29, No. 5, p 985-992, September, 1984. 5 Fig, 1 Tab, 35 Ref.

Descriptors: *Lake sediments, *Methanogenesis, *Hydrogen, *Carbon, *Bacteria, Methane, Lakes.

Anoxic sediments from freshwater environments such as bogs, swamps, and lakes undergoing early diagenesis are frequently characterized by the formation of biogenic methane. Freshwater biogenic methanes exhibit carbon and hydrogen isotopic values strongly depleted in C-13 and deuterium relative to the respective values for carbon dioxide and formation water. The percentages of methane generated by fermentation and carbon dioxide reduction can be estimated by comparison of hydrogen isotopes in the formation water and methane. On the basis of these hydrogen isotope data, about 75% of the methane formation in Wurmsee comes from acetate reduction. Fermentation is thus the dominant although not exclusive process. Carbon dioxide reduction contributed the balance of the bacterial methane generated. (Baker-IVI)
W85-02786

DISSOLVED IODINE SPECIES IN A BRITISH FRESHWATER SYSTEM,
Institute of Hydrology, Wallingford (England).
S. D. Jones, and V. W. Truesdale.
Limnology and Oceanograhpy, Vol. 29, No. 5, p 1016-1024, September, 1984. 4 Fig, 2 Tab, 27 Ref.

Descriptors: *Lakes, *Iodine, *Speciation, *England, *Esthwaite Water, Oxidation, Reduction, Iodate, Iodide.

A 16 month study was conducted of the behavior of dissolved iodine species in a freshwater system in the English Lake District. Iodate and iodide were the principal forms of dissolved iodine in this freshwater system. If the system were in thermodynamic equilibrium, iodate would be the only form detectable. The net reduction of iodate either during the sea-to-air exchange of iodine or during transport in the atmosphere is probably responsible. Once deposited in rain, net oxidation of iodide occurs, the measured speciation approaching that at equilibrium as the iodine moves around this hydrological cycle. Small perturbations in this trend occur within the lakes, where seasonally dependent redox processes operate. Over an annual cycle these processes nullify one another, thereby maintaining the progression toward equlibrium. In the anoxic hypolimnion of Esthwaite Water regeneration processes operated when anoxic conditions develop and iodide is released into solution, presumably by bacterial decomposition of iodine incorporated into organic matter. The particulate iodine could be formed in either the aquatic or terrstrial environment. The behavior of iodine in these freshwater lakes is consistent with that in oxic and anoxic marine basins. Interconversion is not as pronounced as would be expected purely by comparing lacustrine and marine productivities and iodine concentrations. The smaller interconversion in the freshwater environment probably results from the short residence time of the lake waters. Water residence times in marine systems are several orders of magnitude greater. (Baker-IVI)
W85-02788

ENVIRONMENTAL FACTORS AND AQUATIC MACROPHYTE RESPONSE IN REGULATED LAKES - A STATISTICAL APPROACH,
Norsk Inst. for Vannforskning, Oslo.
B. Rorslett.
Aquatic Botany, Vol. 19, No. 3-4, p 199-220, September, 1984. 12 Fig, 2 Tab, 12 Ref. Norwegian Inst. for Water Research grant OF-81620.

Descriptors: *Statistical analysis, *Macrophytes, *Water level, *Norway, *Lakes, Fluctuation, Vegetation, Water depth, Aquatic plants, Ice scour, Solar radiation.

The statistical approach is discussed with vegetation and water level data from nine selected Norwegian lakes. The concepts of depth and relative elevation need to be carefully distinguished. This is essential when a regulated lake with appreciable fluctuation of water level is considered. Even by relating the vertical position of a plant site to the median water level as datum, site depth in its time-averaged sense is not equivalent to the relat elevation of this point. Further, the magnitu discrepancies, in general, are large in shall waters where many species attain their peak p formance. Recasting the vertical distribution suberged macrophytes in terms of the time av aged depth resolves ambiguity. Between-lake co parisons of depth distributions are then facilitat Environmental stress factors such as ice-scour, fluence aquatics over a much larger part of depth gradient with a variable water level. Fact operating through threshold statistics such as s surface irradiance, are most adversely influenc by a time-varying water level. Regulation imp generally results in a compressed vertical nic Simultaneously, the potential niche is shifted i deeper waters. Vegetation data from nine oligot phic, regulated Norwegian lakes show signific correlation to the reduced vertical niche defin by ice-scour and threshold irradiance. Water-le schedules determine the actual vegetational sponse. Thus the total probability distribution water levels should replace the regulation heig or mean annual range of water level variation in analysis of response features. (Baker-IVI)
W85-02793

PHOTOSYNTHESIS OF SUBMERSED M CROPHYTES IN ACIDIFIED LAKES. CARBON FLUXES AND RECYCLING OF C IN JUNCUS BULBOSUS L.,
Uppsala Univ. (Sweden). Limnologiska Instit tionen.
R. G. Wetzel, E. S. Brammer, and C. Forsberg.
Aquatic Botany, Vol. 19, No. 3-4, p 329-342, Se tember, 1984. 8 Fig, 35 Ref.

Descriptors: *Carbon dioxide, *Fluctuations, *A giosperms, *Macrophytes, *Photosynthesis, *Aci ity, *Lakes, Recycling, Acid rain, Ecosystems.

Photosynthetic characteristics of carbon dioxi fluxes and light responses in the submersed angi sperm Juncus bulbosus L. were analyzed in a C tesian-diver system in which irradiance could stringently controlled. Results indicate that mu of the CO2 fixed photosynthetically emanat from recycling of photorespired CO2 and fro respiration within the rooting tissue and bacterial in the rhizosphere. The exchange of inorgan carbon, primarily CO2 at the pH of acidified ec systems, between water and submersed macr phytes is slow in comparison to terrestrial plant both because of high resistance of CO2 diffusion water and to diffusion within the tissue of su mersed leaves. The restricted availability of di solved CO2 in acidified fresh waters impos severe limitations upon macrophytes for activ photosynthesis. The gas lacunal system was critic for appreciable net carbon fixation. Over 50% the carbon dioxide fixed under the experiment conditions was recycled from respiratory source A portion of the assimilated CO2 of active photo synthesis passes through the glycolate pathway Diffusion of this CO2 out of the leaves to th water is slow, particularly under radiant condition of high photosynthetic demand. This causes th CO2 to be efficiently recycled. Some of the CO diffuses into the lacunal spaces in immediate juxt position to the cells or is refixed intracellularly Removal of the gas phase by internal lacuna flooding greatly altered this recycling pattern, an allowed little net fixation. (Baker-IVI)
W85-02794

CHEMICAL LIMNOLOGY OF LAKE ARRO (CAREIRO ISLAND), RESULTING FROM WATER LEVEL FLUCTUATIONS IN TH CENTRAL AMAZON RIVER (LIMNOLOGIA QUIMICA DO LAGO DO ARROZ (ILHA DO CAREIRO), SUAS FLUTUACOES EM FUNCAO DO MEIO HIDRICO DO RIO AMAZONAS)
Amazonas Univ., Manaus (Brazil).
U. B. Lopes, U. de Menezes Santos, and M. de Nazare Goes Ribeiro.
Acta Amazonica, Vol. 13, No. 2, p 227-253, April 1983. 6 Fig, 2 Tab, 11 Ref.

Descriptors: *Lake Arroz, *Careiro Island, *Limnology, *River Solimoes, *Water level fluctua-

s, Chemical composition, Stratification, Stagon, Acari-Bodo, Ecological effects, Cycling rients.

e limnological conditions of the Arroz Lake, eiro Island, central Amazon, are determined by River Solimoes, since they are linked almost all r round. The water level varies annually be-en 7 and 9 meters with peak levels in June and est levels in January. This cycle is the principle or determining the great physical chemical and ogical variations which occur in the lake. The mical analysis clearly demonstrate the seasonal ations in the Arroz Lake: stagnation, with a r separation between the epilimnion and the olimnion, temperature stratification, total salt tent and the presence of complex notable nts during the high water and the total moisture ing lowest level water. From September on-rds the lake receives an intense migration of fish he Loricariidae family, more commonly known acari-bodo' (65,000 of these fish were captured six fishermen between September to Decem-). These fish provoke an intense resuspension of en sediments in the lake, since in laying their s they dig holes up to twenty centimeters deep he mud. That recirculation jointly with the ct of the wind causes the resuspension of the ments, increasing the quantity of dissolved eral salts. This phenomenon causes several malies which permit an elevated degree of re-ling of nutrients, and primary production, ch practically determines the absence of strati-tion of the sediments. (Author's abstract)
5-02815

LINITY STRESSES ALONG A COMPLEX VER CONTINUUM: EFFECTS ON MAYFLY HEMEROPTERA) DISTRIBUTIONS,
ahoma Univ., Norman. Dept. of Zoology.
P. Magdych.
ology, Vol. 65, No. 5, p 1662-1672, October, 4. 9 Fig, 3 Tab, 35 Ref. NSF grant DEB-2460.

scriptors: *Rivers, *Washita River, *Oklahoma, ayflies, *Salinity, River Continuum Concept, SCAL, Benthos, Population dynamics, Stress, del studies.

e problems encountered in attempting to com-e physical, chemical, and biological parameters considered with the ALSCAL model of multi-ensional scaling. The River Continuum Con-t (RCC) was used to evaluate physical, chemi-and biological variables in the saline-stressed shita River in western Oklahoma found over 14 pling intervals. Physical parameters represent-stream discharge, sediment particle sizes, organ-content of the sediment, and related factors. emical variables included conductance, pH, and ncentrations of major salts. Biological variables re densities of mayfly genera from dredge sam-s. The ordinations produced by ALSCAL sum-rized the relationships among sites over sam-ng time. These nonmetric ordinations were ed on distance coefficients which greatly re-ced many of the problems associated with com-ing different types of variables. Rankings of s along the dimensions of the respective ordina-ns represented the underlying physical, chemi-, and biological structure of the river. This owed the comparison of abstract structures ed on these three groups of variables to the ucture of the actual river gradient. Congruence the rankings of sites for each group of variables ggested a close relationship among the associate iables in congruence. The saline effects are not dicted by the RCC. These saline effects are hogonal, abstract gradients controlled by com-x geomorphological processes. These results l fit into the general framework of the RCC in t the benthic community structure appears to be unction of abiotic parameters. But multiple gra-nts must be considered when developing dy-mic management models for similar systems. aker-IVI)
85-02819

NDERSTANDING SIMPLIFIED LAKE CIDIFICATION MODELS,
Virginia Univ., Charlottesville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W85-02822

SPATIAL VARIATIONS IN THE WATER QUALITY OF LOUGH ERNE, NORTHERN IRELAND, ON THE BASIS OF SURFACE SEDIMENT DIATOM ANALYSIS,
University Coll., London (England).
R. W. Battarbee.
Freshwater Biology, Vol. 14, No. 5, p 539-545, October, 1984. 4 Fig, 13 Ref.

Descriptors: *Lough Erne, *River Erne, *Donegal Bay, *Water quality, *Spatial variation, *Northern Ireland, *Lakes, Sediments, Diatoms.

The Lough Erne system comprises two main lakes, Upper and Lower Lough Erne. The lakes are connected by the River Erne and this river forms the outlet to the system at Belleek and ultimately discharges into Donegal Bay. Both lakes are morphometrically complex with many sub-basins and islands. Maximum depth of Lower Lough is 69 m and of the Upper Lough is 27 m. The lake system is eutrophic, increasingly so over the last 100 yr. During the study four more or less distinct groups of surface diatom assemblages were found within the Lough Erne basin. Zone I is a region of variable conditions probably strongly influenced by inflowing rivers. Zones II, III and IV describe major areas of the two lakes within each of which limnological conditions are likely to be relatively uniform. The main division does not occur between the two lakes but between Zones III and IV on Lower Lough Erne where the more shallow, highly productive, islanded zone of the upper reaches gives way via an extensive transitional area to the deep open water and less productive zone of the main basin. The division between Zones II and II occurs some 3 miles beyond the point at which the River Erne flows into the Lower Lough, indicating the substantial influence of the river water from the Upper Lough on the initial reaches of the Lower Lough. Three main sampling sites are probably adequate to reflect conditions in the lake system. Such sites should be located in the lower part of Upper Lough Erne, the upper part of Lower Lough Erne, but at least 3 miles from the river inflow, and in the open water zone of the Lower Lough beyond the transition zone. Surface sediment diatom assemblages can be used to assess regional differences in complex lake systems, especially if the data are standardized by excluding periphyton from the percentage totals. These sediment surveys can aid in the choice of routine monitoring sites and the location of sediment core sites. (Baker-IVI)
W85-02843

BIOLOGICAL PRODUCTIVITY OF LAKE QARUN (ARAB REPUBLIC OF EGYPT),
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
S. A. Abdel-Malek.
Journal of Ichthyology, Vol. 21, No. 6, p 22-32, 1981. 12 Tab, 42 Ref. Translated from Voprossy Ikhtiologii, Vol. 21, No. 6, 1981.

Descriptors: *Lake Qarun, *Egypt, *Fish, Population dynamics, *Salinity, Fisheries, Fish management, Phytoplankton, Zooplankton, Drainage water, Mollusks, Eutrophication.

Change in the composition of the ichthyofauna and food base of Lake Qarun was studied in relation to its salinization due to mineralized drainage water. The possibility of supplementing the ichthyofauna with some marine species has been investigated. Lake Qarun is rich in nitrates and organic nitrogen, from drainage from the fields. Nitrite and phosphate contents are very low. The entry of the enriched drainage waters into the lake caused significant increases in salinity which in turn brought about great changes in the invertebrate fauna, the fresh water species being replaced by marine organisms. Species like Tilapia nilotica, Clarias lazera, Lates niloticus, Labeo niloticus, and Barbus bynni were eliminated. Supplementation of the ichthyofauna of the lake with marine species has been found to be effective and in 1976-77 about 67% of the total catch of 1200 tons consisted of mullet and sole. The shallow depths, large quantity of nutrients flowing into the lake with drainage water from the irrigated land, and high water temperature throughout the year ensure high biological productivity of the lake. On the basis of phytoplankton development, Lake Qarun is eutrophic. The average biomass of benthos in the lake is 3 times higher than the biomass of the bottom fauna in the Azov sea which is highly productive. The high production of mollusks in Lake Qarun and their poor utilization by the fishes suggests the possibility of acclimatization of mollusk-eating fishes in this reservoir. (Baker-IVI)
W85-02851

INFLUENCE OF ENVIRONMENTAL CONDITIONS ON THE POPULATION DYNAMICS OF SMELT, OSMERUS EPERLANUS (OSMERIDAE),
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
M. N. Ivanova.
Journal of Ichthyology, Vol. 22, No. 5, p 172-175, 1982. 1 Fig, 2 Tab, 15 Ref. Translated from Voprosy Ikhtiologii, Vol. 22, No. 6, p 45-51, 1982.

Descriptors: *Smelt, *Lake Beloye, *Rybinsk Reservoir, *USSR, *Fish populations, *Population dynamics, Physicochemical properties, Water temperature, Growth stages, Oligotrophic lakes.

Environmental factors acting on different developmental stages were delineated to determine the life span of smelt, Osmerus eperlanus, from individual year classes; environmental factors causing changes in population structure were also delineated. These were based on long-term observations on the biological features of fish from the Lake Beloye and Rybinsk Reservoir (USSR) populations, and also on experimental work on rearing the Ladoga smelt in ponds. The number of circuli on the scales formed in a given year were used as natural marks for determination of which specimens lived to the maximum age characteristic of each population. The temperature regime and the feeding capacity of the body of water during the period of larval development determine the rate of growth and the development of the reproductive system of the smelt and are factors in determining their population type. The conditions of winter feeding, and particularly the presence or absence of young fish which are accessible - as regards size - are also a factor determining the life span of the smelt and therefore also the structural peculiarities of their populations in different bodies of water. In cold, deep, oligotrophic bodies of water, the young smelt grows and develops slowly. Older specimens are practically always provided with fish food of suitable size. (Collier-IVI)
W85-02855

CHEMISTRY, MINERALOGY, AND MORPHOLOGY OF LAKE ERIE SUSPENDED MATTER,
National Water Research Inst., Burlington (Ontario).
A. Mudroch.
Journal of Great Lakes Research, Vol. 10, No. 3, p 286-298, 1984. 2 Fig, 8 Tab, 25 Ref.

Descriptors: *Lakes, *Mineralogy, *Chemical analysis, *Morphology, *Lake Erie, *Suspended sediments, Water analysis, Organic matter, Calcite, Decomposition.

Suspended matter was collected in Lake Erie in 1978 at the following localities and time: from 1-m, 6-m, and 13-m water depth at a station in the central basin in May, August and September; and from 1-m, 30-m, and 51-m water depth at the deepest point of the lake in May and September. Mineralogical and chemical composition of the samples suspended matter were investigated together with the morphology of individual particles. Al, Ti, and Mg were associated only with inorganic material. Si, Fe, Ca, K, Mn, and P were associated with both biological and inorganic material. The majority of the determined elements were

present in more than one chemical form. Inorganic material was composed mainly of mineral fragments and biological material included pieces of diatoms, other algal species, and amorphous particles and flocculates of unknown origin. The major components of the suspended matter in Lake Erie were organic material, aluminosilicates, and calcite. The high levels of organic material and fluctuations of calcite concentration in the suspended matter indicate a high rate of photosynthesis and respiration in the epilimnion during summer. The concentration of organic C in suspended matter exceeded many times that of the surface sediments, especially in August and September, indicating decomposition and transport of organic matter within the water column or at the sediment-water interface. (Baker-IVI)
W85-02890

COMPOSITION OF PARTICULATE ORGANIC MATTER IN THE EUPHOTIC ZONE OF LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
E. Halfon.
Journal of Great Lakes Research, Vol. 10, No. 3, p 299-306, 1984. 2 Fig, 3 Tab, 40 Ref.

Descriptors: *Great Lakes, *Organic matter, *Water analysis, *Lake Erie, *Euphotic zone, Productivity, Seston, Detritus, Nutrients, Chlorophyll.

A regression method was used to derive the composition of particulate organic matter (POM) as living and dead material in the euphotic zone of Lake Superior, May to November 1973. A modification was made to the literature regression method as it had a conceptual bias and overestimated detritus. POM composition expressed as chlorophyll, particulate organic carbon, particulate organic nitrogen, and particulate organic phosphorus was also analyzed. This analysis showed living seston to be the major component of POM during the 7 months. Detritus was minimal during the year and increased to 39% of POM by fall. Most detritus was autochthonous. The lack of correlation between the particulate organic phosphorus and the other components of POM shows that the available phosphorus is rapidly recycled in an efficient manner and not significantly bound in detrital material. The coupling of statistical techniques and data collected during the intensive study of Lake Superior has provided a good insight into the interrelationships and seasonal patterns of nutrients and chlorophyll. (Baker-IVI)
W85-02891

SEDIMENT TRAP STUDIES IN LAKE MICHIGAN: RESUSPENSION AND CHEMICAL FLUXES IN THE SOUTHERN BASIN,
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
For primary bibliographic entry see Field 2J.
W85-02892

DISTRIBUTION OF EURASIAN WATERMILFOIL, MYRIOPHYLLUM SPICATUM, IN THE ST. CLAIR-DETROIT RIVER SYSTEM IN 1978,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
D. W. Schloesser, and B. A. Manny.
Journal of Great Lakes Research, Vol. 10, No. 3, p 322-326, 1984. 2 Fig, 29 Ref.

Descriptors: *Macrophytes, *St. Clair-Detroit River, *Lake Huron, *Lake Erie, *Great Lakes, *Watermilfoils, Boating, Recreation, Nuisance, Aquatic weeds.

Watermilfoils were relatively unnoticed in the US until the late 1950s when they became a nuisance in large water bodies. Submersed macrophytes were surveyed at 595 stations in the St. Clair-Detroit River system, 23 August to 13 October, 1978. M. spicatum was the fourth most common submersed macrophyte throughout the river system and the third or fourth most common submersed macrophyte in each of the four waters composing the system. The high occurrence of M. spicatum in the St. Clair River below Algonac suggests that it was introduced into the system near that city. Observations made during the study and interpretations of an aerial photograph suggest that M. spicatum was a minor nuisance to small boat navigation in portions of the system. (Baker-IVI)
W85-02893

VARIATION OF CALCIUM, MAGNESIUM, SODIUM AND POTASSIUM CONCENTRATION, PH AND CONDUCTIVITY IN LAKES IN NORTHERN IRELAND,
New Univ. of Ulster, Coleraine (Northern Ireland). Limnology Lab.
B. Rippey, and C. E. Gibson.
Archiv fur Hydrobiologie, Vol. 101, No. 3, p 345-360, September, 1984. 9 Fig, 4 Tab, 28 Ref.

Descriptors: *Lakes, *Ireland, *Calcium, *Magnesium, *Sodium, *Potassium, *Hydrogen ion concentration, *Conductivity, Precipitation, Rock dominance, Physicochemical properties.

The relative amounts of precipitation and rock dominance, as expressed by the Na/(Na + Ca) weight concentration ratio, was found to be an important influence on the chemical composition of lakes in Northern Ireland. Conductivity and pH decreased exponentially with the ratio. When expressed in percentage molar terms, calcium and magnesium decreased linearly with the ratio, sodium increased linearly and potassium remained constant. The results suggested that geological factors do not influence the major cation composition greatly. Only where the parent material composition deviates markedly from the lithosphere average, as with basalt and the magnesium concentration, does the cation composition deviate greatly from the general trends. (Author's abstract)
W85-02894

DISTRIBUTION OF MACROPHYTES AND MICROPHYTES IN HARD WATER OF THE EDER RESERVOIR INFLUENTS (DIE VERBREITUNG VON MAKROPHYTEN UND MIKROPHYTEN IN HARTWASSER-ZUFLUSSEN DES EDERSTAUSEES),
Giessen Univ. (Germany, F.R.). Edersee Ecological Research Station.
G. Fricke, and L. Steubing.
Archiv fur Hydrobiologie, Vol. 101, No. 3, p 361-372, September, 1984. 2 Fig, 3 Tab, 14 Ref.

Descriptors: *Eder Reservoir, *Hesse, *Germany (Federal Republic), *Bioindicators, *Macrophytes, *Algae, *Hardness, Calcium, Ammonium, Phosphates, Saprobicity, Nutrients, Brooks, Streams.

Comparative investigations have been carried out in 5 hard water brooks of the calcium rich Eder reservoir to prove the validity of using macrophytes and microphytes as indicators of water quality. There have been good correlations of the saprobicity evaluation by microphytes and macrophytes, especially in the oligosaprobic and betamesosaprobic reach. The abundance of macrophytes Berula erecta, Callitriche spec., Nasturtium microphyllum and Veronica anagallis-aquatica showed negative correlation to the ammonium concentration beginning with 0.5 mg/l. No effect could be observed of the phosphate concentrations on the macrophytes. (Author's abstract)
W85-02895

NUTRITIVE QUALITY AND SIZE FRACTIONS OF NATURAL SESTON IN AN IMPOUNDED RIVER,
Environmental and Chemical Sciences, Inc., Aiken, SC.
P. F. Kondratieff, and G. M. Simmons, Jr.
Archiv fur Hydrobiologie, Vol. 101, No. 3, p 401-412, September, 1984. 5 Fig, 2 Tab, 44 Ref.

Descriptors: *Dan River, *Virginia, *Seston, Proteins, Aquatic drift, Size class, Rivers, Particle size, Particulate matter.

Organic seston nutritive quality and size fractions were investigated in the 3rd-4th order Dan River in southwestern Virginia. The river is dammed, forming a 67-ha hypolimnetic release impo ment. Seston quality was estimated by measu both particulate protein and ash-free dry-we (AFDW) on unfractionated seston and seston three size classes (105-1000 micro m - Large; 105 micro m - Fine; 45-25 micro m - Ultrafi Seston concentrations decreased significantly (.0001) from a mean of 3.79 mg/l upstream of impoundment to means ranging from 1.22 to mg/l in an downstream. The ultrafine size c dominated the seston by weight at all stations all dates samples. Mean particle sizes ranged fr 2.98 micro m to 4.39 micro m. Stations in the r (both upstream and downstream) had proportio ly more large particles (10-12% by weight) t reservoir stations (2-3% by weight). Reserv seston had significantly higher total protein unit weight than riverine seston ($p < .05$) an vast majority of the protein was in the ultra fraction at all stations (95-99% of total protein unit weight). The reservoir apparently expor higher quality seston than it received in this stu but 5 km downstream of the dam the quality size class composition were similar to that at upstream reference site. The major effect of impoundment was to decrease the concentration seston in the river downstream. (Author's abstra
W85-02897

NITROGEN FIXATION IN THE SEDIME OF SHALLOW LAKE BALATON, A RESE VOIR AND FISHPONDS,
Fisheries Research Inst., Szarvas (Hungary).
J. Olah, M. A. B. Moneim, and L. Toth.
Internationale Revue der Gesamten Hydrobio gie, Vol. 68, No. 1, p 13-44, 1983. 5 Fig, 19 Tab, Ref.

Descriptors: *Lake Balaton, *Keszthely Bas *Koros Reservoir, *Hungary, *Nitrogen fixatio *Lake sediments, Acetylene, Ethylene, Hydrog ion concentration, Oxidation-reduction potenti Ammonia, Nitrates, Nitrites, Reservoirs, Lakes.

For the in situ measurement of nitrogen fixation lake sediments, a method was developed whi assures the rapid saturation with acetylene of t whole enzyme pool in the sediment and maintai the physical, chemical and biological environme nearly intact at the water-sediment interface. O the basis of seasonal measurements, the annu nitrogen fixation in the sediment was estimated four types of shallow water ecosystem: the Keszth ely Basin, Lake Balaton: 4.7 g N/sq m; Koro backwater reservoir: 6.5 g N/sq m; a polycultur fishpond: 0.49 g N/sq m; and a liquid manur oxidation fishpond: 0.61 g N/sq m. The amount o nitrogen fixed in the sediment of the Keszthel Basin was close to the fixation in the wate column, while that fixed in the sediment of Koro backwater reservoir was considerably greater. A multiple regression analysis was made on the bas of synoptic studies on the vertical distribution o nitrogen fixation in the sediment, the pH, Eh, an concentration of organic N, NH4-N, NO3-N, an NO2-N in the interstitial water. The results ind cate that nitrogen fixation is related to the depth the NH4-N concentration, and the redox potential The vertical distribution of nitrogen fixatio cannot be explained in every case by the densitie and distributional patterns of the Azotobacter an Clostridium populations. No correlation was ob served between nitrogen fixation and total organic C in lake sediment. A surprisingly close correlation was found between plankton primary production and the sedimentary nitrogen fixation in these lake ($r = 0.85$, $y = 4.5 \times 0.85$). Short-term (4 h) in vitro studies revealed a glucose mediated increase o nitrogen fixation, but there was no NH4-N inhibi tion detected during this short incubation period (Author's abstract)
W85-02903

INVESTIGATION OF PLUNGING DENSITY CURRENTS GENERATED BY INFLOWS IN LAKES,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hydromechanik und Wasserwirtschaft.
W. Hauenstein, and Th. Dracos.

...l of Hydraulic Research, Vol. 22, No. 3, p ...9, 1984. 8 Fig, 14 Ref. Swiss National Sci... foundation grant 2.084-0.78.

...iptors: *Water currents, *Bottom currents, ...s, *Inflow, Flow characteristics, Model stud... turbulence, Density currents.

...tudy is a first attempt to investigate three-...nsional, submerged turbulent density currents ...sloping bottom. The results given allow an ...ximate determination of characterisic velocity ...widths, depths and dilutions. The solutions ...sed on a simple integral model concept. This ... concept allows the calculation of the steady ...nsteady parts of flows with distinctive steady, ...ll as flows with distinctive unsteady buoyant... ...minated regions. The limiting case implies ...he upper end of the unsteady cap is stationary ...oincides with the virtual origin of the flow. ...tailed analyses concerning the similarity pro... could be carried out. Further investigation ...d focus on a better determination of the ex... ...entally investigated coefficients of the model ...ll as the virtual origins. They should focus on ...er determination of the experimentally inves... ...d coefficients of the model as well as the ...ul origins. They should include more detailed ...erature profiles as well as velocity measure... ...in order to determine correct integration ...ants. Based on its basic concept, the model ...ure, such as the transition zone between ...y current and unsteady cap as well as between ...entum dominated and buoyance dominated ...y flow should be investigated in more detail. ...r-IVI)
...02930

...STACEAN PLANKTON IN NORTHEAST... ONTARIO LAKES SUBJECTED TO ...IC DEPOSITION,

...rio Ministry of the Environment, Sudbury.
...eller, and J. R. Pitblado.
...r, Air and Soil Pollution, Vol. 23, No. 3, p ...91, October, 1984. 10 Fig, 3 Tab, 47 Ref.

...riptors: *Ontario, *Acid deposition, *Acid ...pitation, *Plankton, *Crustacean, Lakes, Acid ..., Cluster analysis, Cyclopoids, Physicochem... ...properties, Water temperature, Thermal strati... ...on, Hydrogen ion concentration.

...ktonic crustaceans were sampled during the ...ner of 1981 in 249 northeastern Ontario lakes, ...ding a large proportion of acidic lakes. Spe... cluster analysis showed a major species group ...mon to most lakes. Two species subgroups ... associated with more productive waters and ...productive waters in the study area. Acidic ... were characterized by reduced numbers of ...ies. Stepwise multiple linear regression of phy... ...chemical lake characteristics against percent ...position of individual species failed to explain ...n of the variation in species proportions. Vari... ...s related to lake thermal structure were most ...uently the primary correlates with species pro... ...ions in near-neutral lakes while in acidic lakes ...best statistical predictors of species percent ...position were most often variables directly ...ted to lake acidity. (Moore-IVI)
...5-02954

...SPONSE OF THE COASTAL BOUNDARY ...ER TO WIND AND WAVES: ANALYSIS ...AN EXPERIMENT IN LAKE ERIE,

...ional Oceanic and Atmospheric Administra... ..., Ann Arbor, MI. Great Lakes Environmental ...earch Lab.
...L. Schwab, G. A. Meadows, J. R. Bennett, H. ...ultz, and P. C. Liu.
...rnal of Geophysical Research, Vol. 89, No. C5, ...043-8053, September, 1984. 18 Fig, 2 Tab, 22 ...

...criptors: *Lake Erie, *Coastal boundary layers, ...undary layers, *Wind, *Waves, Currents, ...ter level, Storms, Surf zone, Lakes, Longshore ...rents, Wave height, Wind driven currents.

...nd, waves, currents, and water levels were ...asured near Lake Erie's southeastern shore during fall 1981. Data were recorded continuously at a wave research tower 6 km offshore at three Waverider buoys deployed around the tower and at three current meter moorings along a transect between the tower and the shore. During four storm episodes, wave and current data were also recorded from a dense array of instruments along a transect across the surf zone. A statistical analysis of the deep water data was performed, and histograms of meteorological parameters, wave parameters, and water level slope were plotted as a function of wind direction. The atmospheric boundary layer was usually unstable; on the average, the water was 2-3 C warmer than the air. This was true for all wind directions. At the tower the highest waves were associated with the greatest fetch distances to the WSW and WNW directions. The longest period waves were also associated with these wind directions. The mean water level slope was opposite the mean wind direction. This discrepancy is most likely due to small leveling errors in the water level gages. The variation of currents with wind direction was also examined. The currents are strongest when the winds are from the west, the quadrant with the strongest wind speeds. However, there are strong currents (5-10 cm/s) for all wind directions. The deep water currents are basically shore parallel, with the onshore/offshore component averaging 39% of the root mean square longshore component. Analysis of the four storm episodes reveals the influence of the offshore currents on the flow regime within the surf zone. Quantitative estimates of the longshore momentum balance outside the surf zone show wind stress and pressure gradient to be the dominant dynamic terms. Inside the surf zone, the radiation stress, wind stress, and bottom stress terms all have comparable effects and are usually larger than the acceleration and pressure gradient terms. In between, there is evidence of longshore flow reversals in the breaker zone and the effect of seiche-induced offshore currents on the near-shore flow regime. (Author's abstract)
W85-02960

CHLORIDE BUDGET FOR THE MISSISSIPPI RIVER HEADWATERS TO MOUTH,

Syracuse Univ., NY. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W85-02976

MACROPHYTE COMMUNITY DYNAMICS IN DREDGED WISCONSIN LAKE,

Wisconsin Geological and Natural History Survey, Madison.
For primary bibliographic entry see Field 4A.
W85-02984

ZOOPLANKTON AND POTENTIAL FISH PRODUCTION IN LAKE ONTARIO,

Canada Centre for Inland Waters, Burlington (Ontario).
U. Borgmann, H. Shear, and J. Moore.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 9, p 1303-1309, September, 1984. 3 Fig, 5 Tab, 13 Ref.

Descriptors: *Crustaceans, *Zooplankton, *Fish populations, *Lake Ontario, Lake fisheries, Lakes, Productivity, Commercial fishing.

The annual production of epilimnetic crustacean zooplankton in Lake Ontario was calculated from data on the abundance of each species and its eggs, and from predictions of egg development times. Bosmina longirostris is the most productive species at the nearshore stations whereas Diacyclops thomasi is the most productive offshore. Total crustacean zooplankton production is fairly uniform throughout the lake, both nearshore and offshore, with the possible exception of somewhat reduced production at the western end of the lake. Average total production was estimated at 15 g/sq m/yr. Using a recent estimate of particle particle-size-conversion efficiency in Lake Ontario, obtained from data on contaminant concentrations in aquatic biota, potential fish production in the lake is predicted for various sizes of fish. From published data on the commercial fish harvest from 1910 to 1930, a time period when commercial production was at a maximum, it is estimated that the past commercial harvest for pelagic species may have been 20% or more of the predicted potential production. (Author's abstract)
W85-02999

INFLUENCE OF TEMPERATURE AND LIGHT ON RATES OF INORGANIC NITROGEN TRANSPORT BY ALGAE IN AN ARCTIC LAKE,

Alaska Univ., Fairbanks. Inst. of Marine Science.
S. C. Whalen, and V. Alexander.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 9, p 1310-1318, September, 1984. 5 Fig, 3 Tab, 39 Ref.

Descriptors: *Arctic lakes, *Nitrogen, *Solar radiation, *Water temperature, *Phytoplankton, Dissolved solids, Solute transport, Nitrates, Ammonia, Algae.

Nitrogen-15 tracer techniques were used to assess the individual effects of temperature and light on maximum rates of dissolved inorganic nitrogen (DIN) transport by phytoplankton in an arctic lake. Transport rates of NO3(-) and NH4(+) as a function of temperature in the range 3-30 C were adequately described by second- or third-order polynomial functions. The optimum temperature for DIN transport was greater than the ambient water temperature by as much as 13 degrees; thus, transport at the ambient water temperature averaged only 55-60% of optimum. Mean temperature coefficients for NO3(-) and NH4(+) transport in the temperature range > 0-15 C were 2.3 +/- 0.5 and 2.4 +/- 0.3. The ratio of dark to light-saturated DIN transport was used as a measure of light dependence in maximum rates of DIN transport. Values of the ratio of dark to light-saturated DIN transport for NO3(-) and NH4(+) were 0.15 +/- 0.09 and 0.41 +/- 0.11, indicating a stronger light dependence for NO3(-) than NH4(+) transport. In cases where dark NO3(-) transport was negligible, light was treated as a substrate and the Michaelis-Menten relationship fitted to the data. The half-saturation constant for light intensity in maximum NO3(-) transport ranged from 7 to 29 micro E/sq m/s, which was 6-31% of the photosynthetically active radiation at the lake surface. (Author's abstract)
W85-03000

HISTORY AND PRESENT VEGETATION OF THE MACROPHYTE SWAMP AT PUKEPUKE LAGOON,

Massey Univ., Palmerston North (New Zealand).
J. Ogden, and T. A. Caithness.
New Zealand Journal of Ecology, Vol. 5, p 108-120, 1982. 6 Fig, 2 Tab, 38 Ref, 2 Append.

Descriptors: *Pukepuke Lagoon, *New Zealand, *Swamps, *Vegetation, *History, Dune lakes, Lakes, Drainage effects, Macrophytes, Cattails, Hydroseral development, Water depth, Hydrogen ion concentration, Organic matter.

Pukepuke Lagoon is one of a series of shallow dune-lakes in the Manawatu district of New Zealand. Its open water area has been reduced by about 90% during the last century by sand drift from adjacent dunes, man-made changes to the local drainage, and the spread of macrophytes, especially Typha. Superimposed upon these changes are others due to the influx of exotic plants and animals. The vegetation of the macrophyte swamp is described in terms of the supposed sequence of hydroseral development. A reciprocal average ordination is used to describe the extensive Typha stands. The first axis of the stand ordination correlates with water depth, pH and the depth of the underlying organic matter. The second axis probably reflects stand disturbance. A species list is presented. (Author's abstract)
W85-03023

BENTHIC FAUNAS OF FORESTED STREAMS AND SUGGESTIONS FOR THEIR MANAGEMENT,

Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
J. S. Rounick, and M. J. Winterbourn.
New Zealand Journal of Ecology, Vol. 5, p 140-150, 1982. 3 Fig, 2 Tab, 38 Ref.

Descriptors: *Benthic fauna, *Streams, *New Zealand, *Stream management, Forests, Streambeds, Banks, Aquatic insects, Mayflies, Stoneflies, Caddisflies, Forestry.

The benthic invertebrate fauna was sampled and selected physical characteristics of the catchment, stream bed and adjacent banks were recorded in 43 first to third order streams in a variety of indigenous forest types and exotic pine plantations on the three main islands of New Zealand. The streams were investigated using a systematic survey technique. A small nucleus of common taxa was numerically dominant at most sites regardless of forest type. The mayfly, Deleatidium was found at 42 of the sites and was the most abundant taxon at 27. Other widely distributed genera were Nesameletus, Coloburiscus (Ephemeroptera), Stenoperla, Zelandoperla, Zelandobius (Plecoptera), Olinga and Hydrobiosis (Trichoptera). Numbers of invertebrate taxa and relative abundance of shredders (large particle detritivores) were not correlated with stream gradient but were correlated significantly with stream stability. The presence, in New Zealand, of a common, widely distributed core fauna, regardless of forest type, suggests that few, if any, species are dependent on particular types of terrestrial vegetation, and conversion from indigenous to exotic forest per se appears to have little impact on the nature of stream invertebrate communities. Combined physical-faunal surveys of the kind used in this study have the potential to identify streams which may require particular protection in relation to forestry practices. (Moore-IVI)
W85-03024

WIND-INDUCED ENTRAINMENT IN A STABLY STRATIFIED FLUID,
Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
For primary bibliographic entry see Field 2E.
W85-03037

BACTERIAL ACTIVITY IN SEDIMENTS OF LAKES RECEIVING ACID PRECIPITATION,
National Water Research Inst., Burlington (Ontario).
S. S. Rao, A. A. Jurkovic, and J. O. Nriagu.
Environmental Pollution (Series A), Vol. 36, No. 3, p 195-205, 1984. 6 Fig, 20 Ref.

Descriptors: *Lake sediments, *Bacteria, *Acid rain, *Ontario, *Silver Lake, *McFarlane Lake, Lakes, Sedimentation, Lake acidification, Water pollution effects, Organic matter, Hydrogen ion concentration.

Bacteriological data for water and sediment cores from some of the lakes receiving acid precipitation near Sudbury, Ontario show a strong relationship between lake acidification and bacteria. Certain physiological groups of bacteria in the water column are insensitive to changes in pH. In the case of respiring and aerobic heterotrophic bacteria, pH values below about 5.5 appear to be critical. Total bacteria in the waters of these lakes existed in the 1000000/ml range while the viable or active populations were about two orders of magnitude lower. A relationship between pH, bacterial populations, sediment microbial activity, and total organic matter was demonstrated. In the acid-stressed Silver Lake where pH readings were 3.8, the sediment respiration was 10-20% of that in the nonacid stressed McFarlane Lake, pH 7.2. A strong correlation was noted between pH and total organic matter in surficial sediments. (Baker-IVI)
W85-03047

DISTRIBUTION OF FISHES IN THE BRODHEAD CREEK DRAINAGE MONROE COUNTY, PENNSYLVANIA,
York Coll. of Pennsylvania. Dept. of Biological Sciences.
R. F. Denoncourt, W. F. Skinner, R. B. Domermuth, and J. M. Burke.
Proceedings of the Pennsylvania Academy of Science, Vol. 57, No. 1, p 56-60, 1983. 1 Fig, 3 Tab, 10 Ref.

Descriptors: *Fish, *Distribution, *Brodhead Creek, *Pennsylvania, Environmental effects, Flooding, Aquatic habitats, Trout, Shiners, Minnows.

Brodhead Creek drains 735 sq km in Monroe County, Pennsylvania. Historically, the cool, well oxygenated waters of the Brodhead and its tributaries have contributed to its reputation as an outstanding stocked-trout stream. The biota of the lower sections are subjected to and must be adapted to the frequent stresses of flood, scoured and shifting substrate, and changing habitats. In addition, the lower reaches have been subjected to several incidences of pollution. Surveys extended from 1940 to 1978 and included data from at least 68 collections in unpublished reports. Surveys in 1981 and 1982 at 20 locations brought the total recorded number of fish species to 35. Two new species, spotfin shiner (Notropis spilopterus) and eastern mudminnow, (Umbra pygmaea), were added to those found by other investigators, and the distribution of the bluespotted sunfish (Enneacanthus gloriosus) within the drainage was extended from one to four rather widespread locations. Trout are stocked throughout much of the drainage; young of the year were taken at many collection stations, indicating natural reproduction. (Moore-IVI)
W85-03067

FISH BIOMASS OF DRAINED SMALL RESERVOIRS,
Akademia Rolnicza, Poznan (Poland). Dept. of Inland Fisheries.
J. Mastynski.
Polskie Archiwum Hydrobiologii, Vol. 1, No. 31, p 69-76, 1984. 2 Fig, 6 Tab, 9 Ref.

Descriptors: *Fish populations, *Biomass, *Goluchow reservoir, *Malta reservoir, *Poland, Sport fishing, Carp, Bream, Reservoir fisheries, Productivity.

In 1979 in Poland, Goluchow reservoir was drained due to damage to the dam, and in 1980, Malta reservoir was drained because of an overhaul of the dam. Total drainage of the two small reservoirs made it possible to determine the components of the ichthyofauna and the biomass of the fish. The duration of filling of both reservoirs was the same, nine years. In Goluchow reservoir, 19 species of fish were collected, including 9 of the family Cyprinidae; 22 species, 13 of the family Cyprinidae were found in Malta reservoir. The yearly angling catch was determined on the basis of the number of licences granted, and data collected from 800 anglers on the Malta reservoir and 200 anglers on the Goluchow reservoir. The fishery production of artificial reservoirs is considerably higher than in natural lakes. During the drainage 17,767 kg of fish - 507.6 kg/ha were caught from 35.0 ha of the Goluchow reservoir. From 64.3 ha of the Malta reservoir, 28,171 kg of fish - 438.1 kg/ha were caught. In Goluchow, silver crucian carp was the dominant species, and in Malta, bream was the dominant species. (Moore-IVI)
W85-03070

INVERTEBRATES, MACROALGAE, AND CHEMICAL FEATURES IN MORAINIC PONDS NEAR LAKES TEKAPO AND OHAU, INCLUDING NEW DISTRIBUTION RECORDS OF CRUSTACEA,
Otago Univ., Dunedin (New Zealand). Dept. of Zoology.
C. W. Burns, M. I. Butler, and P. M. Cuttance.
New Zealand Journal of Marine and Freshwater Research, Vol. 18, No. 2, p 197-210, July, 1984. 5 Fig, 3 Tab, 32 Ref.

Descriptors: *New Zealand, *Ponds, *Invertebrates, *Algae, *Crustaceans, Moraines, Temporary ponds, Ecological distribution, Hydrogen ion concentration, Conductivity, Sodium, Chloride, Osmolality.

The invertebrates and macroalgae in 42 perman and temporary ponds and kettles in glacial mora south of Lake Ohau, and 36 sites in moraine w of Lake Tekapo, South Island, New Zealand, w sampled in December 1980, and taxonomic l were compiled. Most organisms belonged to t characteristically found in shallow waters e where in New Zealand, but new distributions the rare cladocerans Neothrix armata, Monospi dispar, and Ephemeroporus barroisi were reco ed, and the presence of Simocephalus acutiros tus in New Zealand was confirmed. Darkly p mented Daphnia carinata were recorded for first time as also were co-occurring Boecke triarticulata and Boekella dilatata. Cluster analy of the data from both areas identified 3 groups taxa with a high probability of co-occurring. So species were absent from all the sites in one a but present at several sites in the other. This m reflect differences in adaptation to drought, or limited sampling regime, but is also consistent w the areas being in different ecological distric Ponds which still contained water in late autu were sampled for pH (6.7-7.0), conductivity (K 17-79 micro S/cm), sodium (0.35-4.60 mg/L, ch ride (0.89-5.68 mg/L), and osmolality (21- mOsM). (Author's abstract)
W85-03073

DISTRIBUTION OF AQUATIC MACR PHYTES IN LAKE ALEXANDRINA, NE ZEALAND,
Centre for Resource Management, Canterbu (New Zealand).
J. Ward, and J. Talbot.
New Zealand Journal of Marine and Freshwa Research, Vol. 18, No. 2, p 211-220, July, 1984. Fig, 2 Tab, 25 Ref.

Descriptors: *Macrophytes, *Lake Alexandri *New Zealand, Aquatic plants, Water dept Waves, Biomass, Ecological distribution.

The macrophyte distribution of Lake Alexandri (737 m a.s.l.), a small, homothermous, South Ca terbury high-country lake, is closely related depth. Shallow water communities, mostly dom nated by Isoetes alpinus Kirk, extend to a depth about 4 m, but do not grow above 0.7 m because strong wave action. Mid-depth communities co sist of a tall Elodea canadensis Michx./Myriophy lum triphyllum Orchard community between 2 a 4 m at the shallow northern end of the lake, lar areas of Chara fibrosa var. acanthopitys (A.B Zanev. at the southern end, and a Myriophyllu triphyllum/Nitella hookeri A.Br. community at 2 m on the steeply descending eastern and weste sides of the lake. Pure stands of Elodea canadens may replace the last community, particularly o the eastern side. A deep water characean comm nity of Chara globularis Thuill. and Chara cora lina Kl. ex Willd. extends from 4 m to 10-11 with 100% cover; C. corallina continuing sparse to 16 m. Maximum above-ground biomass recor ed for the summer 1982-83 was 1350 g/sq m (dr weight) for C. globularis and 1100 g/sq m for E canadensis. (Author's abstract)
W85-03074

ACTYLENE REDUCTION AND NITROGE FIXATION POTENTIAL IN SOME EUTRO PHIC LAKE SEDIMENTS,
Department of Scientific and Industrial Research Taupo (New Zealand). Ecology Div.
For primary bibliographic entry see Field 2K.
W85-03075

WIND EFFECTS ON WATER AND SALT LOS IN PLAYA LAKES,
Australian National Univ., Canberra. Research School of Earth Sciences.
T. Torgersen.
Journal of Hydrology, Vol. 74, No. 1/2, p 137-149 October, 1984. 5 Fig, 2 Tab, 26 Ref.

Descriptors: *Wind, *Playas, *Water loss, *Salini ty, *Lake George, *New South Wales, *Australia Water surface profiles, Infiltration, Slope.

The theory behind wind stress induced setup of water surface slope on a playa lake is reviewed. Due to the low gradient of the bottom in most playa lakes (1-20 cm/km), the advance and retreat of lake waters due to wind stress can expose or cover many square kilometers. It is even possible for the surface slope to exceed the bottom slope and thereby create a 'roving' lake. Such water movements can transport lake water over undersaturated 'shore' sediments and water can therefore infiltrate and be lost without an increase in lake salinity. This case is demonstrated with data from Lake George, New South Wales, Australia. Such wind effects need to be examined for their relation to the diagenesis of sediments, the composition of the bitterns, and the salt budget of playa lakes. (Author's abstract)
W85-03087

PLANKTON AS A BASIS FOR THE ESTIMATION OF THE POSSIBLE NATURAL FISH PRODUCTIVITY OF DURANKULAK LAKE PLANKTON'T KATO BAZA ZA OTSENKA NA POTENTSIALNATA ESTESTVENA PIBOPRODUKTIVNOST NA KRAIMORSKOTO EZERO DURANKULAK),
V. T. Naidenov, and D. A. Saiz.
Hydrobiology (Bulgarian Academy of Science), Vol. 21, p 3-13, May, 1984. 1 Fig, 3 Tab, 31 Ref.

Descriptors: *Durankulak Lake, *Plankton, *Fish populations, *Productivity, Phytoplankton, Zooplankton, Biomass, Commercial fisheries, Lakes, Standing crop, Fish food.

The studies on the hydrochemistry, biomass and abundance of phyto and zooplankton of Durankulak lake (no water outflow) are used in the attempted estimation of the productive capabilities of the producers as well as first to third order consumers and the possible commercial fish catches. The estimation goes by seasons and years. The equation: R = Q.E/10,000 x (B(P/B))/D x tC, where R is the possible catch, B - the biomass, Q - the total water volume, C - the assumed utilizability of the nutrition basis, E - expected catch as a part of the entire fish production, t - duration of the period of study, D - nutrition coefficient, is used to determine the possible catch which depends on the total water volume, biomass, production, degree of consumption of trophic organisms, nutrition coefficient and technical capabilities for a complete catching of the entire fish standing crop. Having in mind that the Durankulak lake biocenoses are in a climax condition with a relatively constant production level it is estimated that if no alterations of the fish are made the annual plankton-determined fish catch should be within 19 to 62 t. In the case of better utilization of the nutrition basis (mainly phytoplankton and macrophytes) it can be increased up to 120 t. (Author's abstract)
W85-03099

CHARACTERISTICS OF AUTOPURIFICATION IN THE OSSAM RIVER, A TRIBUTARY OF THE DANUBE (EINIGE BESONDERHEITEN IN DER SELBSTREINIGUNG DES DONAUZUFLUSSES OSSAM),
Bulgarian Academy of Sciences, Sofia. Inst. of Zoology.
For primary bibliographic entry see Field 5B.
W85-03100

SOME PRINCIPLES OF THE STRUCTURE AND ORGANIZATION OF THE HYDROBIOLOGICAL MONITORING OF RIVERS (O NEKOTORYX PRINTSIPAX STRUKTURY I ORGANIZATSII GIDROBIOLOGICHESKOGO MONITORINGA REK),
For primary bibliographic entry see Field 7A.
W85-03102

HYDROBIOLOGICAL AND SAPROBIOLOGICAL ALTERATIONS IN THE TUNJA RIVER. I. 1955 - 1967 (TENDENTSII V IZMENENIYATA NA KHIDROBIOLOGICHNOTO I SAPROBIOLOGICHNOTO S'STOYANIE NA REKA TUNDZHA. I. 1955-1967 G),
For primary bibliographic entry see Field 5B.
W85-03106

TEMPERATURE CHARACTERISTICS, ANNUAL HEAT STORAGE, AND RIVER DIVERSION INFLUENCE ON A MONOMICTIC LAKE,
Geological Survey of New South Wales, Sydney (Australia).
T. J. Loranger, and D. F. Brakke.
Northwest Science, Vol. 58, No. 3, p 222-229, August, 1984. 3 Fig, 4 Tab, 7 Ref.

Descriptors: *Lake Whatcom, *Washington, *Nooksack River, *Temperature distribution, *Heat storage, Birgean heat budgets, Lakes, Thermal stratification, Metalimnion.

Temperature and heat content characteristics were determined for Lake Whatcom, in the Puget Sound lowland of Washington state, and the effect of diversion of Nooksack River water into the lake since 1962 was assessed. Temperature data obtained during the periods 1962-1972 and 1979-1981 were used to calculate Birgean heat budgets for the lake for eight separate years. Lake Whatcom reached maximum thermal stratification by mid-August; a distinct metalimnion was consistently present by 1 June of each year. The mean maximum heat storage for the 8 yr studied was 49,400 cal/cm per year. The mean minimum winter heat storage for the study years was 26,300 cal/sq cm per year. The resulting mean annual change in heat storage for the 8-yr period was 23,100 cal/sq cm per year. Diversion of Nooksack river water at a rate of 231,000 cu m/day, which has occurred from spring through fall since 1962, caused a negligible effect on heat storage in the lake. The maximum amount of water diverted into Lake Whatcom before 1 August in any year was 34 million cubic meters. This volume causes a 0.11 C drop in lakewide temperature at the time of maximum heat storage in the lake. (Rochester-IVI)
W85-03110

ALGOLOGICAL INVESTIGATIONS IN THE WATERS OF THE TISZA BASIN AT ALPAR,
Jozsef Attila Univ., Szeged (Hungary). Dept. of Botany.
For primary bibliographic entry see Field 5C.
W85-03115

STUDIES ON THE QUALITATIVE AND QANTITATIVE COMPOSITION AND THE SEASONAL CHANGES OF PHYTOPLANKTON AT THREE SAMPLING AREAS OF THE DEAD TISZA AT LAKITELEK,
Lower-Tisza District Water Authority, Szeged (Hungary).
For primary bibliographic entry see Field 5C.
W85-03117

DIEL AND SEASONAL CARBON BUDGETS IN TWO COLD SPRING ECOSYSTEMS,
Idaho Div. of Environment, Pocatello.
J. A. Perry II, and F. L. Rose.
Archiv fur Hydrobiologie, Suppl. 69, No. 3, p 333-363, September, 1984. 10 Fig, 12 Tab, 66 Ref.

Descriptors: *Ecosystems, *Cold springs, *Carbon cycle, Springs, Seasonal variations, Macrophytes.

The assumption of constancy in spring stream organic carbon budgets was tested. Cold springs were shown not to be constant temperature analogs of either streams or marshes. They are provided with the energy subsidy of velocity, but they have primary production rates similar to marshes. Standing crops of living and detrital organic carbon are similar to marshes; primary production per unit carbon is similar to streams. Living biomass was reduced in fall, detrital biomass was almost totally processed and/or flushed over winter. Cold spring streams are discrete functional units, yet have properties common to several other aquatic environments. (Baker-IVI)
W85-03122

EFFECTS OF ACIDIFICATION AND PHOSPHORUS ADDITION ON PHYTOPLANKTON BIOMASS AND PRODUCTIVITY IN A CIRCUM-NEUTRAL MESOTROPHIC LAKE RECEIVING ACID PRECIPITATION,
West Virginia Univ., Morgantown.
For primary bibliographic entry see Field 5C.
W85-03123

LIMNOLOGY OF THE KERN RIVER (SOUTHERN CALIFORNIA),
Kern County Water Agency, Bakersfield, CA.
G. Hill, and H. Rai.
International Revue de Gesamten Hydrobiologie, Vol. 69, No.5, p 653-678, 1984. 17 Fig, 14 Tab, 20 Ref.

Descriptors: *Kern River, *Limnology, Primary productivity, Nitrates, Phosphates, Geology, Morphology, Rivers.

The Kern River, in Southern California, was studied for 20 months. Geological and morphological effects on water chemistry were noted. Chemically the Kern River is a Ca-Na-HCO3 system with an average total filterable residue of 100 mg/l. Primary production in Kern River water was limited by nitrates and, occasionally, by phosphates. Planktonic biomass was highest in February-March and Melorisira granulata was the dominant species. Chlorophyll a averaged 4.17 microg/l. Radioactivity was low. Carbon forms were influenced by runoff with labile carbon being associated with the saprobic bacteria. Three habitat types of flora were encountered. Total fish potential was largely restricted to man-made Lake Isabella. Of the various changes which might affect the fragile river system, industrial waste is the most likely to make an adverse or harmful change. Uranium mine waste has been shown to affect respiration of natural algal populations during production studies. Another industry of concern is the industrial dump which is operating and expanding in the Kern River watershed. Increasing demands on the Kern River, coupled with industrial and domestic impacts which are increasing, have the potential to do great injury to the river and the areas it serves. (Baker-IVI)
W85-03124

ASSESSMENT OF COMPONENTS CONTROLLING PHYTOPLANKTON PHOTOSYNTHESIS AND BACTERIOPLANKTON PRODUCTION IN A SHALLOW, ALKALINE, TURBID LAKE (NEUSIEDLERSEE, AUSTRIA),
Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Limnologie.
M. Dokulil.
International Revue de Gesamten Hydrobiologie, Vol. 69, No.5, p 679-727, 1984. 24 Fig, 13 Tab, 193 Ref.

Descriptors: *Phytoplankton, *Photosynthesis, *Lakes, *Turbidity, *Neusiedlersee, *Austria, Wind, Waves, Bacteria.

Various aspects of phytoplankton photosynthesis were investigated between 1968 and 1980 in Neusiedlersee, Austria, a shallow, well mixed lake with much turbidity resulting from frequent resuspension of inorganic sediment particles. One of the most important factors is wind induced wave action that disturbs the lake bottom. The turbulent conditions favor small centric diatoms and chlorococcalean phytoplankton associations. There is little photosynthesis during the winter. Its rate increases during spring and varies throughout the rest of the year. Nanoplankton contributed considerably to total photosynthesis. Specific photosynthesis per unit chlorophyll a is governed by factors such as temperature, nutrient supplies, chlorophyll content of the cells and physiological conditions. Bacterial numbers and production are high in Neeusiedlersee. Bacterial cell counts are correlated with turbidity. The results of this study are compared with data from several other shallow lakes and discused. A classification of shallow water bodies is attempted. (Baker-IVI)
W85-03125

MULTICOMPONENT MODEL OF PHOSPHORUS DYNAMICS IN RESERVOIRS,
Najarian and Associates, Eatontown, NJ.
T. T. Griffin, and R. A. Ferrara.

Water Resources Bulletin, Vol. 20, No. 5, p 777-788, October, 1984. 8 Fig, 4 Tab, 23 Ref.

Descriptors: *Reservoirs, *Model studies, *Phosphorus, Nutrients, Eutrophication, Impoundments, Water quality, Trophic levels.

An improved model is developed for time variable, long-term simulation of trophic state in reservoirs with fluctuating inflow and outflow rates and volume. The model as developed represents the phosphorus cycle in two layer (i.e., epilimnion and hypolimnion) reservoirs. The model is designed to simulate seasonally varying reservoir water quality and eutrophication potential by using the phosphorus state variable as the water quality indicator. Long term simulation with fluctuating volumes and variable influent and effluent flow rates are feasible and practical. The model utility is demonstrated through application to a pumped storage reservoir characteristic of these conditions. (Baker-IVI)
W85-03144

DETERMINATION OF THE HYDROGEOLOGIC PROPERTIES OF LAKEBEDS USING OFFSHORE GEOPHYSICAL SURVEYS,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
K. R. Bradbury, and R. W. Taylor.
Groundwater, Vol. 22, No. 6, p 690-695, November-December, 1984. 4 Fig, 1 Tab, 25 Ref.

Descriptors: *Lake beds, *Groundwater, Lakes, Permeability coefficient, Hydrogeologic properties.

A correlation between longitudinal conductance, a geoelectric parameter, and lakebed leakance may provide a rapid and inexpensive method for estimating lakebed hydrogeological properties using data collected by offshore seismic and electrical surveys. A test of the method at three study sites in Lake Michigan shows a positive linear relationship between the logarithm of longitudinal electrical conductance, S, and the logarithm of lakebed leakance at the three sites. Leakance is a measure of the potential for hydraulic connection; thus the S values may be used to spatially map the relative hydraulic connection between lakes and aquifers. Offshore geophysical surveys are relatively fast and inexpensive when compared with direct measurements of offshore lakebed properties. Therefore, offshore electrical surveys, combined with seismic reflection data, provide a promising tool for lake aquifer studies. (Baker-IVI)
W85-03148

ISOTOPE GEOCHEMISTRY OF STRATIFIED LAKE 'A', ELLESMERE ISLAND, N.W.T., CANADA,
Calgary Univ. (Alberta). Dept. of Geography.
M. O. Jeffries, H. R. Krouse, M. A. Shakur, and S. A. Harris.
Canadian Journal of Earth Sciences, Vol. 21, No. 9, p 1008-1017, September, 1984. 13 Fig, 5 Tab, 34 Ref.

Descriptors: *Lake A, *Ellesmere Island, *North West Territory, *Stratified lakes, Lakes, Stratification, Salinity, Temperature, Acidity, Tritium, Seawater.

Lake A on Ellesmere Island was created by postglacial uplift and isolation of a seawater basin a few thousand years ago. In comparison with average seawater the ionic composition of the underlying water in Lake A is slightly modified in cationic composition and drastically modified in anion composition, with marked depletions of sulfate and enrichments of dissolved carbonate species. These enrichments are due to bacterial sulfate reduction and associated oxidation of organic matter. Some sulfide was apparently reoxidized. It is possible that prior to stratification there were extensive hydrogen sulfide and perhaps carbon dioxide emissions to the atmosphere. Alternatively, sulfide minerals may have been precipitated. Despite these uncertainties, the marked depletions in sulfate coupled with the isotopic data indicate that anaerobic microbiological activity has been extensive during the lake's history. Mixing phenomena in the transition zone are hard to assess. The ionic and stable isotope compositions of the deeper trapped seawater indicate some modification of the original seawater in the basin. (Baker-IVI)
W85-03195

SEASONAL VARIATIONS OF 210-PB AND 210-PO CONCENTRATIONS IN AN OLIGOTROPHIC LAKE,
Wisconsin Univ.-Madison. Water Chemistry Lab.
R. W. Taylor, and A. W. Andren.
Geochimica et Cosmochimica Acta, Vol. 48, No. 10, p 2053-2063, October, 1984. 4 Fig, 2 Tab, 36 Ref. EPA grant R806878-01-06.

Descriptors: *Lead radioisotopes, *Polonium radioisotopes, *Crystal Lake, *Wisconsin, Lake sediments, Particulate matter, Vertical distribution, Seasonal variation, Oligotrophic lakes, Biogeochemistry.

The vertical distribution of Pb-210 and Po-210 in the dissolved and the particulate phases were measured in Crystal Lake, Wisconsin, to examine the spatial and temporal variability during the seasonal cycle of this oligotrophic lake. A comparison of the values estimated for the atmospheric flux and sediment accumulation of Pb-210 suggests that the atmosphere is the principal source of Pb-210 to Crystal Lake. The atmospheric flux of Pb-210 at this site is about 0.70 pCi/sq cm/yr compared to only about 0.06 pCi/sq cm/yr for Po-210. Most of the Po-210 in Crystal Lake is consequently produced in situ from radioactive decay of Pb-210. The removal rates of Pb-210 and Po-210 from the water column to the sediments varied temporally by nearly an order of magnitude. During transient periods of high plankton productivity, a large net flux of Pb-210 and Po-210 into the sediments occurred. It was during these short-lived events that most of the annual net removal of these nuclides occurred. Biological removal processes acted to rapidly deplete the standing crops of both Pb-210 and Po-210 in the water column. For Pb-210, replenishment of the water column appeared to occur mainly from atmospheric input. In the case of Po-210, there seemed to be a very efficient biogeochemical recycling scheme operating. Particulate Pb-210 was rapidly stripped from the water column during turnover. As the thermocline quickly eroded, small detrital particles previously trapped in surface water may have been released to deeper water and efficiently removed Pb-210 via an aggregation-scavenging mechanism. Boundary scavenging of dissolved Pb-210 may also be an important removal mechanism, but its magnitude is unknown. Although both Pb-210 and Po-210 are highly reactive with respect to their rapid removal from Crystal Lake, the 0.095 yr mean removal residence time of Pb-210 was nearly a factor of 3 less than the 0.26 yr mean value for Po-210. Such differences in the biogeochemistry of these genetically coupled nuclides demonstrate the complexities involved in predicting the fate of reactive chemical constituents in a seemingly well-defined lake system. (Baker-IVI)
W85-03212

2I. Water In Plants

INFLUENCE OF SOIL DRYING ON THE WATER RELATIONS AND GROWTH OF DOUGLAS FIR (PSEUDOTSUGA MENZIESII (MIRB.) FRANCO) (INFLUENCE DU DESSECHEMENT DU SOL SUR LE FONCTIONNEMENT HYDRIQUE ET LA CROISSANCE DU DOUGLAS (PSEUDOTSUGA MENZIESII (MIRB.) FRANCO)),
Centre National de Recherches Forestieres, Seichamps (France). Station de Sylviculture et de Production.
G. Aussenac, A. Granier, and M. Ibrahim.
Acta Oecologia-Oecologia Plantarum, Vol. 5, No. 3, p 241-253, 1984. 7 Fig, 1 Tab, 15 Ref.

Descriptors: *Soil water, *Soil moisture deficiency, *Trees, *Plant growth, Soil properties, Drought, Fir, Water potential.

Four 22 yr old douglas fir trees were stu
determine the influence of soil drying co
on water relations and growth. The tree
growing inside 2 lysimeters whose waterin
regulated. The predawn tree water potential
balance with the soil water potential at th
where the absorption by root occurs and soi
ture is maximum. Existence of close relatio
between predawn potential and soil water
is shown. Capillary rises were measure
reached 0.5 mm/day under driest soil con
A study of the evolution of the ratio ETR
under decreasing soil moisture conditions
that this ratio decreased rapidly and reache
when predawn potential was lower than -
From the stated relations a tentative model
posed for the variations of the soil water
and of the predawn potential as related
rainfall and the potential evapotranspiratio
both trees in a drying phase, the stem circ
ence growth was stopped at a predawn poten
-3 bars, beyond this threshold and down to -
there was a shrinkage of the stem. After wa
back to the field capacity, the stem circumf
came back to the starting level, then increase
nearly equalized the stem circumference gro
the trees of the control group, for the dom
tree. In the case of the suppressed one the
circumference growth was rapidly sto
(Baker-IVI)
W85-02716

**WATER RELATIONS OF QUERCUS PA
TRIS: FIELD MEASUREMENTS ON AN
PERIMENTALLY FLOODED STAND,**
Washington State Univ., Pullman. Dept. of F
ry and Range Management.
R. A. Black.
Oecologia (Berlin), Vol. 64, No. 1, p 14-20,
tember, 1984. 4 Fig, 3 Tab, 28 Ref.

Descriptors: *Flooding, *Plant growth, *
Vegetation, Oak, Flood tolerance, Flood p

Field measurements of water relations were
to examine the response of mature Quercus p
tris, a flood tolerant tree, to experimental floo
treatments. Flooding treatments included floo
in the dormant season, short-term flooding i
growing season and long term continuous floo
Quercus palustris apparently is a stress-tolerat
the flood plain environment. Flooding in the
mant season had minimal effect on subseq
growing season water relations of Q. palustri
palustris is also well adapted to unpredic
flooding in the growing season which is com
on the Mississippi flood plain. The stomatal clo
caused by flooding in the growing season
reversed within 10 days. Q. palustris similarly
erated the continued stress of long term floodi
the growing season. Long term flooding in
growing season had no effect on tree water
tions. Continuous flooding for extended period
time (less than 3 yr) will result in tree morta
Prior to death of the tree, flooding in the grow
season apparently reduced the reproductive fit
of Q. palustris. While tolerating the stress of flo
ing in the growing season, these flooding stre
caused a reduction in the number of flowers
duced and an abortion of the previous y
mature fruits. These reductions in reproduc
fitness may explain the relative positions of spe
on flood plains where mature trees are appare
capable of tolerating flooding of variable oc
rence and duration but where seedlings are ra
encountered. (Baker-IVI)
W85-02814

**FIELD WATER RELATIONS OF SONOR
DESERT ANNUALS,**
Utah Univ., Salt Lake City. Dept. of Biolo
I. N. Forseth, J. R. Ehleringer, K. S. Werk, and
S. Cook.
Ecology, Vol. 65, No. 5, p 1436-1444, Octob
1984. 5 Fig, 3 Tab, 40 Ref. Dept. of Agricult
grant 5901-0410-8-0093-0.

Descriptors: *Desert plants, *Leaves, *Water
tentials, *Sonoran Desert, Seasonal variation, P
cipitation, Drought resistance, Plant growth.

Field water relations were examined in winter and summer annuals of the Sonoran Desert. Both groups were characterized by low below ground biomass allocation. Leaf conductances and leaf water potentials are high in desert annuals, and in some circumstances and species, may be unusually high. This is consistent with the idea that these annuals are ephemeral and drought-evading. It is clear that some winter and summer desert annuals are capable of tolerating low leaf water potentials and therefore are not drought-evading in the traditional sense. Root/shoot ratios of both winter and summer desert annuals are quite low, suggesting that only a small fraction of the carbon gained is used for water acquisition; carbon is instead used for vegetative and reproductive growth. (Baker-VI)
W85-02817

GEOMORPHIC AND VEGETATIVE CHARACTERISTICS ALONG THREE NORTHERN VIRGINIA STREAMS,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2E.
W85-02834

STORED AVAILABLE SOIL WATER AND THE FALLOW/RECROP DECISION-CRITICAL LEVEL APPROACH,
North Dakota State Univ., Fargo. Dept. of Soil Science
R. J. Goos, B. E. Johnson, F. J. Sobolik, and R. P. Schneider.
Soil Science Society of America Journal, Vol. 48, No. 5, p 1134-1137, 1984. 5 Fig, 2 Tab, 6 Ref.

Descriptors: *Soil water, *Recropping, *Crop production, *Fallowing, Wheat, North Dakota, Water storage, Soil-water-plant relationships.

The amount of stored soil water at seeding has long been appreciated as a critical factor in the success of annual spring wheat (Triticum aestivum L.) production in the semiarid region of the Northern Great Plains. Stored available soil water at seeding, growing season precipitation, and grain yield data from 53 spring wheat experiments in western North Dakota were analyzed by both multiple regression and an interaction chi-square approach. Soil types were generally fine-loamy, mixed Typic Haploborolls or Argiborolls. Regression equations explained too little of the variability of the data to be useful in drawing practical guidelines for future fallow/recrop decisions. The results suggest that stored soil moisture data are better analyzed by the interaction chi-square test, the results of which provide easy-to-interpret guidelines for making future fallow/recrop decisions. For example, for a minimum acceptable recrop wheat yield of 1350 kg/ha, the following critical levels were defined: stored available soil water at seeding less than 6.4 cm, crop failure is likely and summerfallow is advised; stored available soil moisture 6.4 to 9.4 cm, approximately equal odds of crop failure or success; stored available soil moisture > 9.4 cm, crop success is likely and recropping is advised. (Author's abstract)
W85-02874

ALFALFA GROWTH AND SOIL OXYGEN DIFFUSION AS INFLUENCED BY DEPTH TO WATER TABLE,
Agricultural Research Service, Orono, ME. New England Plant, Soil and Water Lab.
For primary bibliographic entry see Field 2G.
W85-02877

XYLEM WATER FLOW IN A CRACK WILLOW TREE (SALIX FRAGILIS L.) IN RELATION TO DIURNAL CHANGES OF ENVIRONMENT,
Vysoka Skola Zemedelska, Brno (Czechoslovakia). Inst. of Forest Ecology.
J. Cermak, J. Jenik, J. Kucera, and V. Zidek.
Oecologia, Vol. 64, No. 2, p 145-151, October, 1984. 4 Fig, 4 Tab, 34 Ref.

Descriptors: *Willow trees, *Diurnal changes, *Transpiration, *Vascular tissues, Marshes, Meteorologic conditions, Heat balance, Plant physiology, Trees, Plant tissues.

The diurnal course of the xylem water flow in a solitary Salix fragilis L. tree in a wet grassland was measured using the tissue heat-balance method. There was considerable variation due to meteorological factors. Maximum flow rate was 0.4 kg/h/sq m of crown projection area, or 5.9 kg/h/kg leaf dry weight. The daily total was 2.4 kg/sq m/day or 36 kg/kg/day. Water flow decreased immediately at the tree base and at the branches after start of rain, and in a branch, after cutting it off: the time constant of the system was 600-700 s in both cases. The part of the crown oriented to the sun transpired up to ten times as much as the shaded part. Over 70% of the total cross-sectional area of the conductive xylem vessels of the trunk was used by the transpiration flow. The water content of the trunk tracked the diurnal changes of the xylem water flow rate with a short time-lag. During the day, 1% of the trunk volume was temporarily exploited as water reserve, an amount equalling 3% of daily water loss. The stereometric configuration of the crown significantly influenced its water loss. During the summer period, about 33 mature (polycormic) trees per ha may drain 100% of water consumed by the present-day sedge-grass marsh. (Author's abstract)
W85-02900

INFLUENCE OF WATER ON CO2 EXCHANGE IN THE LICHEN PARMELIA PRAESIGNIS NYL.,
Arizona State Univ., Tempe. Dept. of Botany and Microbiology.
S. O. Link, and T. H. Nash, III.
Oecologia, Vol. 64, No. 2, p 204-210, October, 1984. 2 Fig, 1 Tab, 27 Ref. NSF grant DEB 792153.

Descriptors: *Plant physiology, *Gas exchange, *Carbon dioxide, *Lichens, Respiration, Water content, Photosynthesis.

Net photosynthetic rates for the lichen Parmelia praesignis Nyl. were obtained as a function of 5 light levels, 5 temperature levels, and of water content as thalli dried from saturated conditions. Data are described as second order polynomials in the light, and as saturation curves in the dark. Rates in the light were depressed at high water contents reaching maximal rates between 110% and 180% water content and declining as thalli dried. Physiological parameters were derived from the drying curves to investigate temperature and light interactions. Dark respiration parameters are the maximal rate, the water content where the rate is half-maximal, the water content at which respiration is zero, and the maximal water efficiency. In the light, parameters are the maximal net photosynthetic rate, the water content at the maximal rate, the water compensation point, the maximal water efficiency, and the sensitivity of net photosynthesis to change in water content. Values of half-maximal rate water contents for respiration were found to increase as temperatures increased. The greatest maximal net photosynthetic rate occurred at higher temperatures as the light intensity increased. In the light, maximal water efficiency and the sensitivity to changes in water content were generally maximal at temperatures yielding the greatest maximal net photosynthetic rates. (Author's abstract)
W85-02901

WATER RELATIONS OF OAK SPECIES ON AND ADJACENT TO A MARYLAND SERPENTINE SOIL,
Towson State Univ., Baltimore, MD. Dept. of Biological Sciences.
J. C. Hull, and S. G. Wood.
American Midland Naturalist, Vol. 112, No. 2, p 224-234, October, 1984. 5 Fig, 4 Tab, 20 Ref.

Descriptors: *Oaks, *Soil water potential, *Plant water potential, *Serpentine soils, *Maryland, Ecological distribution, Xylem water potential, Stomatal conductance.

The predominant oaks of the Maryland Piedmont (Quercus alba and Q. velutina) do not occur on serpentine soils. On serpentine sites they are replaced by Q stellata and Q. marilandica. Soil and plant water relations were measured to evaluate water as a limiting factor to distribution of oaks on serpentine soil. May through August soil water potentials of serpentine soils were not lower than adjacent nonserpentine soils. Dawn xylem water potentials of oaks on serpentine soils were similar to nonserpentine oaks during early and midsummer. By late summer, water potentials of the oaks on serpentine sites were higher. Dawn xylem water potentials and soil water potentials were significantly correlated for all species. A significant correlation between xylem water potential and stomatal conductance was found for the oaks on the serpentine soils. No such correlation was found for oaks on nonserpentine soil, but a xylem water potential threshold for stomatal closure was observed. Despite differences in their responses to moisture availability, water does not appear to be in the environmental factor responsible for the distributional pattern of these species. (Author's abstract)
W85-03015

HYDROECOLOGY OF THE GRASS-ASSOCIATIONS FOUND AT THE DAMS ALONG THE UPPER-TISZA,
Jozsef Attila Univ., Szeged (Hungary). Dept. of Botany.
Gy. Bodrogkozy.
Tiscia (Szeged), Vol. 19, No. 2, p 89-111, 1984. 8 Fig, 8 Tab, 30 Ref.

Descriptors: *Grasses, *Hydroecology, *Dams, *Tisza, *Hungary, Floods, Slopes, Ecological distribution, Soil water.

To this day, the grass stands developing at the dams of the Upper Tisza-valley by means of sowing performed close to one century ago, have come close to the populations of the alpine meadows. Their zonal arrangement is determined by the frequent, but short-termed inundations and the exposition of the dam-slope. A significant variation was demonstrable compared to the similarly located dam grass zones found at the Southern Tisza-valley. 1. Alopecuro-Arrhenatheretum developed on the effect of repeating floods in the lower zones of the Northern-, North-Eastern dam-slope. The helo-hygrophyton and hygrophyton representatives were dominating. 2. Pastinaco-Arrhenatheretum was found located at the upper zone of the dam-slope. Depending on the moisture conditions, three sub-associations could be distinguished and the species belonging to the various subunits of the hygro-mesophyton category were demonstrable. 3. The Lolio-Plantaginetum developed on enhanced zoogenic effect at the dam's Western-South-Western flood-protected area. 4. The zone of the Salvio-Festucetum rupicolae could be differentiated into four sub-associations and occupied the central and upper protected dam zone. Their species components were meso-xerophyton representatives. (Author's abstract)
W85-03118

EFFECTS OF COLD SOIL ON WATER RELATIONS AND SPRING GROWTH OF DOUGLAS-FIR SEEDLINGS,
Pacific Northwest Forest and Range Experiment Station, Wentachee, WA.
W. Lopushinsky, and M. R. Kaufmann.
Forest Science, Vol. 30, No. 3, p 628-634, 1984. 2 Fig, 2 Tab, 21 Ref.

Descriptors: *Soil temperature, *Transpiration, *Plant growth, *Fir, Water stress, Plant physiology.

Effects of low soil temperature on the water relations, shoot growth, and root growth of Douglas-fir seedlings were studied to evaluate the significance of reduced water uptake and growth in seedlings outplanted in cold soils. Transpiration rate was significantly correlated with soil temperature and declined linearly with decreasing temperatures. Xylem pressure potential of seedlings in cold soil that were exposed to moderate evaporative demand averaged -15.4 bars for the 4 days it was measured, compared to -11.1 bars for seedlings in warm soil. Except for the initial decline in P for

the warm soil group, P for both groups remained essentially constant throughout the test period. Xylem pressure potential of seedlings in cold soil that were exposed to high evaporative demand averaged -20.0 bars, compared to -13.4 bars for seedlings in warm soil. Stomatal conductances of seedlings in the cold soil groups averaged 50% or less of those in the warm soil groups. Low soil temperatue delayed bud burst, reduced shoot growth, and completely prevented root growth. (Baker-IVI)
W85-03128

2J. Erosion and Sedimentation

SUSPENDED SEDIMENT RESPONSES IN A WIND-DOMINATED ESTUARY OF THE TEXAS GULF COAST,
Minerals Management Service, Corpus Christi, TX.
G. L. Shideler.
Journal of Sedimentary Petrology, Vol. 54, No. 3, p 0731-0745, September, 1984. 5 Fig, 2 Tab, 18 Ref.

Descriptors: *Suspended sediments, *Wind, *Estuaries, *Texas, *Corpus Christi Bay, Bays, Sediments, Waves, Storms, Water circulation, Turbidity, Water density.

Hydrographic and suspended-sediment characteristics of Corpus Christi Bay indicate the dominant influence of wind as a forcing agent in regulating sedimentary processes within the shallow, restricted estuaries characteristic of the Texas Gulf Coast. Surface-sediment dispersal patterns within the bay primarily reflect wind direction. Offshore-directed northerly winds characteristic of winter storm conditions result in dispersal patterns that are substantially different than the patterns associated with onshore-directed prevailing southeasterly winds, which are characteristic of the summer season. Wind direction influences sediment dispersability establishing the direction of wind-driven currents, set-up effects, and wave propagation. In winter, these factors determine the most intense areas of bayfloor sediment resuspension and the direction and efficiency of both tidal and nontidal water-exchange and sediment movement between the bay and adjoining water bodies. Suspended-sediment characteristics within the water column are not discernibly influenced by baywater density, which was generally vertically homogeneous. Baywater turbidity is directly related to mean wind speed, and is a relatively short-term response parameter. It is influenced mainly by cumulative wind-speed effects that occur within a 30 hr period prior to observation, which is more influential than the immediate wind effects at the time of observation. This temporal relationship largely reflects the water column residence time of muddy bayfloor sediments episodically resuspended by wind generated wave activity. The water column turbidity structure ranges from increasing turbidity gradients with depth to isoturbid conditions. Texturally, the water column suspensate consists of poorly sorted clay size to very fine silt size detritus. (Baker-IVI)
W85-02835

REACTIVATION SURFACES IN SUBTIDAL CHANNEL DEPOSITS, OOSTERSCHELDE, SOUTHWEST NETHERLANDS,
Institute of Earth Sciences, Utrecht (Netherlands). Comparative Sedimentology Div.
T. de Mowbray, and M. J. Visser.
Journal of Sedimentary Petrology, Vol. 54, No. 3, p 811-824, September, 1984. 10 Fig, 24 Ref.

Descriptors: *Oosterschelde, *Netherlands, *Tidal deposits, *Reactivation surfaces, Erosion surfaces, Deposition, Sedimentation.

Recognition of unsteadiness in flow velocities is an important factor in the identification of tidal deposits. One consequence of such unsteadiness is the production of reactivation surfaces - erosion surfaces developed within a cross-stratified set. Reactivation surfaces can be produced in a unidirectional flow system, by the migration of a faster-moving megaripple over a slower one ('overtaking'). The form of the surface is dependent upon the relative sizes of the two megaripples concerned and the flow conditions under which they migrate. Other types of reactivation surfaces are produced by the action of a subordinate current, which erodes the lee side of the dominant-current megaripple. The morphology of the reactivation structures depends on the size of the megaripples concerned (the examples considered here had heights in the range 0.25-2.5 m) and, most importantly, on the relative strengths of the dominant and subordinate currents. Where the subordinate current is relatively weak only the tops of the dominant-current foresets are eroded. With increasing subordinate-current strength, the whole foreset height is subjected to erosion, and a large angular discordance is produced between the large-scale foresets and the reactivation surface. Such strong erosion drastically alters the megaripple relief - the lee-side slope is much reduced. Recovery of the lee side during the subsequent dominant-current phase is gradual, as can be seen from the development of small-scale structures immediately overlying the reactivation surfaces. The regular variation in the strength of the subordinate current during the neap/spring cycle is often reflected in the morphology of the reactivation surfaces. In such examples, the reactivation surfaces formed during spring-tide periods have a large angular discordance with the foresets, indicating that there was considerable erosion by the subordinate current. Reactivation surfaces formed during periods between spring and neap, in contrast, are developed only in the upper parts of the foresets, suggesting that subordinate-current erosion was relatively modest, while the deposits of the neap tides themselves show no evidence of any erosion by the subordinate current. (Author's abstract)
W85-02836

SUSCEPTIBILITY OF AGRICULTURAL SOILS TO INTERRILL EROSION,
Agricultural Research Service, Oxford, MS. Sedimentation Lab.
L. D. Meyer, and W. C. Harmon.
Soil Science Society of America Journal, Vol. 48, No. 5, p 1152-1157, September/October 1984. 1 Fig, 5 Tab, 17 Ref.

Descriptors: *Erosion, *Interrill erosion, *Soil conservation, Soil properties, Rill erosion, Calcium, Organic matter, Soil erodibility.

Soil losses from crop row sideslopes were evaluated for 18 soils in a bare, tilled condition to determine their relative susceptibilities to interrill erosion. Erodibilities varied by a ratio of $>$ 10:1 for the initial run and by 4:1 for succeeding runs. The poorly aggregated high-silt soils were most erodible, and the high-clay soils were least erodible. Simple correlations of interrill erosion with various soil properties were determined. Erosion was best correlated with clay ($<$ 2 micro m) percentage, 1500 kPa water, exchangeable calcium, sum of exchangeable bases, cation exchange capacity, and organic matter content, all negatively. Interrill erosion was well correlated (positively) with the site specific K-factor of the universal soil loss equation. (Author's abstract)
W85-02876

SEDIMENTS OF HANEJI INLET AND ITS ENVIRONS, OKINAWA, SUBTROPICAL JAPAN,
University of the Ryukyus, Naha (Japan). Dept. of Marine Sciences.
H. Ujiie, and K. Nagano.
Galaxea, Vol. 3, No. 1, p 81-95, June, 1984. 9 Fig, 13 Ref.

Descriptors: *Sediments, *Bays, *Haneji Inlet, *Okinawa, *Japan, Subtropic zone, Geology, Erosion, Tidal effects.

A combination of the Emergy-settling tube and pipette methods was used to study the sediments at 43 stations in Haneji Inlet, a closed embayment, and surrounding seas. The composition analysis was used under microscope for the sand fraction and the ignition-loss analysis for the mud fraction. The sediments have some characteristics which well reflect their geological and geographical ronments. A large amount of terrigenous mat has remarkably been trapped in the Inlet as and mud fractions. This may be caused by geology of the southern hinterland which is ceptible to erosion and probably by such a hy ogy as separated from open sea circulation. S portions of the materials seem to be carried during the ebb tide from the Inlet through a n dered, narrow and rather deep channel, wher sediments show intermediate features, not on grain-size distribution but also in compositio sand and mud fractions, between those of inside and outside of Haneji Inlet. Another pr nent sedimentological aspect observed in the is an abundance of fecal pellets probably prod by anelid worms. The pellet-rich sediments co distinctly more organic matter than those re nized in the other embayments of Okin (Baker-IVI)
W85-02880

SEDIMENT TRAP STUDIES IN LAKE MI GAN: RESUSPENSION AND CHEMI FLUXES IN THE SOUTHERN BASIN,
National Oceanic and Atmospheric Admin tion, Boulder, CO. Environmental Research B. J. Eadie, R. L. Chambers, W. S. Gardner, a G. L. Bell.
Journal of Great Lakes Research, Vol. 10, No 307-321, 1984. 15 Fig, 3 Tab, 46 Ref.

Descriptors: *Lake Michigan, *Suspended s *Sediments, *Great Lakes, *Water analysis, C ical analysis, Lake sediments, Minerals, Lakes suspension, Phosphorus, Carbon cycle.

Sediment trap sample collections were carrie in the southeastern region of Lake Michigan years from 1977 to 1980. Findings are comp with water column and sediment characteri Mass flux data indicate strong seasonal patt with maximum fluxes recorded during the uns fied period. The large amount of winter resu sion is a mechanism which provides an inti coupling of recent sediments and the column. Also these trap study results indicate there is a near-bottom benthic nepheloid whose chemical composition approaches th deep water sediments. The amount of resuspe NaOH extractable phosphorus injected into euphotic zone is estimated as approximately to the load of new phosphorus entering sou Lake Michigan. For both phosphorus and ca reintroduction of sediment bound material int upper water column during winter by resuspe could play a significant part in the long behavior of these and associated compo (Baker-IVI)
W85-02892

SEDIMENTATION OF POLYCHLORINA BIPHENYLS (PCBS) IN LIMNIC MARINE ENVIRONMENTS,
Lund Univ. (Sweden). Limnological Inst.
For primary bibliographic entry see Field 5B.
W85-02911

INCIPIENT MOTION OF SEDIMENT PA CLES OVER FIXED BEDS,
Newcastle upon Tyne Univ. (England). Dep Civil Engineering.
P. Novak, and C. Nalluri.
Journal of Hydraulic Research, Vol. 22, No. 181-197, 1984. 12 Fig, 2 Tab, 6 Ref.

Descriptors: *Sediment, *Fixed beds, *Sm beds, *Rough beds, Channels, Froude num Velocity, Shear stress, Sewer systems, Partic matter, Particle size, Design criteria.

The paper analyses experimental data on inci motion of single and grouped sediment particl flow in flumes with fixed smooth or rough with roughness smaller than the particle size. results are represented as far as possible in di sionless plots and equations applicable within experimental range. A comparison with c sponding results for movable sediments bed

uniform grain size) enables a realistic assessment of the influence of the channel bed condition on the critical values of velocities, shear stresses and particle Froude numbers. The second part of the paper discusses the implications of the conclusions reached in this analysis on sewer design. It shows conclusively that for smaller diameters (less than 500 mm) the traditional method of computing slopes required for self-cleansing velocities gives higher values than required for initiation (and continuation) of movement of inorganic particulate matter. (Author's abstract)
W85-02931

EROSION OF COHESIVE SOILS,
Auckland Univ. (New Zealand).
A. J. Raudkivi, and S. K. Tan.
Journal of Hydraulic Research, Vol. 22, No. 4, p 217-233. 7 Fig, 4 Tab, 20 Ref.

Descriptors: *Erosion, *Clays, *Cohesive soils, Model studies, Hydrogen ion concentration, Geochemistry.

Experiments on erosion of cohesive soils using a circular couette flow erosion device and three clays with eight electrolytes (solutions) at approximately constant temperature are described. The analysis of the experimental results using the erosion model based on the rate process concept shows that the erosion rate of a clay by an electrolyte with different pH-values and molar salt concentrations can be explained by the orientation of the clay aggregates in the slurries before consolidation as well as predicted. The features of the eroded clay surfaces depend on the nature of the clay. The eroded surfaces of stiffer clays look in scanning microscope pictures distinctly pitted, whereas surfaces of clays with face to face stacking appear to flake. The eroded surfaces of soft clays show moulded features and undulating surface forms. However, most of the clays are neither stacked face to face nor soft, and they show an intermediate form of eroded surface features. Except for very soft clay, the surface of the eroded clay is distinctly pitted, in keeping with the picture that clay lumps have been lifted out of the surface. (Author's abstract)
W85-02953

BOTTOM-BOUNDARY CONDITION FOR NONEQUILIBRIUM TRANSPORT OF SEDIMENT,
Duke Univ., Durham, NC. Dept. of Mechanical Engineering and Materials Science
K. J. Cheng.
Journal of Geophysical Research, Vol. 89, No. C5, p 8209-8214, September, 1984. 6 Fig, 2 Tab, 10 Ref, 1 Append.

Descriptors: *Bottom-boundary conditions, *Boundary conditions, *Sediment transport, Sediment distribution, Mathematical equations, Model studies.

This paper formulates a generalized bottom-boundary condition for nonequilibrium transport of sediment in terms of two parameters: the deposition velocity and the equilibrium bottom concentration. Theoretical expressions for the two parameters are derived. Analytical solution to the sediment transport equation, using the generalized bottom-boundary condition, is also given. Finally, a number of available formulations of the bottom condition are reviewed and shown to be special cases of this generalized one. (Author's abstract)
W85-02962

DUAL RADIOTRACER MEASUREMENT OF ZOOBENTHOS-MEDIATED SOLUTE AND PARTICLE TRANSPORT IN FRESHWATER SEDIMENTS,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
J. R. Krezoski, J. A. Robbins, and D. S. White.
Journal of Geophysical Research, Vol. 89, No. B9, p 7937-7947, September, 1984. 6 Fig, 2 Tab, 47 Ref. NSF grant OCE 7825680.

Descriptors: *Radioactive tracers, *Solute transport, *Particle transport, *Lake sediments, *Benthic animals, Oligochaetes, Crustaceans, Cesium radioisotopes, Sodium radioisotopes, Benthic environment, Sediment reworking, Burrowing, Feeding.

Gamma spectroscopy methods have been applied to determine the effects of Stylodrilus heringianus and Pontoporeia hoyi, two freshwater benthic macroinvertebrates, on reworking of sediments and the transfer of solutes across the sediment-water interface. Natural lake sediments (sieved to remove organisms) and overlying water were contained in temperature-regulated rectangular plastic cells. A submillimeter layer of sediment solids labeled with Cs-137 was deposited on the sediment interface while overlying water was spiked with Na-22. After addition of Stylodrilus (oligochaete worms) and Pontoporeia (crustacean amphipods) to these microcosms, the vertical distribution of Cs-137 (a tracer of particle transport) and Na-22 (a tracer of solute transport) were determined at daily to weekly intervals for 3 months by scanning the length of the cells with a well-collimated NaI detector. In cells with Stylodrilus, the Cs-137 layer moved downward at a rate that decreased exponentially with time. The displacement of the layer is the result of the conveyor-belt feeding mode of this organism. The rate of marked layer burial is consistent with that of other freshwater annelids (0.0000018 cm/d/individual/sq m; 11.6 C). The exponential decrease in burial rate is ascribed to uniformly distributed feeding of Stylodrilus within the feeding zone of 4.4 cm. In cells with Pontoporeia, Cs-137 activity was smeared downward in time owing to eddy diffusive mixing of sediments over a small range (1-2 cm). In cells without worms, the veneer of Cs active material remained at the interface while the penetration of Na-22 into sediments was consistent with diffusion in free solution with small corrections for sediment porosity and sorption (KD = 0.17). The effective diffusion coefficient De for Na-22 in this cell (0.0000082 sq cm/s) was essentially the same as that for a cell that had been inhabited by worms for 3 weeks and then poisoned with formalin just before addition of Na-22. Thus the presence of biogenically reworked sediments (with pelletized material and remnant burrow structures) did not affect solute transport. In cells with live Stylodrilus, penetration of Na-22 within the feeding zone was considerably more rapid, implying an apparent De twice as high as in cells without worms. Inferences based on the particle reworking results were used to develop an illustrative transport model that includes advective as well as diffusive terms. Advective transport arises from the incorporation of Na-22 into pore fluids moved downward as a result of conveyor-belt feeding. The model indicates that within the feeding zone, solute transport is dominated by advection and that the apparent enhancement of De in pure diffusion models is really the result of solute flow induced by particle reworking. In cells with Pontoporeia, De is approximately twice that in control cells. In these cells, Na-22 profiles may be treated theoretically without advection. (Author's abstract)
W85-02964

INFLUENCES OF INCREASED SAND DELIVERY ON THE MORPHOLOGY OF SAND AND GRAVEL CHANNELS,
Bureau of Land Management, Denver, CO.
W. L. Jackson, and R. L. Beschta.
Water Resources Bulletin, Vol. 20, No. 4, p 527-533, August, 1984. 5 Fig, 1 Tab, 28 Ref.

Descriptors: *Particle size, *Sand, *Gravel, *Channel morphology, Riffles, Bed load, Sediment transport, Scour, Roughness, Sedimentation.

A flume study was conducted to examine (1) changes in the particle-size distribution of sediments in riffles due to the proportion of sand in transport and the total rate of bedload transport at the time the riffle is deposited and (2) the effect of high sand transport rates on the stability of gravel riffles. The median particle size of sediment deposited in the riffle was larger than that of the sediment in transport. Small but significant (alpha = 0.05) decreases in the median particle size of riffle sediments resulted as the sand-to-gravel ratio of sediment in transport varied from 1:1 to 5:1. Gravel deposition efficiency decreased linearly as a function of the sand-to-gravel ratio. Increased concentrations of sand in transport caused previously stable gravel riffles to undergo scour. These results, in combination with information from other studies, suggest that an alluvial channel with pool-riffle sequences and with sand and gravel beds respond to an increased delivery of sand by reducing form roughness. Form roughness can be reduced be degrading riffles and filling pools. Subsequent responses may be increased in width-to-depth ratio and slope. (Author's abstract)
W85-02979

SEDIMENT TRANSPORT, PART I: BED LOAD TRANSPORT,
Waterloopkundig Lab., Delft (Netherlands).
L. C. van Rijn.
Journal of Hydraulic Engineering, Vol. 110, No. 10, p 1431-1456, October, 1984. 12 Fig, 2 Tab, 46 Ref, 1 Append.

Descriptors: *Bed load, *Sediment transport, Saltation, Velocity, Particle motion, Mathematical models, Gravel.

A method is presented which enables the computation of the bed-load transport as the product of the saltation height, the particle velocity and the bed-load concentration. The equations of motions for a solitary particle are solved numerically to determine the saltation height and particle velocity. Experiments with gravel particles (transported as bed load) are selected to calibrate the mathematical model using the lift coefficient as a free parameter. The model is used to compute the saltation heights and lengths for a range of flow conditions. The computational results are used to determine simple relationships for the saltation characteristics. Measured transport rates of the bed load are used to compute the sediment concentration in the bed-load layer. A simple expression specifying the bed-load concentration as a function of the flow and sediment conditions is proposed. A verification analysis using about 600 (alternative) data shows that about 77% of the predicted bed load-transport rates are within 0.5 and 2 times the observed values. (Author's abstract)
W85-03011

UNIFIED CULVERT SCOUR DETERMINATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W85-03013

FORMATION OF RIPPLES ON AN ERODIBLE BED,
Technical Univ. of Istanbul (Turkey). Dept. of Civil Engineering.
B. M. Sumer, and M. Bakioglu.
Journal of Fluid Mechanics, Vol. 144, p 177-190, July, 1984. 7 Fig, 23 Ref.

Descriptors: *Ripples, *Erosion, *Linear stability analysis, Reynolds number, Hydraulic engineering, Fluid mechanics, Flow, Streamflow, Stream bed, Bed load.

A linear stability analysis is presented of both hydraulically smooth and transitional flows over an erodible bed. The present theory is developed to account for the formation of ripples. The theory takes into consideration that the formation of ripples does not depend on flow depths, and that only the bed-load transport is involved in the formation of ripples. The effect of gravity is included in this analysis through the local inclination of the wavy bed surface. Results of the analysis show that an erodible bed will be unstable (and thus ripples will exist) when the grain Reynolds number is less than a certain value. The results appear to depend on the parameter beta, the effect of the combined action of the gravity and the local bed slope upon the bed-load transport. Ripple length appears to increase with grain size. The limiting values of the grain Reynolds number for ripple existence ob-

tained through present analysis were found to be in good agreement with observations. (Baker-IVI)
W85-03034

BED LOAD TRANSPORT IN A RIVER MEANDER,
California Univ., Berkeley. Dept. of Geology and Geophysics.
W. E. Dietrich, and J. D. Smith.
Water Resources Research, Vol. 20, No. 10, p 1355-1380, October, 1984. 26 Fig, 3 Tab, 44 Ref.

Descriptors: *Muddy Creek, *Wyoming, *Meanders, *Rivers, *Sediment transport, Bed load, Sedimentation.

Bed load transport in Muddy Creek, Wyoming, a sand-bedded meandering river with equilibrium bottom topography, consisted of a zone of maximum sediment flux that shifted across the channel from near the inside bank in the upstream part of the bend toward the pool at the minimum radius of curvature. This analysis of sediment transport indicated that a relatively small ratio of cross-stream to downstream transport will allow the zone of high bedload transport to follow the outward shifting zone of high boundary shear stress. Such a small ratio is difficult to measure or to compute from theory accurately. In large streams or in channels with high concentrations of suspended sediment that obscure the bed, it may be that the only way to compute the sediment transport vector through a given reach is to collect a large number of samples at selected positions across several closely spaced cross sections and then to compute the cross-stream sediment transport component using the equation for conservation of sediment mass. In the Muddy Creek study the oblique bed forms on the inside top of the point bar thin and die out where the zone of maximum boundary shear crosses from the inside bank toward the pool. The downstream increasing boundary shear stress over the pool causes the bed forms there to rotate. Coarse particles cross into the outward shifting zone of maximum boundary shear stress, and the fine particles are carried inward into the region of decreasing boundary shear stress. The zone of maximum bed load transport followed the outward shifting maximum boundary shear stress, leading to point bar equilibrium. Only at the downstream end of a bend, where the boundary shear stress field might not vary in the downstream direction, will a particle force balance that assumes no net cross-section transport apply. (Baker-IVI)
W85-03161

EVALUATION OF METHODS FOR CALCULATING THE CONCENTRATION OF SUSPENDED BED MATERIAL IN RIVERS,
Delaware Univ., Newark. Dept. of Geology.
J. E. Pizzuto.
Water Resources Research, Vol. 20, No. 10, p 1381-1389, October, 1984. 8 Fig, 2 Tab, 26 Ref.

Descriptors: *Suspended sediments, *River beds, *Sedimentation, *Mathematical equations, Sediment transport, Prediction, Rivers, Canals.

A modified Rouse equation is used to predict the average concentration of suspended bed material in rivers and canals with sandy, dune-covered beds. Equations of Einstein, Itakura and Kishi, and Engelund and Fredsoe are used to calculate the absolute concentration near the bed. The Itakura and Kishi equation gives the best results. The median concentration predicted with the Itakura and Kishi equation is about 50% greater than the observed concentration, and the errors vary within a relatively moderate range. Two empirical results were also obtained. A constant value of the absolute concentration equal to 22,258 ppm by weight, when substituted into the Rouse equation, gives better results than any of the theoretical equations. A simple regression equation is the most accurate of the methods discussed here. This suggests that, at present, empirical methods are superior to theoretical equations for practical determinations of suspended sediment concentrations. Current theories for the absolute concentration near the bed are incapable of accurately predicting trends observed in the field. Further study is needed to develop accurate models of sediment suspension for natural streams with sandy, dune-covered beds. (Baker-IVI)
W85-03162

STREAM-BED ARMOURING UNDER KNOWN CONDITIONS OF UPSTREAM SEDIMENT INPUT,
Ottawa Univ. (Ontario). Dept. of Civil Engineering.
E. J. Schiller, and A. C. Rowney.
Canadian Journal of Earth Sciences, Vol. 21, No. 9, p 1061-1066, September, 1984. 11 Fig, 3 Tab, 8 Ref.

Descriptors: *Armoring, *Sediment transport, *Stream beds, Sedimentation, Alluvial channels, Stability, Sediment load.

Experiments were conducted to assess ways in which an imposed sediment load can affect the formation and final nature of an armored bed. A flume loaded with a quartz aggregate of known composition was subjected to various sediment laden flows of water to produce armored beds. Characteristic parameters of the armored beds were then compared. Loads of sediment imposed on an armored bed by upstream sources can materially alter the final nature of the armored bed. This process appears to be the result of a complex interaction between original bed material and input feed sediment under the action of the flowing water. As the imposed sediment increased in particle size, the resulting grain roughness, amount eroded from the bed, and effective roughness of the bed all decreased. The mechanism by which the above trends occur is related to the motion of the upstream load in the flowing stream and is specifically related to the resulting bed forms and turbulent flow patterns. Even when specific bed forms were not created, moving sand grains apparently influenced formation of the armored layer. (Baker-IVI)
W85-03197

INTERPRETATION OF GRAIN-SIZE DISTRIBUTIONS FROM MEASURED SEDIMENT DATA, PLATTE RIVER, NEBRASKA,
Geological Survey, Denver, CO. Water Resources Div.
T. R. Eschner, and J. E. Kircher.
Sedimentology, Vol. 31, No. 4, p 569-573, August, 1984. 4 Fig, 9 Ref.

Descritors: *Sedimentation, *Particle size, *Platte River, *Nebraska, *River sediments, Bed load, Suspended sediments, Discharge frequency, Suspended solids, Flow discharge.

Breaks in the slope of log-probability plots of cumulative grain-size distributions of bed material are compared with frequency distributions of bedload and suspended sediment over a range of discharges at two stations on the Platte River in south-central Nebraska. The break between suspension and intermittent suspension as determined from the bed material curve coincides with the upper limit of the grain size overlap between bedload particles and suspended sediment particles, whereas the break between intermittent suspension and traction corresponds to the grain size at the lower limit of overlap of bedload particles and suspended sediment particles. Discharge has little effect on the size distribution of bedload, but it has a significant effect on the size distribution of suspended sediment. With increasing discharge, the percentage-finer value of a suspended sediment sample associated with a given grain size decreases. Thus, the overlap of the bedload and the suspended-sediment distributions lengthens as the coarsest grains in suspension increase in size with increasing discharge. (Baker-IVI)
W85-03214

FACIES MODEL FOR A SANDY EPHEMERAL STREAM AND CLAY PLAYA COMPLEX: THE MIDDLE DEVONIAN TRENTISHOE FORMATION OF NORTH DEVON, U.K.,
Plymouth Polytechnic (England). Geology Div.
I. P. Tunbridge.
Sedimentology, Vol. 31, No. 5, p 697-715, Oct 1984. 18 Fig, 2 Tab, 78 Ref.

Descriptors. *Model studies, *Sedimenta *Ephemeral streams, *Hangman Sandstone G *Trentishoe Formation, *Playas, Clay, Sands Floods, Sand, Sediments, Alluvial plains.

A model is developed for sandy ephemeral st and clay playa deposition using sedimentolo Trentishoe Formation of the Middle Devo Hangman Sandstone Group at its base. I types of sequence are found, representing p mal, medial and distal areas on an extensive all plain. Cross-cutting channel-fill sandstones pose the proximal sequence, representing the posits of a network of low sinuosity sand streams. Upwards coarsening cyclothems w start with relatively distal, thinly bedded sands and siltstone flood sheets cut by complexes o draped channel-fill sandstones and single cha fill sandstones comprise the Medial sequence. flood sheets coarsen and thicken upwards to proximal multistorey sheet sandstones. Lamin mudstone and sandstone cut by desiccation water escape features mark the Distal sequen These escape features alternate with wave rip sandstones, and represent playa lakes occasio incised by high sinuosity channels with late accreting sandstones. The three sequence represent the downslope progression from a sinuosity channel network which passed int ephemeral flood deposit complex which in drained into clay playa. (Baker-IVI)
W85-03215

CONTROLS OF SEDIMENTATION IN MALAWI RIFT VALLEY, CENTRAL AFR
Malawi Univ., Zomba. Dept. of Geography.
R. Crossley.
Sedimentary Geology, Vol. 40, No. 1/3, p 3 July, 1984. 6 Fig, 15 Ref.

Descriptors: *Sedimentation, *Malawi Rift Va *Africa, *Lake Malawi, Topography, Clim Rivers, Deltas, Phosphates, Minerals, Iron, basins, Climate, Topography.

The Malawi Rift is the southernmost classic valley trough in the Cenozoic African Rift V System. Much of its floor is flooded by Malawi which is about 570 km long, 60 km a and up to 500 m deep. This rift basin is a poten ly useful analogue of many economically impo ancient sedimentary troughs. The over-riding portance of the rift boundary structure in con ling sedimentation in the basin as a whole ca be over emphasized. The tectonic topograph the rift escarpment zone is important in contro the character of clastic inputs into the basin and the overall depth of the basin is also relate the type of rift boundary structure. The hydro and climate of the Malawi Basin ensures th substantial part of the basin is flooded and thermal stratification of the lake occurs. The w balance of the Malawi Trough shows that dents of basin location, in terms of how much rift drainage network is captured, can be as im tant as climate in determining whether the becomes filled to an overflow level with water, or whether it becomes floored by a sm enclosed, more saline depositional system. Cli is the dominant control on the hydrologic bu and at present the basin is flooded to over level. Prevailing winds are important in b ridge and back-beach aeolian dune developm Climatic conditions produce thermal stratifica of the lake, with an oxic epilimnion down to 2 depth overlying an anoxic hypolimnion. The bottom waters in the shallower parts of the appear to promote iron precipitation in the ments. (Baker-IVI)
W85-03216

2K. Chemical Processes

CHEMISTRY OF BULK PRECIPITATION A SITE IN SOUTHEAST ENGLAND SMALL-SCALE SPATIAL VARIATION,

QUENCY DISTRIBUTIONS AND VARIATION WITH TIME,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
R. A. Skeffington.
Atmospheric Environment, Vol. 18, No. 8, p 1683-1693, 1984. 8 Fig, 4 Tab, 24 Ref.

Descriptors: *Rainfall, *Seasonal variation, *England, Ammonium ion, Chloride, Deposition, Hydrogen, Nitrates, Organic matter, Sulfates, Spatial variation, Temporal variation.

A statistical analysis is offered of bulk precipitation chemistry data from rain falling on the Tillingbourne Catchment, Surrey, Southeast England in the years 1978-1981. Measurements of weekly average pH, organic content, sulfate, nitrate ammonium and chloride were made. There is some evidence for small-scale variation in precipitation chemistry. Some of the organic component was probably due to a local source. The more elevated rain sampler collected more rainfall and concentrations were no lower, confirming that deposition is governed by rainfall amount. Weekly precipitation pH was normally distributed with a few outliers at high pH. Other precipitation species were about log-normal distributed, but sulfate, and ammonium had more high values than expected and chloride was irregularly distributed. More deposition fell in a fairly small proportion of weeks. Both concentration and deposition vary substantially from month to month and from year to year. Most ions have late spring maxima in concentrations except of Cl(-) which had a winter maximum and FA where the peak extends into summer. The evidence suggests that these patterns are due to meteorological factors. The seasonal pattern in deposition is similar but not as strong. (Baker-IVI)
W85-02732

CHEMISTRY OF BULK PRECIPITATION AT A SITE IN SOUTHEAST ENGLAND - II. RELATIONSHIPS BETWEEN IONS AND COMPARISON WITH OTHER SITES,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
R. A. Skeffington.
Atmospheric Environment, Vol. 18, No. 8, p 1695-1704, 1984. 4 Fig, 7 Tab, 30 Ref.

Descriptors: *Rainfall, *Precipitation chemistry, *England, *Ions, Ammonium, Chlorides, Regression analysis, Hydrogen ion concentration, Sulfates, Nitrates.

A statistical analysis of bulk precipitation chemistry of rain falling on the Tillingbourne Catchment, Surrey, England is presented. The mean volume-weighted pH of precipitation over the years 1978-1981 was 4.15. This is at the low end of the range of other measuring sites in the United Kingdom. Concentrations of sulfates, nitrates, ammonium ions and chlorides were moderate compared to other United Kingdom sites. Seasonal patterns in ionic ratios are not pronounced. Ionic concentrations are highly correlated. The slope of the regression of H(+) vs NO3(-) is almost unity, which probably means that most of the nitrate anion is associated with nitric acid. Deposition is approximately related to rainfall by a power law relationship in which the exponent of the equation varies between 0.5 and 0.9. Both precipitation volume and concentration are required to estimate deposition adequately. (Baker-IVI)
W85-02733

CARBON AND HYDROGEN ISOTOPIC COMPOSITION OF BACTERIAL METHANE IN A SHALLOW FRESHWATER LAKE,
Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hanover (Germany, F.R.).
For primary bibliographic entry see Field 2H.
W85-02786

DISSOLVED IODINE SPECIES IN A BRITISH FRESHWATER SYSTEM,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2H.
W85-02788

ORGANIC COMPLEXATION OF ZINC IN ESTUARINE INTERSTITIAL AND SURFACE WATER SAMPLES,
Liverpool Univ. (England). Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W85-02789

CARBON FLOW THROUGH OXYGEN AND SULFATE REDUCTION PATHWAYS IN SALT MARSH SEDIMENTS,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 2L.
W85-02790

PARTICLE FLUX AND TRACE METAL RESIDENCE TIME IN NATURAL WATERS,
Lamont-Doherty Geological Observatory, Palisades, NY.
P. H. Santschi.
Limnology and Oceanography, Vol. 29, No. 5, p 1100-1108, September, 1984. 3 Fig, 2 Tab, 50 Ref. DOE grant DE-AC02-76-EV02185 and NSF grant DEB-80-17639.

Descriptors: *Trace metals, *Chemical composition, *Fluctuations, *Zinc, *Thorium, *Oceans, *Lakes, Nuclides, Seawater.

A simple inverse relationship between trace metal residence time and particle flux through the water column was tested on the trace metals Zn(2+) in freshwater and Th(IV) in ocean water systems with available data on the vertical flux and concentration of particulate matter and of Zn(2+) in lakes or on the disequilibrium of U/Th nuclides in the ocean. Even though a single-box model of trace metal removal from a body of water such as the ocean or a lake is an oversimplification, it appears that this approach together with a first-order removal process adequately represents the cycling of trace metals such as Th(IV) in the ocean and Zn(II) in lakes. The master variable in this case is the particle flux through the system, which regulates both concentration and residence times. (Baker-IVI)
W85-02792

DETERMINATION OF INORGANIC TELLURIUM SPECIES IN NATURAL WATERS,
Florida State Univ., Tallahassee. Dept. of Oceanography.
M. O. Andreae.
Analytical Chemistry, Vol. 56, No. 12, p 2064-2066, October, 1984. 1 Fig, 1 Tab, 20 Ref. NSF grant OCE-8200931.

Descriptors: *Water analysis, *Tellurium, *Natural waters, Seawater, Chemical analysis, Natural waters, Spectrometry.

A combination of preconcentration and analytical procedures which allow the determination of Te(IV) and Te(VI) with Mg(OH)2 at concentrations typical of natural waters is presented. Te(IV) and Te(VI) are coprecipitated from natural waters, including seawater. Following redissolution of the precipitate with HCl, Te(IV) is reduced in 3 M HCl to tellurium hydride. The hydride is trapped inside the graphite tube of a graphite furnace atomic absorption spectrometer heated to 300 C, and then determined by atomization. Te(VI) is reduced to Te(IV) by boiling with HCl and then determined as Te(IV). The limit of detection is 0.5 pmol/L and the precision is 10-20%. (Baker-IVI)
W85-02831

ION CHROMATOGRAPHIC DETERMINATION OF NITRATE AND SULFATE IN NATURAL WATERS CONTAINING HUMIC SUBSTANCES,
Lund Univ. (Sweden). Dept. of Analytical Chemistry.
G. Marko-Varga, I. Csiky, and J. A. Jonsson.
Analytical Chemistry, Vol. 56, No. 12, p 2066-2069, October, 1984. 2 Fig, 3 Tab, 14 Ref.

Descriptors: *Water analysis, *Nitrates, *Sulfates, *Natural waters, *Humic acids, Chromatography, Monitoring.

In the study of the pollution of natural waters, the concentrations of nitrate and sulfate are important factors. The analytical methods use for nitrates and sulfates are to varying extents influenced by the presence of humic substances in natural waters. Determinations of anions in natural waters by various methods, including ion chromatography, are disturbed by the inevitable presence of humic substances. A cleanup column, packed with chemically bonded amine material for HPLC, is useful for the selective removal of disturbing humic substances prior to anion analysis by ion chromatography. For all the development work described, the same separation column is used. No change was noted in color of the resin nor any deterioration of the chromatographic properties after more than 500 injections and thus it was concluded that the separation column was effectively protected from the disturbing fraction of humic acid. A technique similar to the one described probably can be used to discriminate metal ions associated with humic substances from free metal ions. (Baker-IVI)
W85-02832

MAJOR ION AND CARBONATE SYSTEM CHEMISTRY OF A NAVIGABLE FRESHWATER CANAL,
Liverpool Univ. (England). Dept. of Inorganic, Physical and Industrial Chemistry.
For primary bibliographic entry see Field 5B.
W85-02841

CONCENTRATIONS AND ANNUAL LOADING OF DISSOLVED ORGANIC MATTER IN A SMALL MOORLAND STREAM,
Stirling Univ. (Scotland). Dept. of Environmental Science.
For primary bibliographic entry see Field 5B.
W85-02842

ACID PRECIPITATION IN THE COLORADO FRONT RANGE: AN OVERVIEW WITH TIME PREDICTIONS FOR SIGNIFICANT EFFECTS,
Colorado Univ. at Boulder. Dept. of Environmental, Population, and Organismic Biology.
G. W. Kling, and M. C. Grant.
Arctic and Alpine Research, Vol. 16, No. 3, p 321-329, August, 1984. 5 Fig, 4 Tab, 76 Refs.

Descriptors: *Colorado Front Range, *Rocky Mountains, *Acid precipitation, *Ecological effects, Lakes, Streams, Alpine regions, Mountains, Model studies.

The sensitivity of both aquatic and terrestrial systems to acid precipitation is determined by the dynamic interaction of pedology, vegetation, geology, and climate. By evaluating these variables, first-level assessments were made regarding the sensitivity of Colorado Front Range to the effects of increasing acicity in precipitation. Natural features in the Colorado Front Range interact to form a region that is potentially sensitive to acid precipitation. Regression analysis on historical data from 88 lakes and streams showed significant ($p < 0.001$) decreasing pH and alkalinity trends with increasing elevation. A similar significant ($p < 0.008$) decreasing trend as elevation increases was found for soil pH and base saturation. The greatest proportion of change in acid input and buffering capacity in this western region has probably occured in the last 10 years. Considering both soil and water chemistry, regions above 3300 m (alpine) were the most sensitive to continued inputs of acidic materials. If current acid loading rates remain constant, strong potential exists for buffering losses in surface waters, increases in soil acidification, and adverse effects on biota. A model using reported rates of decline in buffering capacities of Front Range lakes suggests that these changes are likely to become important in a matter of decades. If acid deposition rates increase, buffering capacity losses in lakes and streams will sooner reach the

threshold where adverse biological changes will occur. (Collier-IVI)
W85-02856

VARIATION OF CALCIUM, MAGNESIUM, SODIUM AND POTASSIUM CONCENTRATION, PH AND CONDUCTIVITY IN LAKES IN NORTHERN IRELAND,
New Univ. of Ulster, Coleraine (Northern Ireland). Limnology Lab.
For primary bibliographic entry see Field 2H.
W85-02894

INTERACTION OF CLAYS WITH DILUTE FLUORIDE SOLUTIONS,
Newcastle Univ. (Australia). Dept. of Chemistry.
J. Slavek, H. Farrah, and W. F. Pickering.
Water, Air, and Soil Pollution, Vol. 23, No. 2, p 209-220, August, 1984. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Clays, *Fluorides, *Fate of pollutants, Hydrogen ion concentration, Sodium fluoride, Kaolinite, Illite, Montmorillonite, Aluminum, Adsorption.

Interaction between dilute (mg/L) NaF solutions and clay suspensions (0.08% w/v) has been examined as a function of pH (range 3 to 8), clay type (Na(+)- or Ca(2+)-kaolinite, illite, montmorillonite) and NaF concentration. No F loss from solution was detected at pH $>$ 6.5, while enhanced uptake was found on decreasing the pH, especially in the 4 to 3 region. Removal of F from 0.0001 to 0.0006 M NaF was only slightly dependent on weight of solid, but did increase with concentration of F(-). It is proposed that F losses are due to the formation of sparingly soluble Al species (e.g. cryolite, Na fluoro silicate), occasionally augumented with CaF2 formation (Ca(2+)-clays). The Al is released by proton attack on the lattice, following conversion of the suspended solids into the unstable H(+)-form, either through acid addition (pH $<$ 5) or through hydrolysis of the Na(+)-form material. The latter process was most pronounced with the illite and montmorillonite samples. The amount of F fixed by montmorillonite was roughly double that held by the other two clays, and had maximum value (pH 3) of approximately 4 mg/g, using 11 mg/L NaF solutions. Soluble fluoro-complexes, similar in quantity to the retained F, were detected, in many of the studies. It was concluded that contact of the clay components of soils or sediments with mg/L levels of F in adjacent aqueous phases would result in only a minor proportion being retained. (Author's abstract)
W85-02928

PHOTOREDUCTIVE DISSOLUTION OF COLLOIDAL IRON OXIDES IN NATURAL WATERS,
Massachusetts Inst. of Tech., Cambridge.
T. D. Walte, and F. M. M. Morel.
Environmental Science and Technology, Vol. 18, No. 11, p 860-868, November, 1984. 11 Fig, 2 Tab, 39 Ref. NSF grant OCE-8119103 and NOAA grant NS79AA-D-00077.

Descriptors: *Photochemical reactions, *Iron oxides, *Dissolution, *Natural waters, Chromophores, Colloids, Organic matter, Photoreduction, Irradiation, Hydrogen peroxide, Hydrogen ion concentration.

Size-separation (0.1 micro m filtration and ultrafiltration) techniques and coulometric procedures have been used to investigate the photoreductive dissolution of iron oxides under conditions typical of natural waters. In the absence of organic agents, iron oxides are solubilized to varying degrees through photodissociation of ferric hydroxy groups at the colloid surface. The degree of dissolution is dependent principally on the chromophore concentration and is highest at low pH and high colloidal surface area. Naturally occurring organic materials significantly increase the initial rate of dissolution. Despite the enhancement by organic agents significant effects of light on net dissolution are only observed at low pH. Irradiation of natural waters produces hydrogen peroxide in quantities sufficient to markedly affect the solution-phase speciation of iron and under certain conditions (e.g., seawater) also affects the net photodissolution of iron oxides. (Author's abstract)
W85-03057

ACTYLENE REDUCTION AND NITROGEN FIXATION POTENTIAL IN SOME EUTROPHIC LAKE SEDIMENTS,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
L. Mackenzie.
New Zealand Journal of Marine and Freshwater Research, Vol. 18, No. 2, p 241-249, July, 1984. 3 Fig, 3 Tab, 20 Ref.

Descriptors: *Nitrogen fixation, *Acetylene reduction, *Eutrophic lakes, Lake sediments, Nutrients, Biomass, Microorganisms, Organic carbon.

The in situ acetylene-reducing (nitrogen-fixing) activities within the sediments of 2 eutrophic lakes were examined to determine whether this process plays a significant role in enhancing nutrient enrichment of these lakes. Estimates of the N-fixing potential on a sediment dry-weight basis were 10.9-112.1 ng/g/h or on an area basis were 45.3-99 ng/sq m/h. The distribution of C2H2 reducing activity within the sediment paralleled the distribution of Kjeldahl N, total organic carbon, and microbial biomass and was inversely related to NH4(+)-N in interstitial water. A seasonal variation in the activity was observed in the top most sediment strata, with the highest rates occurring during winter. Estimates of the total N input reveal that this is of little quantitative importance compared to inputs of combined N from other sources. (Author's abstract)
W85-03075

HYDROCHEMICAL BUDGETS FOR A MAGNESIAN LIMESTONE CATCHMENT IN LOWLAND ENGLAND,
Birmingham Univ. (England). Dept. of Civil Engineering.
R. W. Crabtree, and S. T. Trudgill.
Journal of Hydrology, Vol. 74, No. 1/2, p 67-79, October, 1984. 2 Fig, 7 Tab, 22 Ref.

Descriptors: *Hydrochemistry, *Magnesian Limestone, *England, *Solution budget, Solutes, Weathering, Groundwater, Calcium, Magnesium, Water pollution effects, Acid rain, Percolation, Springs, Piston flow, Matrix seepage.

A solute budget study was conducted on a Magnesian Limestone catchment in lowland eastern England for a year from June 1, 1979 to June 1, 1980. Of the total solute output from the catchment, 66% was derived from chemical weathering. This was equivalent to the removal of 778.1 kg/ha/yr in solution. Solutional denudation losses of Ca(2+) and Mg(2+) were 180 and 101 kg/ha/yr, with a Ca(2+)/Mg(2+) ratio of 0.57. The total input of material from atmospheric sources into the catchment was 400.5 kg/ha/yr. The high input is assumed to be the result of air pollution by nearby industries, a higher rainfall and wind-blown soil and quarry dust. The major solutes species produced were Ca(2+), Mg(2+) and HCO(-3), derived mainly from chemical weathering by percolating acidic rain water. Catchment runoff was comprised of combined piston flow in fissures to springs and matrix seepage. Solute levels are lower in spring than wells, but Ca(2+)/Mg(2+) ratios overlap for the two flow types. Springs have a rapid response to rainfall events, without any dilution of solute concentrations. The wells all showed a slight seasonal response, which was more evident in the springs. (Moore-IVI)
W85-03083

SIMULATION OF NITROGEN DYNAMICS IN FLOODED SOILS,
Florida Univ., Gainesville. Dept. of Soil Science.
P. S. C. Rao, R. E. Jessup, and K. R. Reddy.
Soil Science, Vol. 138, No. 1, p 54-62, July, 1984. 8 Fig, 6 Tab, 26 Ref.

Descriptors: *Flooded soils, *Nitrogen cycle, *Simulation, Fertilizers, Denitrification, Volatilization, Nitrification, Hydrogen ion concent
Nitrates, Ammonia, Flooding.

A simulation model, NFLOOD, was develop
describing simultaneous partitioning, trans
tions, and transport of nitrogen in flooded
Selected cases were simulated using NFLO
identify the relative gaseous losses of so
fertilizer N via denitrification and NH3 vol
tion. Model simulations identified the factor
trolling gaseous N losses to be: the rate of NI
and NO3(-) diffusion from or into the soil; ni
tion (NH4(+) to NO3(-)) rate in the floo
and the soil; the magnitude of diel variati
floodwater pH, and the method of fertili
application. Addition of fertilizer N to floo
rather than to soil results in greater gaseous
of N. NH3 volatilization losses are importan
with significant diel variations in floodwat
and when nitrification rate is small, and denit
tion losses are directly related to rate of ni
tion in the floodwater and the oxidized soil
In this model, NH4(+) and NO3(-) upta
plants from the floodwater and from the soi
not considered. Denitrification losses may be
er, and volatilization losses may be smalle
those simulated at present. (Moore-IVI)
W85-03092

AMMONIUM ION, HUMIC MATERIALS, TRIHALOMETHANE POTENTIAL NORTHEASTERN KANSAS GRO WATERS,
Kansas State Geological Survey, Lawrence.
J. E. Denne, L. R. Hathaway, and S. P. McC
Groundwater, Vol. 22, No. 6, p 755-763, N
ber-December, 1984. 5 Fig, 4 Tab, 26 Ref.

Descriptors: *Glacial aquifers, *Groundwate
lution, *Kansas, Humic acids, Ammonium
trates, Trihalomethanes, Aquifers.

Glacial buried-valley aquifers serve as pr
sources of potable groundwater in northe
Kansas. Potential problems associated wit
trates, ammonium, and organic material do ex
a large percentage of well waters in the regio
nitrate level standard for drinking water is ex
ed, but water from the deep buried valleys
monly has low nitrate levels and relatively
ammonium concentrations. The high dissolve
monium concentrations seem to be associated
reducing conditions and relatively high lev
extractable ammonium in the glacial dep
which range up to 75 mg/kg. The amounts g
ally increase downward from the topsoil,
highest values in the gray sediments and b
soils, materials often containing high conte
organic matter. A black floating scum observ
the fluid and sediments from numerous test
drilled in the study area may be from buried h
materials. Chlorination of water containing h
material and other dissolved organics may le
the production of chloroorganic compound
cluding THMs. For two public-water supply
chlorinated samples quenched for one week
ed THM concentrations close to the maxi
contaminant level The THM production pot
and the ammonium content of ground water
the glacial aquifers need further evaluation.
role of anaerobic bacteria in these aquifer sy
might warrant consideration in relationship t
THM potential of the waters. In this hydroge
mical environment, well siting and constru
and disinfection procedures need careful revie
order to minimize water quality hazards. (B
IVI)
W85-03155

ISOTOPE GEOCHEMISTRY OF STRATI LAKE 'A', ELLESMERE ISLAND, N.W CANADA,
Calgary Univ. (Alberta). Dept. of Geography.
For primary bibliographic entry see Field 2H.
W85-03195

WATER-ROCK INTERACTION AND CHE TRY OF GROUNDWATERS FROM THE NADIAN SHIELD,

Waterloo Univ. (Ontario). Dept. of Earth Sciences.
S. K. Frape, P. Fritz, and R. H. McNutt.
Geochimica et Cosmochimica Acta, Vol. 48, p. 1617-1627, 1984. 6 Fig, 2 Tab, 36 Ref.

Descriptors: *Chemical composition, *Canadian Shield, *Groundwater, Geochemistry, Water analysis, Isotopes, Chlorides, Bromides, Salts, Dissolved solids, Saline water, Brines, Temperature effects.

The chemical and isotopic compositions of groundwaters in the crystalline rocks of the Canadian Shield reflect different degrees of rock-water interactions. The chemistry of the shallow, geochemically immature groundwaters and especially of the major cations is controlled by local rock compositions, whereby dissolution reactions dominate. Conservative constituents, such as chloride and bromide, are not entirely a result of such reactions but appear to be readily added from leachable salts during the initial stages of the geochemical evolution of these waters. Their concentration changes little as major cations increase, until concentrations of total dissolved solids reach 3000 to 5000 mg/l. The isotopic composition of these shallow waters reflects local, present day precipitations. Isotopic and chemical compositions of the deep, saline waters and brines are determined by extensive, low-temperature rock-water interactions. This is documented in major ion chemistries, oxygen contents and strontium isotopic compositions. These data indicate that the deep brines have been contained in hydrologically isolated pockets. The almost total loss of primary compositions makes discussion of the origin of these brines very speculative. All brines from across the Canadian Shield have a very similar chemical composition, which probably reflects a common geochemical history. The concentrations of some major and most minor elements in these fluids appear to be governed by reactions with secondary mineral assemblages. (Baker-IVI)
W85-03205

INCORPORATION OF TRIVALENT CHROMIUM INTO RIVERINE AND ESTUARINE COLLOIDAL MATERIAL,
Maine Univ. at Orono, Walpole. Dept. of Oceanography.
L. M. Mayer, L. L. Schick, and C. A. Chang.
Geochimica et Cosmochimica Acta, Vol. 48, No. 9, p 1717-1722, 1984. 6 Fig, 31 Ref.

Descriptors: *Chemical reactions, *Chromium, *Estuarine environment, Trace metals, Salinity, Seawater, Flocculation.

The binding of dissolved trivalent chromium by dissolved and colloidal substrates at the river-estuary interface was studied using a combination of product and reactant mode experiments, at concentrations of materials typical of estuarine conditions. Using spikes of 1-20 micro g/l Cr(3+), about one third of the Cr(3+) was scavenged by that fraction of riverine colloidal material which flocculated upon mixing of river water and seawater. Reactant mode experiments, using chemiluminescence as a speciation technique, showed that virtually all of the spiked Cr(3+) was bound by dissolved or colloidal substrates, but that the higher molecular weight fractions were able to kinetically out-compete the lower molecular weight fractions. Cr added to waters near a river estuary interface may apparently be bound within a few hours by dissolved or colloidal material present in the river water. On the order of a third of this scavenged material will be incorporated into the flocs that form as a result of destabilization of riverine colloidal material by seasalt, owing to the higher reactivity of the riverine colloidal material to Cr binding. The increase in salinity encountered during passage of the river water through the estuary will probably not kinetically inhibit this binding, nor will it have much effect on the partitioning of the Cr between flocculated and unflocculated substrates. (Baker-IVI)
W85-03206

DESORPTION AND COAGULATION OF TRACE ELEMENTS DURING ESTUARINE MIXING,
Lamont-Doherty Geological Observatory, Palisades, NY.
Y.-H. Li, L. Burkhardt, and H. Teraoka.
Geochimica et Cosmochimica Acta, Vo. 48, No. 9, p 1879-1884, October, 1984. 4 Fig, 2 Tab, 25 Ref.

Descriptors: *Trace elements, *Estuarine environment, *Desorption, *Coagulation, *Hudson River, *Mississippi River, Seawater, Suspended solids, Hydrogen ion concentration, Heavy metals.

Mixing experiments of seawater and the Hudson and Mississippi riverwaters with radiotracer spikes show that Co, Mn, Cs, Cd, Zn, and Ba will be desorbed from river suspended particles, while significant fractions of dissolved Fe, Sn, Bi, Ce, and Hg will be coagulated during estuarine mixing. The Kd's for Co, Mn, Cs, Cd, Zn, and Ba decrease with salinity, suggesting the desorption of these cations from the river suspended particles during estuarine mixing. The coagulation of the metal-humates of these cations are negligible during the estuarine mixing of the Hudson and Mississippi rivers. The increase of distribution coefficients (Kd's) for Fe, Sn and Bi, Ce and Hg with salinity suggests that a significant fraction of Fe, Sn, Bi, Ce and Hg coagulate during estuarine mixing. The Kd for Ir is independent of salinity and the Kd for Sb decreases only slightly with increasing salinity or pH. Both elements may exist as anions in natural aquatic environments. The decrease in Kd for Hg with slight increase in pH may indicate the existence of anionic Hg-organic matter complexes in natural aquatic environments. The extent of desorption of Co, Mn, Cs, Cd, Zn and Ba from suspended particles during estuarine mixing depends more on salinity than on pH changes. In a normal natural estuarine environment, the increase in both pH and sea salts and the existence of suspended particles all enhance the coagulation of metals with high hydrolysis constants such as Fe, Sn, Bi and rare earths. (Baker-IVI)
W85-03208

MANGANESE CHEMISTRY IN RIVERS AND STREAMS,
Edinburgh Univ. (Scotland). Dept. of Geology.
D. P. H. Laxen, W. Davison, and C. Woof.
Geochimica et Cosmochimica Acta, Vol. 48, No. 10, p 2197-2111, October, 1984. 4 Fig, 2 Tab, 33 Ref.

Descriptors: *Manganese, *Rivers, *Streams, *Chemistry, Chemical speciation, Chemical properties, Acidity, Specific conductance, Geochemistry, Particulates, Lakes.

The speciation of Mn in 15 rivers and streams representing a wide range of water types is examined. By collecting details of the geochemistry of these waters factors which play an important role in determining the speciation pattern may be discerned. Using the technique of anodic stripping voltammetry (asv), specific for reduced Mn(II) species, a major part of the <0.015 micro m Mn size fraction is found to be present in a reduced Mn(II), asv-labile, form. There is also a significant asv inactive Mn fraction found in some waters, considered to be present as a small colloidal species. The soluble Mn fraction represented 15-95% of the total Mn and does not appear to be dependent upon pH, alkalinity, conductance or humic substance concentration in the water. Under the dynamic, short residence time, conditions that apply in most rivers, the particulate and soluble Mn fractions are decoupled, their respective presence being dependent principally on the catchment hydrogeological conditions. Consideration of manganese speciation in waters which were incubated for five months showed that pH becomes the controlling factor when equilibrium is approached. Thus it appears in general that Mn chemistry in rivers and streams is dominated by the hydrogeological conditions in the catchment, rather than chemical processes within these water bodies. It is only when Mn enters lakes, estuaries and the ocean, where residence times are considerably longer, that chemical processes will become dominant and the system will approach an equilibrium speciation. (Baker-IVI)
W85-03213

2L. Estuaries

NITROGEN-15 ISOTOPE DILUTION STUDY OF AMMONIUM PRODUCTION AND CONSUMPTION IN A MARSH SEDIMENT,
Marine Biological Lab., Woods Hole, MA.
W. B. Bowden.
Limnology and Oceanography, Vol. 29, No. 5, p 1004-1015, September, 1984. 4 Fig, 5 Tab, 28 Ref.
DEB grant 81-12090 and NFS grant OCE 78-0847.

Descriptors: *Marshes, *Ammonium, *Isotope studies, Sediments, Tidal marshes, Temperature effects, Microbial degradation, Massachusetts.

Isotope dilution experiments were performed using sediments from a tidal, freshwater marsh in Massachusetts. Ammonium production (rp) and consumption (rc) rates in these marsh sediments are controlled in large part by temperature and the quality and availability of organic substrates. High temperature and good substrate quality support high values for rp and rc, while low temperature and poor substrate quality restrict rp and rc. In general, the cumulative effect of these controlling variables is to restrict most ammonium production and consumption to the top 10-20 cm of sediment during the warm growing season of May-September. The mean gross rate of ammonium production for seven experiments run between September 1980 and December 1981 is about 11.6 nmol N/cu cm of fresh sediment/hr for 5-10 cm deep, mixed, emergent marsh sediments incubated at 13 C. For the same sediments, gross consumption excluding plant root uptake is about 6.4 nmol N/cu cm fresh sediment/hr. The findings show that mixing elevates ammonium production and consumption rats by up to 7 times and that the observed rates are constant for about 50 hr. Isotope dilution of ammonium is a good indicator of ammonium turnover in sediments but may be a poor indicator of total nitrogen turnover and, therefore, of total microbial activity. (Baker-IVI)
W85-02787

ORGANIC COMPLEXATION OF ZINC IN ESTUARINE INTERSTITIAL AND SURFACE WATER SAMPLES,
Liverpool Univ. (England). Dept. of Oceanography.
C. M. G. van den Berg, and S. Bharmvanij.
Limnology and Oceanography, Vol. 29, No.5, p 1025-1036, September, 1984. 6 Fig, 4 Tab, 34 Ref.

Descriptors: *Estuaries, *Zinc, *Surface waters, *Metal complexes, River Mersey, River Dee, River Ribble, England, Gulf of Thailand, Heavy metals, Estuarine environment, Chemical reactions, Salinity.

The organic complexing capacity for zinc in natural water samples was determined by equilibration of added Zn-65 with manganese dioxide. Stability constants for complexes with EDTA and NTA in seawater were determined in preliminary tests. Samples were collected from interstitial waters in surficial sediments from the upper Gulf of Thailand and the estuary of the River Mersey in England and from surface water from the estuaries of the Rivers Dee and Ribble in England. Complexing capacities for zinc of between 0.02 and .000002 M were observed in the surface water. Values for conditional stability constants ranged from 7.4 to 9.3 and decreased with increasing salinity. Between 93 and 98% of zinc is complexed by organic material in most interstitial water samples as a result of higher ligand concentrations, much less in surface waters. This finding indicates that the dissolved zinc concentration may well increase as a result of competition by dissolved ligands for zinc adsorbed on sedimentary particles. Such a process of remobilization of adsorbed zinc as a result of ligand production by bacterial or algal decay, may explain the increased metal concentrations in waters near sediments or in shallow waters. (Baker-IVI)
W85-02789

CARBON FLOW THROUGH OXYGEN AND SULFATE REDUCTION PATHWAYS IN SALT MARSH SEDIMENTS,
Woods Hole Oceanographic Institution, MA.
B. L. Howes, J. W. H. Dacey, and G. M. King.
Limnology and Oceanography, Vol. 29, No. 5, p 1037-1051, September, 1984. 7 Fig, 54 Ref. NSF grants BSR7905127, BSR8021741, BSR8104701, and NSF EPSCOR.

Descriptors: *Salt marshes, *Sediments, *Oxygen uptake, Sulfates, Chemical reactions, Seasonal variation, Salinity, Interstitial water, Hydrogen ion concentration, Carbon dioxide.

Surface oxygen uptake, sulfate reduction and total sediment metabolism were measured in sediments (0-30 cm) supporting stands of short Spartina alterniflora in a New England salt marsh. Surface oxygen uptake varied seasonally and was highly correlated with total sediment metabolism. Rates of oxygen uptake ranged from about 75 to 121 mmol/sq m/day during winter to a maximum in August of 363. Total carbon dioxide production followed the same trend with a winter low of 65 mmol/sq m/day and a maximum in August of 415. Porewater salinity was constant with depth, ranging between 31.7 and 31.9% In contrast, both pH and percent water varied with depth. The pH was lowest in the top 1 cm and rose to about pH 6.9 below 5 cm. The sulfate concentration in porewater from the 0-2 cm interval was about that expected from seawater at the salinity of the interstitial water. Below this depth sulfate decreased to values of about 21.6 mmol/liter. The rate of increase in carbon dioxide concentration at all depths in the sediment was linear through time. Time-course experiments using carbon dioxide production and sulfate reduction indicate that the aqua regia technique is not reliable for measuring sulfate reduction and that the rate of sulfate reduction is much less than previously reported for this marsh. Estimates of annual oxygen uptake conform with those of carbon dioxide production and below ground production. Carbon mineralization is estimated to average about 180 mmol C/sq m/day, among the highest measured for marine sediments. Simultaneous measurements of oxygen uptake, carbon dioxide production and sulfate reduction suggest that at least half of this decomposition occurs via sulfate reduction. (Baker-IVI)
W85-02790

ABOVE- AND BELOWGROUND EMERGENT MACROPHYTE PRODUCTION AND TURNOVER IN A COASTAL MARSH ECOSYSTEM, GEORGIA,
Georgia Univ., Sapelo Island. Marine Inst.
J. P. Schubauer, and C. S. Hopkinson.
Limnology and Oceanography, Vol. 29, No. 5, p 1052-1065, September, 1984. 6 Fig, 2 Tab, 47 Ref. Savannah State College contract R806728020.

Descriptors: *Coastal marshes, *Macrophytes, *Productivity, *Georgia, Primary productivity, Estuaries, Marshes, Seasonal variation, Distribution.

Seasonal patterns of above ground plant mass and the depth distribution of live roots, rhizomes, and dead below ground organic matter were measured for Spartina alterniflora and Spartina cynosuroides in Georgia tidal marshes. The estimates obtained of total net primary production for S. alterniflora and S. cyanosuroides (7,620 and 7,708 g dry mass/sq m/yr, respectively) are larger than any previously reported productivity values for salt and brackish marsh macrophytes based on harvest techniques. Below ground production was roughly 1.6 x above ground production. Turnover rates for below ground live material were 1.42/yr for S. cyanosuroides and 3.22/yr for S. alterniflora. The fate of root and rhizome material, including the extent to which such material enters the estuarine or nearshore food webs, is not clear. (Baker-IVI)
W85-02791

SUSPENDED SEDIMENT RESPONSES IN A WIND-DOMINATED ESTUARY OF THE TEXAS GULF COAST,
Minerals Management Service, Corpus Christi, TX.
For primary bibliographic entry see Field 2J.
W85-02835

SOUTH AFRICAN ESTUARIES AND THEIR IMPORTANCE TO FISHES,
Port Elizabeth Museum, Humewood (South Africa).
J. H. Wallace, H. M. Kok, L. E. Beckley, B. Bennett, and S. J. M. Blaber.
South African Journal of Science, Vol. 80, No. 5, p 203-207, 1984. 5 Fig, 1 Tab, 15 Ref.

Descriptors: *South Africa, *Estuaries, *Fisheries, *Fish migration, Ecological effects, Species distribution, Migration, Estuarine environment.

South African estuaries represent a specialized environment; of a total of approximately 1500 species of fish found on the continental shelf, fewer than 100 species are able to make use of the estuaries. A mass migration by small juveniles of these species into estuaries is very marked during late winter, spring, and early summer; in the estuaries, high temperatures and a rich food supply favor rapid growth, and the juveniles are protected from most marine predators. The fish migrate back to sea with the onset of adolescence. Data from nearshore sampling programs have enabled the division of South Africa's estuary-associated fish fauna into six categories according to the extent of their dependence on estuaries. Of the 81 species which depend on estuaries, 29 are taken by anglers and an additional 21 are suitable for human consumption. Continuing degradation will result in a decline in South Africa's estuarine fish fauna and consequently in recreational angling, in the yield of high-protein food and in economic activities dependent upon this natural resource. (Collier-IVI)
W85-02837

MACROBENTHIC COMMUNITIES OF THE LOWER CHESAPEAKE BAY. II. LYNNHAVEN ROADS, LYNNHAVEN BAY, BROAD BAY,AND LINKHORN BAY. BENTHIC STUDIES OF THE LOWER CHESAPEAKE BAY 5,
Old Dominion Univ., Norfolk, VA. Dept. of Oceanography.
G. H. Tourtellotte, and D. M. Dauer.
Internationale Revue der Gesamten Hydrobiologie, Vol. 68, No. 1, p 59-72, 1983. 3 Fig, 6 Tab, 45 Ref.

Descriptors: *Chesapeake Bay, *Benthos, *Lynnhaven Bay, *Broad Bay, *Linkhorn Bay, *Virginia, Bays, Ecological distribution, Species diversity, Sediments, Macrobenthos, Water quality.

Preliminary data was sought on the subtidal macrobenthic communities of the Lynnhaven Bay system. Species distributions were examined in relation to sediment distributions. Most species dominant in clean sands were restricted to this sediment type, while most dominant species in sediments containing silt-clay were widely distributed. Ranges of indices of community structure were largest in clean sands which is probably the result of a combination of greater porosity and permeability of this sediment type and strong seasonal recruitment patterns. Species diversity was highest in fine sands containing silt-clay, due to spatial heterogeneity caused by a mixture of sediment types and particle reworking by species. Low diversity in Linkhorn Bay may indicate water quality problems resulting from urbanization of the shoreline. (Baker-IVI)
W85-02902

USE OF OLIGOHALINE MARSHES BY FISHES AND MACROFAUNAL CRUSTACEANS IN NORTH CAROLINA,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
L. P. Rozas, and C. T. Hackney.
Estuaries, Vol. 7, No. 3, p 213-224, September, 1984. 4 Fig, 6 Tab, 27 Ref.

Descriptors: *Salt marshes, *Oligohaline environment, *Fish, *Crustaceans, *North Carolina, Salinity, Rivulets, Seasonal variation, Nekton.

Fishes and invertebrate macrofauna (nekto habiting three low salinity, intertidal rivulet sampled biweekly from July 1981 through 1982 Twenty-nine species of fishes (24 335 i uals, 9.671 kg wet weight) representing 19 fa and four species of invertebrates (6 312 indiv 4.708 kg wet weight) were collected. The abundant species were spot (Leiostomus urus), grass shrimp (Palaemonetes pugio), b chovy (Anchoa mitchilli) and Atlantic men (Brevoortia tyrannus). Only a few large pred fish (e.g., largemouth bass, Micropterus salm were collected in the rivulets although large bass and longnose gar (Lepisosteus osseus) abundant in nearby permanently flooded are number of species was greatest during the w months and lowest during the winter. There three seasonal peaks of numerical abun spring peak attributed to the influx of juvenile Atlantic menhaden, Atlantic croaker (Micro ias undulatus), and southern flounder (Paralic lethostigma); summer peak due to grass sh and fall peak to bay anchovy and grass sh The occurrence of these species was not corr with salinity in the study area. Average densi spot and Atlantic menhaden in the oligo rivulets at the peak of juvenile recruitment similar to the average densities of these s reported for salt marshes. The results sugges oligohaline estuarine areas contain important ery habitat for some euryhaline species. (Au abstract)
W85-02995

DEWATERING OF AN UNVEGETA MUDDY TIDAL FLAT DURING EXPOSU DESICCATION OR DRAINAGE,
New Hampshire Univ., Durham. Dept. of Sciences.
F. E. Anderson, and B. A. Howell.
Estuaries, Vol. 7, No. 3, p 225-232, Septe 1984. 5 Fig, 2 Tab, 25 Ref.

Descriptors: *Intertidal areas, *Mud flats, *D tering, *Sediments, Drainage, Interstitial wate linity, Evaporation, Water content.

The water content of a surface sample of inte sediment reflects two time dependent proc The first is the amount of evaporation or dra which occurs with exposure, the second i amount of consolidation that has taken place deposition. An experiment to evaluate the effe exposure on water content and salinity was ducted at Adams Cove, Great Bay, New H shire. The unvegetated muddy tidal flat was pled to determine the changes in surface water content and salinity during exposure. D the summer, pore water salinities increased an water contents decreased. The increasing sali reflect a changing base salinity as precipitatio runoff decline during the summer months. decreasing water content over the same p reflects a compaction or aging of the sedi reducing the available pore surface. Local ev ration accounted for 61% of the upper inte surface salinity, with evaporation rates incre salinity as high as 2.2% per hour. Daily chang water content are only partially explained by e sure and evaporation, with the primary co being controlled permeability and drai (Moore-IVI)
W85-02996

ESTIMATING WATER VOLUME DISCHA THROUGH SALT-MARSH TIDAL CHANN AN ASPECT OF MATERIAL EXCHANGE,
Delaware Univ., Lewes. Coll. of Marine Stu
C. T. Roman.
Estuaries, Vol. 7, No. 3, p 259-264, Septem 1984. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Canary Creek, *Delaware, *F discharge, *Salt marshes, *Tidal channels, rents, Velocity, Tidal channels, Material excha

A knowledge of lateral current velocity variat is essential when attempting to accurately quan the flux of materials through salt marsh-estua tidal creek cross-sections. Water volume disch

estimates were made at a sample cross-section of the Canary Creek salt marsh (Lewes, Delaware). Canary Creek meanders for about 5 km and drains approximately 190 ha of Spartina alterniflora dominated marsh. To account for cross-sectional velocity variations, a dense spatial array of current meters was used. Simultaneous measurements were taken at hourly intervals over three complete tidal cycles. A practical method is presented whereby instantaneous average cross-sectional velocity, instantaneous cross-sectional discharge and tidal cycle discharge can be estimated from a dense current meter array, or ideal data set. A simplified spatial array can be used to estimate water discharges within acceptable error limits. Instantaneous cross-sectional discharges and total tidal cycle discharges were estimated with uncertainties of +/- 11% and +/- 7%, respectively. A preliminary study should be conducted to evaluate cross-sectional material concentration variability. If material concentrations vary significantly in the cross-section then detailed characterizations of concentration dynamics, with subsequent calibrations, must be conducted. (Moore-IVI)
W85-02998

TWO-DIMENSIONAL MASS TRANSPORT IN ESTUARIES,
Virginia Univ., Charlottesville. Dept. of Civil Engineering.
W.-S. Lung, and D. J. O'Connor.
Journal of Hydraulic Engineering, Vol. 110, No. 10, p 1340-1357, October, 1984. 9 Fig, 1 Tab, 30 Ref, 1 Append.

Descriptors: *Estuaries, *Mass transport, Water circulation, Velocity, Hydrodynamics, Mathematical equations, Eddy viscosity, Salinity, Momentum.

On a tidally average basis, the two-dimensional estuarine circulation is characterized by a horizontal seaward velocity in the upper layer and a landward velocity in the lower layer, with a compensating vertical velocity to maintain hydraulic continuity. A relatively simple method of analysis is developed for this type of circulation from the hydrodynamic equations of momentum, continuity, and state. It is based on the condition that the salinity distributions in both the longitudinal and vertical directions are known or may be assigned. In addition to an analytical solution for the horizontal and vertical velocities, the analysis generates the values of vertical eddy viscosity which characterizes the vertical exchange of momentum, an important process of circulation in partially mixed estuaries. Successful applications of the analysis to a number of estuaries throughout the country prove that the present method is efficient and simple to use. The present method of analysis offers a definite advantage as a first approximation to this type of estuarine circulation. (Author's abstract)
W85-03006

INITIAL TRANSIENTS IN LONG WAVE COMPUTATIONS,
James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Civil and Systems Engineering.
For primary bibliographic entry see Field 8B.
W85-03008

MATHEMATICAL MODEL STUDY OF THE FLUSHING CHARACTERISTICS OF A SHALLOW TIDAL BAY,
Birmingham Univ. (England). Dept. of Civil Engineering.
R. A. Falconer.
Proceedings of the Institution of Civil Engineers, Part 2, Vol. 77, p 311-332, September, 1984. 10 Fig, 2 Tab, 21 Ref.

Descriptors: *Holes Bay, *England, *Mathematical models, *Bays, *Flushing, Model studies, Estuaries, Tidal bays, Wetlands, Land reclamation.

The development and application of a mathematical model to compare the hydraulic features and flushing characteristics of Holes Bay in Dorset for the present boundary configuration and for two proposed new outlines of the bay are described. There were two main numerical difficulties to be overcome in the mathematical model. Firstly, the narrow entrance associated with Holes Bay required the convective accelerations in the momentum equation to be treated carefully. Secondly, due to the nature of the bed topography of Holes Bay, extensive areas of marshland were dried out and flooded on each consecutive ebb and flood tide. A proposed land reclamation project for this area was examined, both with and without the emmbankment bridge, and shown that it would not improve either the exchange characteristics or the overmixing properties of Holes Bay. However, the detrimental effects that the land reclamation would have on the gross flushing characteristics appear to be relatively small. Holes Bay appears to have reasonably satisfactory flushing characteristics for the mean spring tide conditions when compared with similar results documented for a number of harbors and marinas where the flushing efficiency is known to be inadequate. (Baker-IVI)
W85-03052

NOTE ON FLOW STRUCTURE IN THE GREAT OUSE ESTUARY,
Birmingham Univ. (England). Dept. of Civil Engineering.
J. R. West, D. W. Knight, and K. Shiono.
Estuarine, Coastal and Shelf Science, Vol. 19, No. 3, p 271-290, September, 1984. 10 Fig, 2 Tab, 21 Ref.

Descriptors: *Great Ouse Estuary, *England, *Estuaries, *Flow structure, Salinity, Velocity, Turbulence, Density gradients, Shear, Tidal effects.

The channels in estuaries are usually asymmetrical in cross-section, have a variation in bed material and bed structures across the channel, and have a longitudinal density gradient. The interaction of these phenomena with the tidal flow leads to vertical and transverse density gradients. Field measurements of vertical profiles of velocity and salinity along with turbulence measurements were used to examine the effect of density gradients on the flow structure in the Great Ouse estuary. During the flood tide shear and longitudinal density gradients cause well mixed conditions in the lower part of the water column. In the upper part of the water column the velocity profile shape could be explained by the presence of a transverse density gradient induced secondary flow and acceleration effects. On the ebb tide the vertical density gradient appears to be the dominant factor which determines the structure of the flow. Existing mathematical analyses of estuarine transport which consider only two dimensions, a similar flow structure for flood and ebb tides or small vertical density gradients may suffer from important deficiencies for some hydraulic conditions. The velocity profile data were used to obtain estimates of the bed shear stress for a flood and ebb tide. The values showed a cyclical variation with the flood values being considered more reliable due to the well-mixed nature of the flow near the bed. (Moore-IVI)
W85-03107

SUMMERTIME NET TRANSPORT OF DISSOLVED OXYGEN, SALT AND HEAT IN A SALT MARSH BASIN, NORTH INLET, S.C.,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
L. R. Gardner, and C. Gorman.
Estuarine, Coastal and Shelf Science, Vol. 19, No. 3, p 331-339, September, 1984. 6 Fig, 10 Ref. NSF grant SM176-02406.

Descriptors: *Salt marshes, *Dissolved oxygen, *Salt, *Heat, *North Inlet, *South Carolina, Solute transport, Tidal effects, Solar radiation, Coastal waters.

This study addresses the impact marshes have on the dissolved oxygen content of tidal waters, particularly during summer when respiratory demand for oxygen in adjacent coastal waters is at a maximum and the solubility of oxygen is lowest. The net transports of dissolved oxygen, salt and heat have been measured for 65 tidal cycles during late spring and summer for a small (0.14 sq km) salt marsh basin near North Inlet, S.C. The results indicate that export of dissolved oxygen occurs only on tidal cycles that begin between 2:00 am and 10:00 am such that high tide occurs within 4 h of noon. The largest exports of oxygen and heat are produced by spring tides beginning near sunrise. Although the time window for oxygen export is only about 8 h in duration, there is a more or less overall long-term balance between export and import because the magnitude of oxygen export is about 25% greater than import. The magnitude of heat export similarly exceeds heat import but because the time windows for heat export and import are equal, there is an overall export of heat. This study thus suggests that in summer salt marshes of the Atlantic coast export heat and are in balance with respect to the export and import of dissolved oxygen. However, because of the interaction of the diurnal tide with the daily cycle of solar radiation, transient dissolved oxygen concentrations in tidal waters can range from 1.5 to 10.0 ppm. Thus loading of additional oxygen consuming materials to these waters possibly could lead to significant periods of anoxia. (Author's abstract)
W85-03108

HEAVY METALS IN A CONTAMINATED AUSTRALIAN ESTUARY - DISPERSION AND ACCUMULATION TREND,
Aix-Marseille-1 Univ. (France).
For primary bibliographic entry see Field 5B.
W85-03109

OXYGEN PRODUCTION IN A BAY WITHIN THE FRESHWATER SECTION OF THE ELBE ESTUARY. AN INVESTIGATION OF THE MUHLENBERGER LOCH IN HAMBURG (DIE SAUERSTOFFPRODUKTION EINER BUCHT IM SUSSWASSERBEREICH DES ELBE-AESTUARS UNTERSUCHUNGEN IM 'MUHLENBERGER LOCH' IN HAMBURG),
Hamburg Univ. (Germany, F.R.). Inst. fuer Hydrobiologie und Fischereiwissenschaft.
For primary bibliographic entry see Field 6G.
W85-03121

EFFECTS OF SALINITY ON PREFERRED AND LETHAL TEMPERATURES OF THE BLACKCHIN TILAPIA, SARATHERODON MELANOTHERON,
Pennsylvania State Univ., University Park. School of Forest Resources.
J. R. Stauffer, Jr., D. K. Vann, and C. H. Hocutt.
Water Resources Bulletin, Vol. 20, No. 5, p 771-775, October, 1984. 4 Tab, 24 Ref.

Descriptors: *Fish, *Salinity, *Acclimatization, Adaptation, Estuaries, Acidity, Dissolved oxygen, Temperature effects, Population dynamics, Distribution.

The possibility that acclimation to different salinities affects the preferred and lethal responses of the blackchin tilapia, Sarotherodon melanotheron was investigated. It would appear that cool temperature is the most important parameter which limits the dispersal of these cichhlids. S. melanotheron is euryhaline and can probably disperse further northward in brackish water than in freshwater or marine environs. Although relatively stenothermal in freshwater, it can withstand temperatures outside of its zone of tolerance for short time periods. Furthermore, when acclimated to cold temperatures, it does select temperatures well within its zone of tolerance. S. melanotheron's thermal tolerance zone may be expanded, depending upon salinity. This possibility suggests that the species could expand its range in North America. (Baker-IVI)
W85-03143

BIOCHEMISTRY OF ACETATE IN ANOXIC SEDIMENTS OF SKAN BAY, ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. G. Shaw, M. J. Alperin, W. S. Reeburgh, and D. J. McIntosh.

Geochimica et Cosmochimica Acta, Vol. 48, No. 9, p 1819-1825, September, 1984. 4 Fig, 1 Tab, 31 Ref.

Descriptors: *Acetate, *Skan Bay, *Alaska, *Anoxic sediments, Bays, Sediments, Biogeochemistry, Oxidation, Sulfates, Organic matter, Bacteria.

The role of acetate in the biogeochemical cycling of organic matter in contemporary marine anoxic sediments of Skan Bay, Alaska was investigated with inhibition and quasi in situ turnover experiments. The turnover time for acetate oxidation in the upper 30 cm of the sediment column is about 1 hr. A molybdate inhibition experiment indicated that sulfate reducing bacteria were responsible for more than 95% of acetate oxidation. The measured rate of acetate oxidation is too great to be balanced by the measured rates of sulfate reduction. One explanation for this fact is that only a fraction of the measured porewater concentration of acetate is microbially available, leading to errors in the rate determinations. Acetate is oxidized to carbon dioxide in Skan Bay sediments with rate constants comparable to those observed in other anoxic marine sediments. Acetate is not converted to methane in the upper 30 cm of sediment. Methane production from acetate occurs only at 2 m. Most of the acetate oxidation is inhibited by 20 mM sodium molybdate and is therefore probably mediated by sulfate reducing bacteria. A portion, perhaps 10% to 40%, of added acetate is rapidly sorbed to sediment particles. (Baker-IVI)
W85-03207

DESORPTION AND COAGULATION OF TRACE ELEMENTS DURING ESTUARINE MIXING,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 2K.
W85-03208

MIXING AND CYCLING OF URANIUM, THORIUM AND 210-PB IN PUGET SOUND SEDIMENTS,
Washington Univ., Seattle. School of Oceanography.
R. Carpenter, M. L. Peterson, J. T. Bennett, and B. L. K. Somayajulu.
Geochimica et Cosmochimica Acta, Vol. 48, No. 10, p 1949-1963, October, 1984. 6 Fig, 4 Tab, 53 Ref.

Descriptors: *Uranium, *Thorium, *Lead radioisotopes, *Puget Sound, *Washington, *Sediments, Estuarine environment, Radioisotopes, Seawater, Manganese oxides, Particulates.

The relative importance of Pb, U and Th isotope sources differs greatly for Puget Sound sediments. Atmospheric input accounts for one-half to one-third the excess Pb-210, but is negligible for all other isotopes considered. Only for the short-lived excess Th-234 is in situ production in overlying seawater important. Detrital particles, entering primarily from rivers, are the only significant sources of Th-232 and Th-230 and provide roughly one-half the excess Pb-210 and most of the U-324 and U-238. Advecting seawaters introduce little dissolved Th-232 and Th-230 into Puget Sound because their particle reactivity causes them to be scavenged before the waters reach Puget Sound, and their long half lives prevent significant production in Puget Sound. Inflowing seawaters bring relatively large amounts of dissolved U into Puget Sound, but scavenging reactions are not effective at removing it unless waters are biologically pumped down into sediments where mildly reducing conditions develop. In Dabob Bay Pb-210 is transported to the seafloor by sinking zooplankton fecal material, extensively reworked by the benthos and reincorporated primarily into hydrous Mn oxides. Pb-210 is also associated with hydrous Mn oxides in sediments of other areas of Puget Sound. Excess Th-234 profiles in sediment reveal considerable detail about the dynamic nature and recent history of mixing processes. Mixing coefficients and layer thicknesses derived from a best fit of a four layer diffusion-advection-decay model to the Th-234 data adequately describe the corresponding Pb-210 profiles within the surface mixed layer. This indicates mixing processes are influencing the sedimentary profiles of both isotopes in an equivalent, depth dependent manner. (Baker-IVI)
W85-03209

BIOGEOCHEMICAL CYCLING IN AN ORGANIC-RICH COASTAL MARINE BASIN; 4. AN ORGANIC CARBON BUDGET FOR SEDIMENTS DOMINATED BY SULFATE REDUCTION AND METHANOGENESIS,
North Carolina Univ. at Chapel Hill. Marine Sciences Program.
C. S. Martens, and J. Val Klump.
Geochimica et Cosmochimica Acta, Vol. 48, No. 10, p 1987-2004, October, 1984. 12 Fig, 6 Tab, 48 Ref. NSF grants OCE 80-09245 and OCE 82-08666.

Descriptors: *Chemical reactions, *Estuarine environment, *Methanogenesis, *Sulfates, *Cape Lookout Bight, *North Carolina, *Outer Banks, Lagoons, Carbon cycle, Carbon dioxide, Methane, Seasonal variation, Cycling nutrients, Organic carbon.

The organic carbon deposition rate at Station A-1 in Cape Lookout Bight, North Carolina is calculated to be 149 mmole/sq m/yr during the late 1970's. Of this input, 35.6 mmole/sq m/yr is recycled to overlying waters from the sediments, 84 as total CO_2 and 16 as methane. Most of the recycling takes place during warm summer months via diffusion of carbonate and gas bubble ebullition of methane. At least 24.4 mmole/sq m/yr of the upward total carbon dioxide flux representing 68% of the total measured upward carbon flux is produced in association with sulfate reduction. Methanogenesis accounts for approximately 32% of the net carbon flux assuming equal amounts of CO_2 are produced with methane beneath the zone of sulfate reduction. The mean residence time of metabolizable organic carbon in the upper 80 cm at Station A-1 is calculated to be 4.3 months with greater than 98% of the remineralization occurring in the upper 25 cm. (Baker-IVI)
W85-03211

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

STUDIES ON PERFORMANCE OF DESALINATION PLANT BY REVERSE OSMOSIS SYSTEM - II; EFFECTS OF INHIBITION OF BACTERIAL GROWTH WITH NAHSO3 ON PERFORMANCE OF PLANT (IN JAPANESE),
Shimonoseki Univ. of Fisheries (Japan).
S. Hikasa, H. Matsushita, M. Yasunari, and T. Kirihata.
Journal of Shimonoseki University of Fisheries, Vol. 32, No. 1-2, p 15-22, January, 1984. 3 Fig, 2 Tab, 3 Ref.

Descriptors: *Reverse osmosis, *Desalination plants, *Sulfates, Membrane process, Seawater, Saline water, Ships.

A fresh water generating plant equipped with a reverse osmosis module is the most suitable system for small ships. However, the performance of this plant is influenced remarkably by different factors, such as sea water temperature and suspended substances in seawater. In this experiment, $NaHSO_3$ was added to the feedwater once a day, and its concentration was adjusted to 60 ppm. This treatment inhibited bacterial growth on the filter medium and decreased remarkably the adhesion of bacteria on the surface of the reverse osmosis module. This treatment was very effective for maintaining the desalting performance of the plant. (Author's abstract)
W85-02838

REFRIGERATOR-HEAT-PUMP DESALI TION SCHEME FOR FRESH-WATER A SALT RECOVERY,
Centro di Ricerca Idraulica e Strutturale, M (Italy).
M. Reali.
Energy, Vol. 9, No. 7, p 583-588, July, 1984. 4 1 Tab, 9 Ref.

Descriptors: *Desalination, *Heat pumps, *Re eration, *Vapor pressure, Saline water, Salt, densation, Solar energy, Wind energy, Seaw Brine.

This study concerns a refrigerator-heat-pump salination scheme (RHPDS), which allows ene efficient recovery of fresh water and salt from sea. In this scheme, a salt-water chamber is tinuously refilled with sea water via atmosph pressure. Sea water is evaporated into a vac chamber and the water vapor is condensed on of a fresh-water chamber. A refrigerator-h pump circuit maintains the two water chambe suitably different operating temperatures allows efficient recovery of the latent heat of densation. The scheme is analyzed with spe consideration to potential exploitation of ren able energy sources such as solar and wind ene (Author's abstract)
W85-02957

3B. Water Yield Improvement

CIRCULAR VS. LINEAR WATER SYSTE GOING BACK TO NATURE'S WAY,
Sheaffer and Roland, Inc., Chicago, IL.
For primary bibliographic entry see Field 6A.
W85-03039

PARAFFIN-WAX WATER-HARVESTING SO TREATMENT IMPROVED WITH ANTISTR PING AGENTS,
Agricultural Research Service, Phoenix, Water Conservation Lab.
D. H. Fink.
Soil Science, Vol. 138, No. 1, p 46-53, July, 198 Fig, 1 Tab, 17 Ref.

Descriptors: *Water harvesting, *Paraffin w *Antistripping agents, Soil treatment, Soil erosi Cellulose xanthate, Weathering.

The paraffin-wax water-harvesting soil-treatm is being used in arid areas to supply precipitati runoff water for a variety of agricultural u However, because paraffin has only weak van Waals-type binding forces, it may, under adve weathering conditions, be easily stripped off soil by the wedging action of water acting at wax-soil interface. Addition of 2 to 4% antist ping agent (compounds added to asphalt dur highway construction to strengthen the asph aggregate interfacial bond) to the paraffin-w water-harvesting soil treatment markedly proved the treated soil's resistance to the weath ing effects of freeze-thaw cycling and water e sion. Addition of the better of the nine antis compounds tested permitted a reduction of wax application rate of 0.5 kg/sq m. Prior stabili tion of the soil with cellulose xanthate reduced required wax/antistrip rate to only 0.25 kg/sq This is 1/8 the currently recommended applicat rate of wax for soils exposed to freeze-thaw wea ering. (Author's abstract)
W85-03091

3C. Use Of Water Of Impaired Quality

SALINITY AND ALFALFA YIELD UNDER I FLUENT IRRIGATION IN SOUTHWESTE SASKATCHEWAN,
Department of Agriculture, Swift Current (S katchewan). Research Station.
Y. W. Jame, V. O. Biederbeck, W. Nicholaichuk and H. C. Koven.

Canadian Journal of Soil Science, Vol. 64, No. 3, p 323-332, August, 1984. 5 Fig, 2 Tab, 14 Ref.

Descriptors: *Irrigation, *Water reuse, *Wastewater irrigation, *Salinity, Plant growth, Crop yield, Alfalfa, Saskatchewan, Swift Current.

The effect of wastewater irrigation on soil salinity and crop yield was determined in a study at Swift Current, Saskatchewan. If managed properly it is safe to use the saline sewage effluent for irrigation without seriously affecting alfalfa production. With the average EC of the sewage effluent as high as 2.6 dS/m, an over irrigation of 10-15% above the normal recommended application rate will provide sufficient water to leach through the profile and thus maintain a salt balance in the root zone favorable for plant growth. With this application rate, it is expected that in the well-drained soils the salinity level in the upper layer of the root zone will approach an ECe value of 2.5 dS/m and ECe will increase with depth with the value near the bottom of the root zone in the range of 4-6 dS/m. With salinity at this level, it is possible to maintain production at more than 85% of that on nonsaline soils when nutrients are not limiting growth. Higher rates of application are not recommended because they would reduce the productivity per unit water applied, increase the risk of leaching potentially harmful chemicals into the ground water and may also result in management problems unless surface drainage is provided. Salts will accumulate more readily in the root zone and cause more serious salinity problems in the presence of the high water table as compared to the well-drained soils. (Baker-IVI)
W85-02802

REUSE OF AGRICULTURAL DRAINAGE WATERS: AN ECONOMIC ANALYSIS,
California Univ., Riverside.
K. C. Knapp, and A. Dinar.
Water Resources Bulletin, Vol. 20, No. 4, p 521-525, August, 1984. 5 Tab, 9 Ref.

Descriptors: *Water reuse, *Drainage water, *Irrigation water, *Economic evaluation, *California, Salinity, Impaired water use, Salt tolerance, Oranges, Grapes, Lettuce, Alfalfa, Wheat, Cotton.

Many western agricultural areas are facing increased water costs and in some cases reduced supplies from primary water sources. At the same time some areas are suffering from drainage problems associated with high water tables. A possible response to both problems is to reuse the agricultural drainage water for irrigating crops. The profitability of reusing agricultural drainage water for crop production depends on the salt tolerance of the crop being grown, the salt concentration of the drainage water, the cost of obtaining it, and the price of good water. The economics of drainwater reuse is examined for navel oranges, grapes, lettuce, alfalfa, wheat, and cotton in the Imperial/Coachella Valley and Kern County areas of southern California. Drainwater reuse is not profitable for the fruit and vegetable crops considered but may be profitable for the field crops considered when the price of good water is relatively high and the cost of obtaining drainage water of reasonable quality is low. (Moore-IVI)
W85-02978

SALT GRADIENT PONDS: INVESTMENT TIMING MODEL,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
T. C. Hughes, and S. Orlovsky.
Journal of Water Resources Planning and Management, Vol. 110, No. 4, p 403-417, October, 1984. 4 Fig, 3 Tab, 10 Ref, 2 Append.

Descriptors: *Salt gradient solar ponds, *Investment, *Impaired water use, *Colorado River basin, *Thermal powerplants, Saline water, Mathematical models, Salinity management, Economic aspects, Solar energy.

Salt gradient solar ponds can play an important role in management of river salinity in semiarid locations such as the Colorado River Basin. A mathematical model and solution procedures are presented for investment timing of expansion of a salt gradient pond system. An application of the model is presented for several sites in the upper Colorado River basin where planned fossil fuel electric generating plants are located near existing source of saline or brackish water. The concept involves use of both concentrated brine waste streams from the power plants and the existing low quality water sources for the pond system water and salt demands. The salt gradient pond can: (1) Replace a power plant's customary zero discharge evaporation; (2) produce additional energy; and (3) remove much more salt from the river system than the conventional evaporation pond. An economic model solution procedure and application are presented for expansion of salt gradient solar pond systems. Such systems have important potential for salinity management applications, when used in conjunction with thermal/electric plants near sources of saline water. (Author's abstract)
W85-03061

EFFLUENT IRRIGATION OF PARA GRASS: WATER, NITROGEN, AND BIOMASS BUDGETS,
Florida International Univ., Miami. Drinking Water Quality Research Center.
L. L. Handley, and P. C. Ekern.
Water Resources Bulletin, Vol. 20, No. 5, p 669-677, October, 1984. 2 Fig, 7 Tab, 46 Ref.

Descriptors: *Land disposal, *Wastewater irrigation, *Nitrogen, *Hawaii, Irrigation. Grass, Water budget.

Biological methods for wastewater renovation and groundwater recharge were sought which would be suitable for Hawaiian soils, vegetation, and climate. Both water and nitrogen balances showed that irrigation of para grass was an effective means of removing nitrogen from domestic sewage effluent. With irrigation amounts of up to 510 mm/week beyond rainfall and average evapotranspiration of 32 mm/week, most of the irrigation percolated for possible groundwater recharge. An excellent nitrogen sink, the harvested crop removed as much as 173 mkg/ha/mo of nitrogen, eight times the amount removed by sugarcane and four times the amount removed by Bermuda grass. With effluent averaging 34 g/L nitrogen and average irrigation rates as great as 98 mm, 5 times/week, percolate nitrate-nitrogen levels were below the critical 10 mg/L for potable water. At highest application of 2,600 kg/ha/yr nitrogen, the crop used more than 80% of applied nitrogen; percolate accounted for 9% and gaseous loss accounted for less than 11%. With harvest intervals varying from 6 to 13 weeks crop productivity was linear with applied nitrogen and averaged 110 t/ha/yr of dry matter with a maximum of 159 t/ha/yr. Under consistent effluent irrigation, there was no significant seasonality to productivity in an area where soil temperatures remained about 18 C. At the maximum nitrogen application rate, forage had a calculated crude protein content of 13%, dry weight, and a caloric value of 4,000 kcal/kg of dry matter. Toxic nitrate-nitrogen in the fodder did not occur with effluent containing up to 59 mg/L total nitrogen. The crop required minimal maintenance. (Baker-IVI)
W85-03132

3D. Conservation In Domestic and Municipal Use

WATER CONSERVATION, RECYCLING, AND REUSE: U.S. NORTHEAST,
Brookhaven National Lab., Upton, NY. Dept. of Applied Science.
E. Kaplan.
Journal of Water Resources Planning and Management, Vol. 110, No. 4, p 455-477, October, 1984. 14 Tab, 20 Ref. DOE contract DE-AC02-76CH00016.

Descriptors: *Water conservation, *Water reuse, *Recycling, Water use, Consumptive use, Domestic water, Industrial water, Agriculture, Utilities, Electric power production, Water supply.

This paper focuses upon present and future possibilities for water conservation, recycling, and reuse in New England and Middle Atlantic states. Telephone interviews and questionnaries sent to trade associations, public utility commissions, federal, state and other agencies were used to supplement information gathered in the literature. Water intake and consumptive demands in 1980 were calculated for industrial, electric utility, agricultural, and residential sectors. Corresponding information for the year 2000 were estimated using data from utilities, public utility commissions, and the U.S. Bureau of Economic Affairs. Water supplies were estimated using the concept of safe yield. Assuming reductions in water use by industries, agriculture and by private residences in the year 2000, it was found that many users, particularly the electric utility sector, would still experience serious water supply shortfalls in several industrialized states. (Author's abstract)
W85-03064

3E. Conservation In Industry

WATER SUPPLY FOR POWER IN TEXAS-GULF REGION,
Case Western Reserve Univ., Cleveland, OH. Dept. of Systems Engineering.
B. F. Hobbs.
Journal of Water Resources Planning and Management, Vol. 110, No. 4, p 373-391, October, 1984. 3 Fig, 3 Tab, 40 Ref. DOE contract W-7405-eng-26.

Descriptors: *Cooling water, *Powerplants, *Water conservation, *Water demand, *Water supply development, *Texas, Linear programming, Mathematical models, Cost analysis, Institutional constraints, Water reuse.

In order for the Gulf region of Texas to accomodate projected growth in electric generating capacity, additional water supplies will have to be obtained, or alternate cooling methods used. Most water-energy assessments have considered only a few supply types and conservation technologies. A linear program is developed that incorporates: supply curves for several water sources that reflect institutional constraints; and water demand curves based on the cost of alternative power plant cooling methods. By focusing on a single region, the model can incorporate cost information for several types of water supplies for each of a large number of subbasins. A base case model solution for the year 2000 is discussed. Sensitivity analyses and scenarios for the year 2030 are also presented. For the Texas-Gulf region in the year 2000, the high cost of dry or mixed wet/dry cooling is unjustified unless: new technologies lower the incremental cost of wet/dry cooling by more than 80%; or unforeseen institutional restrictions prevent utilities from securing economic surface and ground water supplies. This conclusion contradicts previous studies which projected serious water-energy conflicts for the region. This study finds differently because it considers alternative water sources that utilities are beginning to use throughout the West, including groundwater, water rights transfers, interbasin diversions, and sewage plant effluent. (Moore-IVI)
W85-03059

WATER CONSERVATION, RECYCLING, AND REUSE: U.S. NORTHEAST,
Brookhaven National Lab., Upton, NY. Dept. of Applied Science.
For primary bibliographic entry see Field 3D.
W85-03064

3F. Conservation In Agriculture

IMPACT ON GROUNDWATER RESOURCES OF CONVERSION FROM FURROW TO DRIP IRRIGATION,
Hawaii Univ., Honolulu. Dept. of Agricultural and Resource Economics.
H. Yamauchi.
Water Resources Bulletin, Vol. 20, No. 4, p 557-563, August, 1984. 2 Fig, 1 Tab, 3 Ref.

Descriptors: *Drip irrigation, *Furrow irrigation, *Groundwater recharge, *Sugarcane, *Hawaii, Groundwater potential, Water conservation, Groundwater depletion, Crop yield, Surface water.

The adoption of more efficient irrigation practices in agriculture is often regarded as an economical means of reducing the competition for scarce water supplies between agricultural, and nonagricultural demands. A model is developed to analyze the groundwater conservation and depletion effects of converting sugarcane irrigation from the furrow to the drip method. With drip irrigation, whatever gains there are in water application efficiencies over furrow irrigation must be gaged against the potential for expanded irrigation and the relative reductions in recharge. Conversion to drip can significantly reduce under-irrigation and also expand on total irrigated acres. In theory, shrinkage of groundwater fields through substitution of imported surface water sources can offset some of the depletion effects of reduced recharge, but this has not been shown to be the case in Hawaii. As long as drip promises increased profitability through higher yields and lower production costs, the tendency for increased metropolitan competition for and depletion of common groundwater resources will not necessarily be alleviated by conversion to drip irrigation. (Moore-IVI)
W85-02982

ECONOMICS OF CHANGES IN IRRIGATION MANAGEMENT IN PAKISTAN: AN INTEGRATIVE MODELING APPROACH,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.
S. H. Johnson, III, and J. O. Reuss.
Water International, Vol. 9, No. 2, p 66-71, 1984. 4 Fig, 3 Tab, 15 Ref.

Descriptors: *Irrigation practices, *Model studies, *Pakistan, *Economic aspects, Water management, Planning, Wells, Groundwater, Water supply development, Irrigation.

Alternative irrigation management systems at the distributary level were investigated and their economic impacts were measured at the farm level. This was accomplished by using an integrative simulation model developed to represent conditions in the Punjab, the largest state in Pakistan. Restricted demand systems as well as conjunctive systems supplemented with ground water were examined using the model. Results indicate that canal closure in February to April, rather than December and January, would increase per hectare returns by US $15-35. Due to the limited capacity of the present canals, changing from a continuous flow to a demand system does not appear to be economically feasible. If sufficient ground water were to be pumped from public tube wells this would require more than 850 million dollars in capital costs not to mention maintenance and energy subsidy costs. Pumping this supplemental water from private wells is much more appealing as it removes the need for additional public investment in ground water development and facilitates decentralization of operation. Shallow private wells, in contrast to deeper, public tube wells, are also environmentally better as they usually pump higher quality water. (Baker-IVI)
W85-03029

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

CLIMATE AND THE COLORADO RIVER: THE LIMITS OF MANAGEMENT,
National Center for Atmospheric Research, Boulder, CO.
S. L. Rhodes, D. Ely, and J. A. Dracup.
Bulletin of the American Meteorological Society, Vol. 65, No. 7, p 682-691, July, 1984. 6 Fig, 4 Tab, 26 Ref.

Descriptors: *Flood control, *Water management, *Colorado River, *Climates, *Lake Mead, *Lake Powell, Floods, Management, River basins, Runoff, Snowmelt, Planning, Arizona, California, Mexico.

During the late spring of 1983, unusually heavy snowmelt runoff in the Upper Colorado River Basin resulted in flooding, primarily below Parker Dam, and economic losses in the River's lower basin in Arizona, California, and Mexico. This flooding was the result of the convergence of three factors: the reservoir system along the Colorado generally has been full since the summer of 1980; there has been a gradual physical encroachment into the lower basin flood plain over the last 20 years; and the natural climatic variability of the basin happened to produce a large amount of runoff during the late spring of 1983. The rapid sequence of meteorological events occurring late in the spring, coupled with the problem of attempting to move massive amounts of water through Lakes Powell and Mead in a short period of time, resulted in streamflows above those that lower basin residents and businesses had come to expect. The interplay of the three factors that contributed to the 1983 flooding in the Lower Colorado Basin could recur in 1984 as well as in later years. Given that climate variability is beyond the control of the river's managers, attention must be focused on flood plain encroachment and the question of how much storage space should be dedicated to flood control in Lake Mead and upstream. (Baker-IVI)
W85-02799

MACROPHYTE COMMUNITY DYNAMICS IN DREDGED WISCONSIN LAKE,
Wisconsin Geological and Natural History Survey, Madison.
S. A. Nichols.
Water Resources Bulletin, Vol. 20, No. 4, p 573-576, August, 1984. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Macrophytes, *Dredging, *Lilly Lake, *Wisconsin, *Lake rehabilitation, Revegetation, Aquatic plants, Recreation.

Lilly Lake is a 37 ha, natural, hard-water lake in Kenosha County, Wisconsin. Between July 1978 and June 1980 the entire lake was dredged to a sand bottom or a depth of 4 m as part of a lake renewal effort. The macrophyte community was studied before and for three growing seasons after dredging. In water depths up to 1.5 m, revegetation was rapid after dredging. The plant community changed from one dominanted by large-leafed Potamogeton (pondweed), Megalodonta beckii (water marigold), and Elodea canadensis (waterweed) to one dominated by Chara (stonewort), Najas flexilis (naiad), and Myriophyllum (milfoil). Prior to dredging, because of the shallow water depth and high water transparency, the entire lake bottom was covered with vegetation. After dredging, plant growth ceased at about the 4 m depth. Growth recovered much more slowly in water depths between 1.5 and 4 m. The area between 1.5 m and 2.5 m in particular supported a monotypic milfoil stand after dredging. Under predredging conditions a majority of the macrophytes reached the water surface, where they hampered water use. After dredging, macrophytes in the 2.5-4 m depth zone seldom grew high enough in the water column to interfere with surface water use. Dredging allowed about 80% of the previously unusable surface are to be open for recreation. (Moore-IVI)
W85-02984

DETERMINATION OF CROP PRODUCTION LOSS DUE TO INADEQUATE DRAINAGE IN A LARGE WATERSHED,
Iowa State Univ., Ames. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W85-02987

OUTPUT INCREASE FROM EXISTING HYDROELECTRIC PLANTS,
Hydrologic Engineering Center, Davis, CA.
D. W. Davis, and J. J. Buckley.
Journal of Water Resources Planning and Man ment, Vol. 110, No. 4, p 361-372, October, 19 Fig, 5 Tab, 5 Ref.

Descriptors: *Hydroelectric plants, *Ele power production, Turbines, Electrical equipm Hydroelectric power, Flood control sto Water resources development.

The potential for increasing the energy output investigated at all existing hydroelectric plan the US, regardless of ownership, for incre through enlarging power-houses, modifying o placing turbines and generators, and impro water handling works. The hydroelectric po generation system analyzed in this study is c prised of 1,288 individual plants, totaling a 3,000 individual generation units, with inst capacity of 63,375 MW, generating 272 gigawatt hr of electrical energy per year. potential energy increase was found to be a 11% requiring an increase of 22% in inst capacity. Virtually all the increase due to ca ing existing spill through enlargement of exi powerhouses (adding additional units). Equipr uprating and improvements only would likely tribute on an aggregate national scale no more 1.4% increase. Potential for increased en output from operational improvements and sto reallocation is possible at sites with existing f control storage (a national aggregate increas about 0.6%). The existing hydropower gener system on the whole is making quite efficient of the energy resources available at the exi sites. (Moore-IVI)
W85-03058

ESSENTIAL URBAN DETENTION POND CONSIDERATIONS,
Wright Water Engineers, Inc., Denver, CO.
J. E. Jones, and D. E. Jones, Jr.
Journal of Water Resources Planning and Man ment, Vol. 110, No. 4, p 418-433, October, 19 Ref.

Descriptors: *Detention reservoirs, *Urban ru *Runoff management, Storm runoff, Plann Community development.

Widespread misapplication of detention pondi probably attributable to the simplicity and attr veness of its basic concept, combined with lac awareness or appreciation of complex inter tionships which influence its performance in u drainage systems. There is urgent need to prop relate runoff management and flood plain man ment to total urban water resource managem Some fundamental and peripheral considerat that often bear upon proper integration of de tion ponding into urban water resource man ment are reviewed. The most frequently enc tered problem with detention ponding is the w has been implemented out of context, by itself, mechanism for reducing peak runoffs from indi ual development sites. Communities should de op detention ponding programs only if they h the desire to manage creatively and effecti their stormwater problems and improve the li environment for the public. The level of comm ty commitment required and the importanc multipurpose facilities are often underestimate wide variety of operational, maintenance, attit nal and institutional questions should be indivi ly addressed during planning and design deci making. (Moore-IVI)
W85-03062

LIMNOLOGICAL CHANGES IN A SM LAKE STOCKED WITH GRASS CARP,
Ministry of Agriculture and Fisheries, Rot (New Zealand). Fisheries Research Div.
C. P. Mitchell, G. R. Fish, and A. M. R. Burne New Zealand Journal of Marine and Freshw Research, Vol. 18, No. 2, p 103-114, July, 19 Fig, 24 Ref.

Descriptors: *Grass carp, *Aquatic weed con *Parkinson Lake, *New Zealand, Biological trol, Dissolved oxygen, Water temperature, W level, Nutrients, Zooplankton, Chlorophyll a.

A heavy infestation of aquatic weeds (Egeria densa and Eleocharis sphacelata) in a 1.92 ha lake (Parkinsons Lake, North Island, New Zealand) disappeared within 2 years of the introduction of Chinese grass carp (Ctenopharyngodon idella Val). The elimination of aquatic plants did not result in any significant change in dissolved oxygen, water temperature, or annual fluctuations in lake levels over the successive 2 years. Dissolved inorganic phosphorus concentrations did not increase appreciably although there was a short term rise in particulate phosphorus levels. Oxidized nitrogen fluctuations were small in the lake over the experimental period. Some reduction in water transparency occurred although chlorophyll a levels showed no overall increase. There were increases in zooplankton numbers and biomass. A large increase of ammonium nitrogen in the lake accrued 12 months after all macrophytes had been eliminated, this possibly was a result of heavy use of inshore water by cattle. (Author's abstract)
W85-03071

SOME EFFECTS OF EUTROPHICATION AND THE REMOVAL OF AQUATIC PLANTS BY GRASS CARP (CTENOPHARYNGODON IDELLA) ON RAINBOW TROUT (SALMO GAIRDNERII) IN LAKE PARKINSON, NEW ZEALAND,
Ministry of Agriculture and Fisheries, Rotorua (New Zealand). Fisheries Research Div.
For primary bibliographic entry see Field 5C.
W85-03072

CONTROL OF ECHINOCHLOA STAGNINA (RETZ.) P. BEAUV. BY HARVESTING FOR DRY SEASON LIVESTOCK FODDER IN LAKE KAINJI, NIGERIA - A MODELLING APPROACH,
Imperial Coll. at Silwood Park, Sunninghill (England).
A. J. Morton, and E. A. Obot.
Journal of Applied Ecology, Vol. 21, No. 2, p 687-694, August, 1984. 3 Fig, 2 Tab, 5 Ref.

Descriptors: *Lake Kainji, *Nigeria, *Aquatic weed control, *Fodder, *Reservoirs, Hydroelectric plants, Harvesting, Standing crop, Grasses, Model studies.

The annual grass, Echinochloa stagnina is the major component of the emergent vegetation of Lake Kainji, Nigeria. The Kainji dam was built mainly for the genration of hydroelectric power, and the power generation authority views the grass as a problem and a threat to the life expectancy of the lake because of water displacement by E. stagnina and increased silting associated with its growth. The grass is a valuable spawning and breeding ground for economically important fish, and the grass is a valuable source of fodder for cattle during the dry season. A possible solution which takes into account all of these interests is the controlled harvesting and utilization of E. stagnina. A simple model of the colonization potential of E. stagnina is described and is used as a means of exploring the effects of harvesting of the grass. Between 28% to 46% of the Lake's surface could have been covered by E. stagnina during the years 1972-1983. Approximately 75% of the E. stagnina standing crop could be cut for harvest each year on a sustainable basis, assuming a colonization factor of 5.1 and assuming constant productivity from year to year. (Moore-IVI)
W85-03077

4B. Groundwater Management

INVESTIGATION INTO THE EFFECT OF DIFFERENT PUMPING REGIMES ON DRAWDOWN IN LARGE DIAMETER WELLS,
Birmingham Univ. (England). Dept. of Civil Engineering.
S. Holt, and K. R. Rushton.
Hydrobiological Sciences Journal, Vol. 29, No. 3, p 271-278, 1984. 2 Fig, 2 Tab, 7 Ref.

Descriptors: *Aquifers, *Drawdown, *Water supply development, *Wells, Water management, Transmissivity, Pumping regime,.

The response of large diameter wells to different short and long term pumping regimes has been investigated using a numerical model. The short term investigation shows that for a single pumping phase, a major proportion of the water withdrawn comes from well storage and it is not until recovery that most of the aquifer yield occurs. The nature of the pumping regime does influence the variation in well water level and aquifer drawdown. An increase in the number of phases leads to a decrease in the maximum drawdown in the well. The use of two or three pumping phases each day rather than single phase does bring considerable advantage. For long term pumping the objective is to withdraw the maximum amount of water from the aquifer without drawdown in the well becoming excessive. For the particular aquifer configuration considered, 40 cu m abstracted each day is a suitable overall rate. There is little difference in the number of days to failure between constant abstraction and one, two or three phases each day. When more water is abstracted each day it is advantageous to adopt two phase pumping rather than one phase each day. Whatever pumping regime is used, as more water is abstracted each day the proportion of available water utilized becomes less. In the extreme, excessive drawdown can occur after one day with only 2% of the available water used. (Baker-IVI)
W85-02826

EIGENVALUE TECHNIQUE FOR SOLUTE TRANSPORT,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W85-03004

IDENTIFICATION OF AN OPTIMAL GROUNDWATER MANAGEMENT STRATEGY IN A CONTAMINATED AQUIFER,
Kansas State Geological Survey, Lawrence.
S. J. Colarullo, M. Heidari, and T. Maddock, III.
Water Resources Bulletin, Vol. 20, No. 5, p 747-760, October, 1984. 8 Fig, 2 Tab, 19 Ref.

Descriptors: *Groundwater management, *Model studies, Aquifers, Groundwater pollution, Linearity.

A groundwater hydraulic management model was used to identify the optimal strategy for allocating limited fresh water supplies and containing wastes in a hypothetical aquifer affected by brine contamination from surface disposal ponds. The present cost of pumping from a network of potential supply and interception wells is minimized over a five year planning period, subject to a set of hydraulic, institutional, and legal constraints. Hydraulic constraints are formulated using linear systems theory to describe drawdown and velocity variables as linear functions of supply and interception well discharge decision variables. Linear system theory as a mechanism for coupling the hydraulic behavior of an aquifer with the economic consequences of managing this behavior is an invaluable tool for identifying optimal management strategies in freshwater aquifers which are subject to localized contamination. However, the assumption of linearity that is inherent to such an approach must be validated during postoptimality analysis by inputting optimal discharges and recharges to an external flow simulation model. The resulting simulated drawdown and velocity can be compared to drawdown and velocity predicted by the quadratic programming component of the groundwater hydraulic management model. Validation of the linearity assumption is especially important to cases in which large maximum drawdowns are allowed. For this investigation, simulated and optimal drawdowns and velocities matched closely, given the probable extent of optimization and simulation round off error. (Baker-IVI)
W85-03141

4C. Effects On Water Of Man's Non-Water Activities

SUBSTRATE-MEDIATED RESPONSE OF STREAM INVERTEBRATES TO DISTURBANCE,
Georgia Univ., Athens. Dept. of Entomology.
For primary bibliographic entry see Field 5C.
W85-02818

EFFECT OF URBANIZATION IN AN ARID REGION: FORMATION OF A PERCHED WATER TABLE THAT CAUSES ENVIRONMENTAL DAMAGES,
Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.
For primary bibliographic entry see Field 2F.
W85-02862

NEW GLOBAL ASSESSMENT OF THE STATUS AND TRENDS OF DESERTIFICATION,
New South Wales Univ., Kensington (Australia). School of Geography.
For primary bibliographic entry see Field 2A.
W85-03201

4D. Watershed Protection

REMOVAL OF WOODY DEBRIS MAY AFFECT STREAM CHANNEL STABILITY,
R. E. Bilby.
Journal of Forestry, Vol. 82, No. 10, p 609-613, October, 1984. 4 Fig, 2 Tab, 8 Ref.

Descriptors: *Logging, *Forest management, *Channel erosion, *Streamflow, *Erosion control, Erosion, Sediment transport, Channel improvement, Washington, Salmon Creek.

Many western states mandate the removal of logging debris from streams in order to prevent cumulations impassable to anadromous fish. Monitoring a small western Washington stream revealed large changes in channel structure during the first high flow after cleaning. Changes in channel morphology and the movement of woody debris after logging and subsequent channel cleaning in a stream in western Washington are described. Characteristics of those pieces which remained stable after cleaning were determined. The stream in discussion was Salmon Creek, a fourth order tributary to the Chehalis River in the Coast Range of Washington. The Creek drains a watershed of about 900 ha. The 600 m section studied was unlogged prior to 1980. The major change seen on Salmon Creek as a result of channel cleaning and high flow was a reduction in the frequency of pools formed by woody debris. The alteration or removal of debris during the stream cleaning and the subsequent movement of the debris and sediment during the initial highflow after the cleaning eliminated many of the pools. Once the debris was deposited in stable locations and again began to function in control of flow, pools began to reform, as seen by the increase in pool frequency and area following the high flow seen on December 26. Unstable debris, such as tree tops or branches, which enter during logging should be removed to lessen this accumulation in barriers that cannot be surmounted by anadromous fish. An interim guide to stream cleaning is presented. (Baker-IVI)
W85-02800

COMBATING DESERTIFICATION: EVALUATION OF PROGRESS,
International Center for Arid and Semi-Arid Land Studies, Lubbock, TX.
H. E. Dregne.
Environmental Conservation, Vol. 11, No. 2, p 115-121, Summer, 1984. 8 Fig, 1 Tab, 11 Ref.

Descriptors: *Desertification, *Erosion, *United Nations, Evaluation, Assessment, Planning, Deci-

sion making, Erosion control, Land use, Water supply.

In 1983 the United Nations Environment Programme undertook an evaluation of the progress made in implementation of the Plan of Action to Combat Desertification since the 1977 UN Conference on Desertification. Despite all that has been accomplished the exaggerated expectations have not come close to being realized. Land degradation continues widely, even though in places dunes are being stabilized, trees planted, and there is some success in reducing salinization of irrigated land. Too little effort is directed towards field control of desertification. All of the indirect contributions to desertification control will assist in combating desertification in the field at some time in the future. Emphasis during the first seven years has been directed towards fulfilling eight of the 26 action recommendations. Those eight cover various aspects of national and land use planning, increasing agricultural production, improving water supplies, and strengthening science and technology. Practically nothing has been done to improve understanding of the socio-economic factors underlying desertification, the human factor having been almost totally ignored. A strengthening of the Desertification Branch of the UN Environment Program is essential if there is to be any widespread improvement in combating desertification. The role of the Consultative Group on Desertification Control needs to be redefined, and the coordinating role of the Interagency Working Group on Desertification must be made more effective. (Baker-IVI)
W85-03202

POPULATION CRISIS AND DESERTIFICATION IN THE SUDANO-SAHELIAN REGION,
United Nations Environment Programme, Nairobi (Kenya).
S. Milas.
Environmental Conservation, Vol. 11, No. 2, p 167-169, Summer, 1984. 4 Fig, 7 Ref.

Descriptors: *Desertification, *Erosion, *Farming, *Ethiopia, *Drought, *Sudano-Sahelian Region, Water demand, Erosion control, Environmental impact.

Human activities cause desertification and human action can halt it. Improved land use and farming methods with increased inputs can raise the carrying capacity of land - the number of human or animal population units that it can support on a sustained basis - thus relieving the excessive pressures that often lead to desertification. The United Nations Environment Program assessment shows that desertification can be controlled by using already tested and proven technology, and that it is cost effective to do so. World-wide, the cost of lost agricultural productivity due to desertification is some $26 thousand millions a year, while halting desertification would cost $4.5 thousand millions a year for 20 years. The principal problem causing desertification in the Sudano-Sahelian region and elsewhere in the dry tropics, is mismanagement of the land. But due to poverty, exacerbated by rapidly-increasing numbers of mouths to feed, these people often have little choice. Increased human population density, lack of appropriate technological advances, and, in many cases, adverse outside pressures, have combined to intensify stresses on the land. (Baker-IVI)
W85-03204

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

SPECIES-DEPENDENT VARIATION IN ALGAL SENSITIVITY TO CHEMICAL COMPOUNDS,
Goeteborg Univ. (Sweden). Dept. of Botany.
H. Blanck, G. Wallin, and S.-A. Wangberg.
Ecotoxicology and Environmental Safety, Vol. 8, No. 4, p 339-351, August, 1984. 4 Fig, 4 Tab, 42 Ref.

Descriptors: *Phytotoxicity, *Algae, *Algal sensitivity, Water pollution effects, Pesticides, Wastewater, Detergents.

In standardized algal toxicity tests proposed for routine use, single algal species are employed to represent the algae. Under these circumstances, the species-dependent variation in sensitivity becomes crucial. Chemical compounds were tested on thirteen freshwater algal species grown in 250-micro l liquid cultures on plastic microtitration plates. The 19 compounds tested include: alamine 336, aliquat 336, copper sulfate, diuron, disodium hydrogen arsenate, glyphosphate, hydroquinone, paraquat, phenylmercury acetate, potassium dichromate, primene JM-T, SAN 9789, sodium lauryl sulfate, sodium nitrite, wastewater, tributyl phosphate, and tributyltin chloride. The species-dependent variation in algal sensitivity (EC100) may reach over three orders of magnitude, the degree of variation depending on the chemical tested. No generally sensitive or generally insensitive species could be identified. The predictive value of small algal test batteries was low. Although it did increase with size it took the presence of more than nine members in the test batteries to improve the value to 0.1. A nine-membered test battery might underestimate the sensitivity of the most susceptible algae by a factor of 0.1. A predictive value of 0.01 requires a three-membered test battery when accounting for 95% of the chemicals and a five-membered battery at the 99% confidence level. Algal test batteries, using simple test techniques, should replace single unialgal cultures in routine work. (Moore-IVI)
W85-02698

USE OF QUANTITATIVE ANALYSIS OF URINE TO ASSESS EXPOSURE TO ASBESTOS FIBERS IN DRINKING WATER IN THE PUGET SOUND REGION,
Washington Univ., Seattle. Dept. of Environmental Health.
E. S. Boatman, T. Merrill, A. O'Neill, L. Polissar, and J. R. Millette.
Environmental Health Perspectives, Vol. 53, p 131-139, November, 1983. 6 Fig, 4 Tab, 24 Ref. EPA contract CI790578.

Descriptors: *Everett, *Washington, *Urine, *Asbestos, *Drinking water, Fate of pollutants, Pollutant identification.

The possibility that significant numbers of asbestos fibers were present in the urine of residents of the Everett area of Washington State was investigated. Two groups of residents were used: one group had resided in the area less than 3 months; the other, more than 20 years. Tapwater in the area contained about 200 x 10 to the 6th power fibers/liter. A control group was obtained from Seattle where the tapwater asbestos fiber content was 100 times less. At no time did the asbestos content of the urine samples from Everett consistently exceed that of the control's. There was a significant difference in the asbestos content of urine samples from subjects with less than 3 yr residence times vs those with more than 20 years. Asbestos concentrations in urine samples from Everett residents as a whole did not differ significantly from that in samples from Seattle residents. Variable degrees of chrysotile contamination of control water samples and of Nuclepore membrane filters presented a problem. The data are at present inconclusive but would suggest no relationship between high concentrations of fibers in drinking water and the numbers estimated for voided urine. (Baker-IVI)
W85-02712

ASBESTOS IN DRINKING WATER: A CANADIAN VIEW,
Environmental Health Directorate, Ottawa (Ontario).
P. Toft, and M. E. Meek.
Environmental Health Perspectives, Vol. 53, p 177-180, November, 1983. 6 Ref.

Descriptors: *Asbestos, *Drinking water, *Ca
*Public health, Human diseases, Cancer, Epi
ology.

Because of the widespread occurrence of ch
tile asbestos in drinking water supplies in Ca
public health professionals have been faced
evaluating the potential hazards associated
the ingestion of asbestos in food and dri
water. The results of available Canadian mo
ing and epidemiologic studies of asbestos in d
ing water are reviewed and discussed in lig
other published work. The Canadian studies
vide no consistent, convincing evidence o
creased cancer risks attributable to the ingesti
drinking water contaminated by asbestos,
though the observed asbestos concentrations
relatively high in several communities. Only
study, conducted in the San Francisco Bay A
has shown evidence of increased cancer incid
associated with the ingestion of asbestos in d
ing water. (Baker-IVI)
W85-02715

SIZE AND METAL CONCENTRATION IN MANGROVE MUSSEL MYTELLA GUYAN SIS (MOLLUSCA: BIVALVA) FROM BAIA SEPETIBA, BRAZIL,
Universidade Federal Fluminense, Niteroi (Br
L. D. de Lacerda, N. R. W. Lima, W. C. Pfeiff
and M. Fiszman.
Revista de Biologia Tropical, Vol. 31, No.
333-335, November, 1983. 2 Fig, 1 Tab, 7

Descriptors: *Rio de Janerio, *Brazil, *Mu
*Mangrove swamps, *Heavy metals, *Water p
tion effects, Pollution indicators, Mollusks, M
toring, Metals.

The natural variability of metal concentratio
M. guyanensis was estimated. The chosen par
ter was size, as it is well correlated with most o
metabolic functions and is of major concer
developing monitoring programs. The sam
area is in the mangrove swamp of Itingussu,
de Sepetiba, Rio de Janerio State, an area
increasing industrial activity and consequ
with moderate levels of heavy metals in the aq
environment. The analysis of metals in s
showed a significant inverse relationship fo
metals, presenting a constant trend not observe
soft tissues. As the mechanisms of metal uptake
excretion in shells are slower than those of
tissues, shells should be used as monitoring in
ments. The results suggest that the relation
tween metal concentration and size in mollusks
significant factor to be considered in monito
programs. These relationships vary with spe
and care should be taken in considering re
obtained in species from temperate regions
those from the tropics, even when the species
closely related. (Baker-IVI)
W85-02718

RECENT ADVANCES IN COLIFORM ME ODOLOGY FOR WATER ANALYSIS,
Montana State Univ., Bozeman. Dept. of Micr
ology.
M. W. LeChevallier, and G. A. McFeters.
Journal of Environmental Health, Vol. 47, No.
5-9, July-August, 1984. 3 Fig, 1 Tab, 32 Ref.

Descriptors: *Bacteria, *Water quality con
*Water analysis, *Coliforms, *Indicator organis
Monitoring, Water quality, Drinking water.

Indicator bacteria are used to evaluate the pota
ity of drinking water because it would be impo
ble to accurately enumerate all pathogenic o
nisms that are transmitted by water borne rou
The effectiveness of the coliform group of bact
as indicators of water quality is largely relate
their efficiency of enumeration. Recent impro
ments in coliform methodologies make these i
cators more sensitive and accurate measures
drinking water quality. It is important that a m
general coliform definition exist so that new m
ods may be evaluated with a more comprehens
set of criteria. Changes in the media used for
membrane filter technique have been proposed

he enumeration of stressed total and fecal coliforms. Steps taken in the formation of a new elective agar medium have ensured that it is selective while minimizing the inhibition of stressed coliforms. Various resuscitation techniques for ecal coliforms are becoming more widely known. New procedures for coliform verification have been proposed. In one method presumptive coliforms were tested for the presence of B-galactosidase and cytochrome oxidase. The fermentation tube (MPN lactose) technique is described. New approaches to the most probable number method of making these assays more efficient for the recovery of indicator bacteria from drinking water are described. (Baker-IVI)
W85-02722

TENTATIVE ASSESSMENT OF WATER POLLUTION BY THE MEDAKA EGG STATIONING METHOD: AERIAL APPLICATION OF FENITROTHION EMULSION,
Hiroshima Univ. (Japan). School of Medicine.
Y. Hiraoka, and H. Okuda.
Environmental Research, Vol. 34, p 262-267, 1984. 6 Fig, 1 Tab, 7 Ref.

Descriptors: *Bioindicators, *Water quality control, *Monitoring, *Fenitrothion, *Medaka, Fish eggs, Toxicity, Pesticides.

To determine how centrum abnormalities in medaka could be used to indicate the degree of water pollution, several rearing experiments were carried out. Medaka eggs were placed at certain points on a stream flowing from an area in which fenitrothion emulsion (organophosphorus pesticide-MEP) was being applied aerially. There was sufficient probability that the eggs were exposed to the MEP. They were brought to the lab, and reared in dechlorinated water to adulthood. The external forms and vertebral centra of each adult fish were closely observed. There was no incidence of deformity among the control and blank experiments, but in the exposure experiments, the incidence of deformed fish was 1.7 to 4.8%. The caudal peduncle of most of the deformed fish were slightly crooked in a lateral direction. The incidence of centrum-damaged fish was 11% in the control, 9% in the blank, and 34-66% in the exposure experiments. These abnormalities were deflection, shortening, and fusion of the centra. Abnormalities occurred mainly in the 29th and 30th centrum, and urostyle of medaka in the exposure experiment groups. (Baker-IVI)
W85-02726

DETERMINATION OF ALKALINITY AND ACIDITY OF WATER BY CONDUCTOMETRIC ACID-BASE TITRATION,
National Water Research Inst., Burlington (Ontario).
I. Sekerka, and J. F. Lechner.
Journal of the Association of Analytical Chemists, Vol. 67, No. 5, p 893-895, 1984. 2 Fig, 2 Tab, 12 Ref.

Descriptors: *Water analysis, *Titration, *Acidity, *Alkalinity, Sulfates, Phosphates, Organic compounds, Water quality control.

The determination of total alkalinity by using acid-base titration with trichloroacetic acid solution as titrant is described. Total acidity is determined by titration with ammonium hydroxide solution. Both titrations are monitored conductometrically. Performance is evaluated and compared with performance of the potentiometric titration. Automated conductometric titration is simple, fast (30s/titration), sensitive to a detection limit of 0.1 ppm calcium carbonate, and accurate. The relative error of the determination increased from about 1% at high levels to about 10% at 1 ppm calcium carbonate. The relative standard deviation of alkalinity measurements ranged from 1 to 5%; for acidity these ranges were from 1.5 to 17%. Relative standard deviation reached 33% at lower detection limits. Samples containing noncarbonate contributory components of alkalinity can be reproducibly analyzed. (Baker-IVI)
W85-02734

PURGE AND TRAP CHROMATOGRAPHIC METHOD FOR THE DETERMINATION OF ACRYLONITRILE, CHLOROBENZENE, 1,2-DICHLOROETHANE, AND ETHYLBENZENE IN AQUEOUS SAMPLES,
Monsanto Agricultural Products Co., St. Louis, MO. Research Dept.
J. M. Warner, and R. K. Beasley.
Analytical Chemistry, Vol. 56, No. 11, p 1953-1956, September, 1984. 4 Fig, 2 Tab, 9 Ref.

Descriptors: *Pollutant identification, *Water analysis, *Chromatography, *Organic compounds, Acrylonitrile, Chlorobenzene, Dichloroethane, Ethylbenzene.

A purge and trap method is presented for the determination of four priority pollutants in aqueous samples. Water samples are purged at 50 C with helium and the analytes are trapped on Tenax GC. The trap is thermally desorbed directly into a gas chromatograph equipped with a flame ionization detector. Instrument calibration is performed by direct injection of standard solutions in methanol through a modified purge vessel. The method was validated in the laboraory for the range of 20-500 ppb for each analyte using a 5 g aqueous sample. Average recoveries were 62%, 100%, 99%, and 92% for acrylonitrile, chlorobenzene, 1,2-dichloroethane, and ethylbenzene, respectively. Testing of the method on field samples was performed by using samples collected from various sources at an industrial site at which the four analytes were present either as raw materials or as byproducts. (Baker-IVI)
W85-02736

DETERMINATION OF INORGANIC CARBON (TIC) IN SMALL SAMPLES WITH THE USE OF MICRO-COMPUTERS (EINSATZ VON MICRO-COMPUTERN BEI DER BESTIMMUNG VON ANORGANISCHEM KOHLENSTOFF (TIC) IN GERINGEN WASSERMENGEN),
Technische Univ. Muenchen (Germany, F.R.). Lehrstuhl fuer Hydrogeologie und Hydrochemie.
B. Merkel, and U. Ferstl.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17, No. 4, p 153-157, August, 1984. 2 Fig, 1 Tab, 9 Ref.

Descriptors: *Water analysis, *Carbon, *Computers, Inorganic carbon, Acidity, Infrared photometry.

The determination of inorganic carbon (TIC) by IR-photometry is used as an example of the use of microcomputers in water analysis. Using a simple but dependable injection device, total inorganic carbon concentrations can be measured in samples of about 30 microliters. The analog output signal of the IR-photometer, a linear function of the carbon dioxide concentration, is digitized and transfered on line to the computer while the integration of the digits is done post-run. The equilibrium distribution of the inorganic carbon species is calculated from measured total inorganic carbon and pH value. The computer output can be directed to either the screen, the printer, or the data-file. (Author's abstract)
W85-02741

DETECTION OF ELEMENTARY SULPHUR IN FRESHWATER SEDIMENTS,
Hajdu-Bihar County Water Canalization Works, Debrecen (Hungary).
I. Devai, C. Heim, I. Wittner, G. Devai, and Z. Dinya.
Environmental Pollution (Series B), Vol. 8, No. 2, p 155-160, 1984. 1 Tab, 16 Ref.

Descriptors: *Sulfur, *Sediments, *Lake Balaton, *River Zala, *Hungary, *Wastewater treatment facilities, *Lakes, *Rivers, *Pollutant identification, Chromatography, Spectrophotometry, Chlorinated hydrocarbons.

Chlorinated hydrocarbons in the sediments of the shallow Lake Balaton, the River Zala and two open air BMKO type sewage treatment plants were studied by gas chromatography. For the detection of chlorinated hydrocarbon contaminantion of Lake Balaton sediments, air-dry sediment samples were first used. A chromatogram indicating the presence of PCBs was characteristics of each hexane-eluate. In the case of samples from the mouth of the River Zala, however, an all-screening, large peak occurred with a 3.78 minute retention time. This peak also occurred in samples from Lake Balaton and from the open air sewage treatment plant samples. It was suggested that a great amount of elementary sulfur must be present in the sediment investigated. The sulfur peak was missing from the air-dry samples eluted in hexane, since the finely dispersed sulfur underwent slow oxidation under these conditions. An urgent need is seen to investigate the sulfur cycle, and compare these findings with the phosphorus and nitrogen cycles. (Baker-IVI)
W85-02746

RESULTS OF INTERLABORATORY RINGTESTS CONCERNING THE DETERMINATION OF CHLOROPHYLL-A IN WATER (ERGEBNISSE EINES RINGVERSUCHES ZUR CHLOROPHYLL-A-BESTIMMUNG IM WASSER),
Ruhrverband, Essen (Germany, F.R.). Chemisches und Biologisches Lab.
E. A. Nusch.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17, No. 3, p 89-94, June, 1984. 6 Fig, 6 Tab, 15 Ref.

Descriptors: *Quality control, *Laboratories, *Chlorophyll a, *Chemical analysis, Ethanol, Extraction, Water analysis, Phaeopigments.

The Ethanol extraction method according to Nusch and Palme (Nusch, E. A. and Palme, G., 1975. Gas- und Wasserfach, Vol. 116, p 562-565) on which a German Standard (DIN 38412, Part 16) has been drafted, was tested tentatively in a preliminary ringtest with 6 laboratories and definitively in a ringtest with 18 laboratories participating. In spite of various difficulties in the performance (e.g. instability and inhomogenity of samples, unexperienced assistants) the method proved to be sufficiently accurate, precise and reproducible. The interlaboratory standard deviation of chlorophyll determinations in the final ringtest (3 different reconstituted and natural samples) was 5-11%. These satisfactory results confirm the previous tentative experiments which yielded standard deviations of +/- 6-10% for the chlorophyll determinations. The average variation coefficient of 226 determinations in 2 round robins with 6 different chlorophyll concentrations (20-340 micro g/l) amounts to 8%. The variation coefficients of 190 phaeopigment determinations with 6 different concentrations (8-58 micro g/l) average 27%. (Author's abstract)
W85-02755

LIMITS OF DETERMINATION AND DETECTION OF CHLORINE, CHLORINE DIOXIDE AND CHLORITE BY THE METHOD OF PALIN (BESTIMMUNGS- UND NACHWEISGRENZEN DER METHODE VON PALIN ZUR DIFFERENTIELLEN ANALYSE VON CHLOR, CHLORDIOXID, UND CHLORIT IM TRINKWASSER),
Rheinisch-Westfaelische Wasserwerksgesellschaft m.b.H., Mulheim an der Ruhr (Germany, F.R.).
H. Overath, and K. T. Oberem.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17, No. 3, p 99-105, June, 1984. 8 Fig, 4 Tab, 11 Ref.

Descriptors: *Chlorine dioxide, *Chlorite, *Detection limits, Chemical analysis, Water treatment, Drinking water.

Chlorine dioxide is increasingly used for disinfecting drinking water. For chlorite, an inevitable side product, the fixing of a threshold value is expected in the near future which must not be surpassed in drinking water. Palin (Palin, A. T., 1975. J. American Water Works Assoc., Vol. 67, p 32-33) developed a well known method for detecting chlorine, chlorine dioxide and chlorite simultaneously. For this analytical method the limit of determination and the limit of detection are now accessible. It

turned out that with a single test 0.10 mg/l chlorite can be quantitatively detected in the presence of chlorine dioxide and/or chlorine with a statistical probability of P = 99%. (Author's abstract)
W85-02756

MULTIVARIATE STATISTICAL ANALYSES OF 96-HOUR SEDIMENT BIOASSAY AND CHEMISTRY DATA,
Aqua Tech Environmental Consultants, Inc., Melmore, OH.
R. A. Laskowski-Hoke, and B. L. Prater.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 4, p 400-409, October, 1984. 3 Tab, 19 Ref.

Descriptors: *Water analysis, *Lake Michigan, *Bioassay, *Chemical analysis, *Lake sediments, Water quality, Harbors, Lakes, Multivariate analysis.

As a result of increased concern over toxic substances in freshwater sediments, renewed interest has been focused on the importance of sediment quality and sediment-organism, sediment-water column interactions. An investigation began in 1977 in five harbors of Lake Michigan to determine if relationships existed between results of chemical and bioassay analyses. The canonical correlation analyses illustrated significant relationships betwen the bioassay and various chemistry data sets. As an analytical tool, it facilitated the identification of the most important variables in each of the chemistry data sets relative to the bioassay data and confirmed the results of the univariate analyses. The multivariate analyses also illustrated that the redundancy of the bioassay data set was greater than that of each of the chemistry data sets. Although direct cause and effect relationships between mortality of test organisms and concentrations of chemical parameters are not postulated, these results add credence to the potential for such relationships. (Baker-IVI)
W85-02777

DIFFERENTIAL RESPONSE OF MARINE ORGANISMS TO CERTAIN METAL AND AGRICHEMICAL POLLUTANTS,
Toledo Univ., OH. Dept. of Biology.
H. H. Lee, and C. H. Xu.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 4, p 460-467, October, 1984. 2 Fig, 3 Tab, 10 Ref.

Descriptors: *Water pollution effects, *Metals, *Marine animals, *Agricultural chemicals, Organic compounds, Brine shrimp, Starfish, Sea urchins, Amphioxus, Bioassay.

Oocyte maturation of the starfish, fertilization and embryogenesis of sea urchins, and the development of amphioxus and brine shrimps were used to assay the effects of several common metals and agrichemicals frequently found in the marine environment. Brine shrimp embryos were most tolerant to all the substances at the levels tested. There were no effects on their hatchability or development. The most toxic substances in affecting 1-methyladenine induction of starfish oocyte maturation were triphenyls. Cu, Mg, Ni and Zn inhibited fertilization of sea urchin eggs as evident by the absence of fertilization membrane and cleavage. The findings of the differential response of different species and stage specific response to environmental pollutants can be used in a diversity of purposes. (Baker-IVI)
W85-02783

POTENTIOMETRIC STRIPPING ANALYSIS FOR MANGANESE(II) IN NATURAL WATERS,
Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Analytical and Marine Chemistry.
H. Eskilsson, and D. R. Turner.
Analytica Chimica Acta, Vol. 161, p 293-302, July, 1984. 7 Fig, 2 Tab, 15 Ref.

Descriptors: *Pollutant identification, *Water analysis, *Manganese, *Surface waters, *Drinking water, *Potentiometric stripping analysis, Potentiometers, Copper, Zinc, Gallium, Natural waters.

Potentiometric stripping analysis (p.s.a.) methods for the measurement of manganese(II) in natural waters in the concentration range of 2 nM - 30 microM are described along with the determination of total dissolved manganese following pretreatment with hydroxylamine. The method was used to measure manganese levels in nine North Atlantic water samples taken in 1981. The measurements in deaerated samples agreed well with atomic absorption spectrometry (a.a.s.) measurements, whereas lower values were generally obtained in non-deaerated samples. In contrast to the batch measurements, linear response could be obtained up to at least 30 microM manganese by the use of short deposition times. The detection limit of the flow technique was estimated to be 1.8 nM. The reproducibility of the measurements depended to some extent on the pH of the samples. Manganese was measured in a series of samples taken from the Norwegian fjord Framvaren in September of 1983. Total manganese concentrations were measured by both p.s.a. and a.a.s. after hydroxylamine treatment and the agreement was generally good, although between 20 and 30 m depth, potentiometric stripping gave significantly higher values than a.a.s. Tap water samples containing significant levels of both copper and manganese were examined. Only on the addition of 30 microM gallium nitrate were a straight calibration line and a realistic estimate of manganese concentration able to be obtained. (Baker-IVI)
W85-02798

DERIVATIZATION OF ORGANIC AND INORGANIC N-CHLORAMINES FOR HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC ANALYSIS OF CHLORINATED WATER,
Old Dominion Univ., Norfolk, VA. Alfriend Chemical Labs.
F. E. Scully, Jr., J. P. Yang, K. Mazina, and F. B. Daniel.
Environmental Science and Technology, Vol. 18, No,. 10, p 787-792, October, 1984. 5 Fig, 25 Ref.

Descriptors: *Water analysis, *Chloramines, *Water treatment, *Chlorination, *Chromatography, Disinfection, Wastewater treatment, Reaction kinetics.

Organic and inorganic N-chloramines are converted to highly fluorescent dansyl derivatives by reaction with 5-(dimethylamino)naphthalene-1-sulfinic acid (DANSO2H). Details of the method for derivatizing dilute aqueous solutions of N-chlormaines are given along with the application of high performance liquid chromatography to the separation of mixtures of chloramine derivatives. The derivatization method is applied to the analysis of aqueous solutions of individual amines and a mixture (2 mg/L as N in each amine component) chlorinated to different Cl2/N levels and incubated for 1 hr. The chloramine concentrations measured in this manner are correlated with residual chlorine levels determined by the DPD-titrimetric method. A sample of a chlorinated municipal wastewater effluent was analyzed and found to contain both organic and inorganic N-chloramines. A dichloramine probably undergoes two successive displacements of its chlorines on reaction with DANSO2H to form its parent amine and two dansyl chloride molecules. Subsequent reaction would yield the same derivative as the corresponding monochloramine. There is good correlation between the amount of recovered dansylamide and the residual oxidant in the region of the curve where dichloramine formation becomes significant. The use of a cosolvent inhibits the hydrolysis of the intermediate sulfonyl chloride. (Baker-IVI)
W85-02807

ORGANIC COMPOUNDS IN WATER: ANALYSIS USING COUPLED-COLUMN HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY AND SOFT-IONIZATION MASS SPECTROMETRY,
Water Research Centre, Medmenham (England). Medmenham Lab.
B. Crathorne, M. Fielding, C. P. Steel, and C. D. Watts.
Environmental Science and Technology, Vol. 18, No. 10, p 797-802, October, 1984. 5 Fig, 1 Tab, 27 Ref.

Descriptors: *Chromatography, *Water anal
*Mass spectrometry, *Organic compounds, *W
quality control, Drinking water, Rivers, Ioniza

The use of coupled-column high-performa
liquid chromatography and mass spectrom
using field desorption (FD) and fast atom b
bardment (FAB) ionization for the separation
identification of organics isolated from river
drinking waters is reported. HPLC analysis
extracts of both river and drinking waters inv
ably results in complex chromatographs. M
spectrometry (FD and FAB) is carried out both
HPLC fractions and on total extracts. A typ
example of an FD mass spectrum obtained from
extract of a drinking water is shown. Gener
FD yields only molecular ions. FAB, in gene
has provided less information on total extracts t
that provided by FD. Thus, FAB mass spectra
complex extracts highlight polar compounds w
high surface activity, quaternary ammonium c
pounds. The nature of FD and FAB mass sp
trometry is such that only approximate quantita
data can be readily obtained from total extrac
and most HPLC fractions. Many of the nonvola
organics identified are anthropogenic in origin
possess biological activity. (Baker-IVI)
W85-02808

**USE OF BONDED PHASE SILICA SORBEN
FOR THE SAMPLING OF PRIORITY PO
LUTANTS IN WASTEWATER,**
Ford Motor Co., Dearborn, MI.
E. Chladek, and R. S. Marano.
Journal of Chromatographic Science, Vol. 22,
8, p 313-320, August, 1984. 7 Fig, 8 Tab, 32 R

Descriptors: *Pollutants, *Wastewater analy
Pollutant identification, Silica, Sorbents, Wa
quality control.

A cartridge sampling technique for priority poll
ants in wastewater has been developed us
bonded phase silica absorbents. This technique
been compared to the EPA Method 625 wh
requires liquid-liquid extraction of the wastewa
The sample matrix and the chemical/physi
properties of each pollutant can play an import
role in determining proper sampling and eluti
techniques. Spiking studies carried out on act
wastewater samples were valuable in determini
techniques that maximize the recoveries of diff
ent types of pollutants and yet minimize ba
ground interferences. Once these techniques w
established it was possible to apply the cartrid
adsorbent method to the determination of a w
variety of priority polutants. From a practi
standpoint, the cartridge adsorbent extracti
method has several advantages in comparison w
liquid-liquid extraction: cartridge sampling
wastewater can be undertaken in the field; ve
little solvent is needed for extraction; the lab
facilities and equipment required for sample prep
ration are greatly reduced; and the selective e
tion procedures yield a final eluate with few
background interferences than are obtained
liquid-liquid extraction. (Baker-IVI)
W85-02809

**DETERMINATION OF CHLORINATE
PHENOLS IN WATER, WASTEWATER, AN
WASTEWATER SLUDGE BY CAPILLARY GC
ECD,**
Imperial Coll. of Science and Technology, Lond
(England). Public Health Engineering Lab.
R. S. K. Buisson, P. W. W. Kirk, and J. N. Lester
Journal of Chromatographic Science, Vol. 22, N
8, p 339-342, August, 1984. 1 Fig, 3 Tab, 33 R

Descriptors: *Water analysis, *Pheno
*Wastewater analysis, *Pollutant identificatio
Chlorinated phenols, Organic compounds.

A method is described which permits the analys
of chlorinated phenols in aqueous samples at ng
concentrations. Extraction is carried out by h
mogenization with dichloromethane, clean-up b
sample concentration and back extraction wi
alkali, and derivatization for capillary gas chrom
tography/electron capture detection by extracti

alkylation with pentafluorobenzoyl chloride. The method is applied to municipal wastewater treatment works effluent, digested wastewater sludge, and soil leachate and the concentrations found are reported. Any method for the analysis of chlorophenols in environmental samples must overcome the problem of extraction of the polar phenols from a polar medium and coextraction of a number of possible interfering compounds. The problem of the poor resolution of pentachlorophenol in the sludge sample could be overcome by adjusting the temperature program in its final stages to hold the temperature at a lower level. This lengthens the analysis time. This method has a sensitivity and precision equal to and in some cases better than other published methods. The method retains simplicity of technique and rapid completion time even when applied to the most contaminated samples. (Baker-IVI)
W85-02810

ELIMINATION OF AMMONIA INTERFERENCE IN THE PURGE-AND-TRAP GC DETERMINATION OF ORGANOHALOGENS IN WATER,
Florida International Univ., Miami. Drinking Water Quality Research Center.
W. J. Cooper, M. F. Mehran, R. A. Slifker, and D. L. Savoie.
Journal of Chromatographic Science, Vol. 2, No. 10, p 462-464, October, 1984. 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Ammonia, *Organohalogens, *Water analysis, *Chromatography, *Trihalomethanes, Organic compounds.

A quick and reliable method for eliminating the ammonia interference during the purge-and-trap method of analysis of THMs and other organohalogen compounds is reported. The technique is used on chlorinated ground water and secondary wastewater effluents. Pasteur pipettes were used to make mini-ion exchange columns for ammonia removal as a pretreatment step prior to the standard purge-and-trap analysis. To insure adequate removal of the ammonia by ion exchange, the pH of the sample was lowered to 5 by adding KH2PO4. The precision estimates for the procedure employing the ammonia removal column were the same as for the standard purge-and-trap analytical procedure in the absence of ammonia. (Baker-IVI)
W85-02811

SCREENING METHODS FOR SYNFUEL CHEMICALS IN AQUATIC ENVIRONMENTS,
Tetra Tech, Inc., Lafayette, CA.
W. B. Mills, and D. B. Porcella.
Journal of Environmental Management, Vol. 18, No. 4, p 297-307, June, 1984. 2 Fig, 6 Tab, 2 Ref.

Descriptors: *Water analysis, *Synfuels, *Organic compounds, Water quality control, Model studies, Toxicants, Spills, Pollutant identification, Rivers, Lakes, Estuaries, Hydrocarbons.

Screening level procedures have been developed for computing concentrations of toxic and conventional water pollutants in surface waters. The procedures can be easily adapted to a broad variety of streams, reservoirs, and estuarine environments. Both dynamic and steady state situations can be analyzed. Synfuel chemicals are especially suited to this analysis because field data are lacking to assess the potential fate and effects of the wide variety of compounds that could enter the aquatic environment from synfuel activities. Two situations in a stream environment were evaluted: desorption from contaminated bed sediments and a spill. Results were obtained using a hand calculator and showed broad variation in behavior and persistence of the four synfuel compounds evaluated. In some cases concentrations exceeded water quality criteria for several days following a spill. Other benefits of performing the screening calculations include a quick assessment of potential ecological effects, and an analysis of potential risk to human populations. Based on the magnitude of such risks, a decision in favor of more detailed modeling can be made. Uncertainties in important processes can be analyzed quickly and conveniently. The methods are easily adapted to a variety of environmental situations or scenarios. This is not always a simple task for more complex model structures. (Baker-IVI)
W85-02812

QUAL II MODEL,
Universidade Nova de Lisboa (Portugal). Sanitary Engineering Group.
A. S. Camara, and C. W. Randall.
Journal of Environmental Engineering, Vol. 110, No.5, p 993-996, October, 1984. 1 Ref.

Descriptors: *Streams, *Water quality, *Model studies, Mathematical equations, Nitrates, Phosphorus, Ammonia, Water quality control, Algae.

QUAL II is a stream water quality model developed for the EPA that integrates a set of simultaneous equations over time. These equations include dispersion and advection terms and the reactions and interactions among a variety of water quality constituents including dissolved oxygen, biochemical oxygen demand, ammonia, nitrite, nitrate, phosphorus, algal biomass, coliforms and radionuclides. Attempts to apply the model have brought out some shortcomings. It is pointed out that the model contains a poor representation of the NO3, P and algae terms. Both the solution of the singularity problem and a more correct modeling of the evolution of those constituents, could be achieved by introducing non-zero coefficients on NH3 and P, in the respective differential equations. (Baker-IVI)
W85-02821

SPECTROPHOTOMETRIC DETERMINATION OF NITRITE IN WATERS WITH 5,7-DIHYDROXY-4-IMINO-2-OXOCHROMAN,
Shizuoka Univ., Hamamatsu (Japan). Dept. of Applied Chemistry.
M. Nakamura, T. Mazuka, and M. Yamashita.
Analytical Chemistry, Vol. 56, No. 12, p 2242-2244, October, 1984. 3 Fig, 2 Tab, 13 Ref.

Descriptors: *Water analysis, *Pollutant identification, *Nitrites, *Spectrophotometry, Water quality, Chemical analysis, Wastewater analysis.

A method is described for the rapid, sensitive, selective, and reproducible extraction and spectrophotometric determination of nitrite in water samples with 5,7-dihydroxy-4-imino-2-oxochroman which was chosen from a general investigation of various coumarins and chromans. This reagent reacts quickly with nitrite in acidic medium. The product is extracted readily into the mixed solvent of n-butylalcohol and ethyl acetate and has an absorption maximum at 361 nm. Beer's law is obeyed over the concentration range of 0.005-0.280 ppm of nitrite nitrogen. The molar absorptivity is 23200 L/mol, and Sandell sensitivity is 0.602 ng/sq cm for nitrite nitrogen. The relative standard deviation is plus or minus 0.3% for the determination of 0.105 ppm of nitrite nitrogen. The method has been used for the determination of nitrite in river, lake, waste and rain waters. (Baker-IVI)
W85-02833

XENOBIOTIC PERTURBATION OF MICROBIAL GROWTH AS MEASURED BY CO2 UPTAKE, IN AQUATIC HETEROTROPHIC BACTERIA,
Columbia National Fisheries Research Lab., MO.
B. T. Johnson, and V. I. Romanenko.
Journal of Great Lakes Research, Vol. 10, No. 3, p 245-250, 1984. 4 Fig, 2 Tab, 20 Ref.

Descriptors: *Bacteria, *Carbon dioxide, *Absorption, Water quality control, Monitoring, Bioassay, Environmental effects, Fisheries, Kepone, Simazine, Dilox, Mirex, Phalates.

A microbiological assay, based on the dark reaction carboxylation by heterotrophic bacteria, was developed to assess chemical-induced changes in aquatic heterotrophic bacterial populations in the laboratory and in natural waters. This simple, sensitive, reproducible C-14 radiometric assay was used to monitor changes in biosynthetic activity of naturally occurring heterotrophic bacteria stimulated with an organic nutrient and incubated with known or potential aquatic chemical contaminants. Kepone at water concentrations of more than 1.0 mg/L significantly inhibited bacterial carboxylation. Inhibition tended to follow a linear dose-response. Simazine slighty stimulated bacterial carboxylation; Dylox, mirex and di-2-ethylhexyl phthalate produced no effects. The predictive value of this assay would be enhanced by directly relating physiological activiy to bacterial biomass, and thereby, differentiating perturbation of a specific biochemical process from a general population depressant or stimulant. A specific activity perturbation index would give the environmental microbiologist a quantitative measurement to use in a predictive model for assessing the impact of xenobiotic stress on aquatic biogeochemical cycles and ultimately the fishery. (Baker-IVI)
W85-02885

CANCER IN WILD FRESHWATER FISH POPULATIONS WITH EMPHASIS ON THE GREAT LAKES,
Columbia National Fisheries Research Lab., MO.
P. C. Baumann.
Journal of Great Lakes Research, Vol. 10, No. 3, p 251-253, 1984. 15 Ref.

Descriptors: *Water pollution effects, *Fish, *Cancer, *Great Lakes, Carcinogens, Tumors, Fish populations, Water pollution effects, Polychlorinated biphenyls, Polynuclear aromatic hydrocarbons, Carcinogens.

Papillomas in white sucker, gonadal tumors in carp x goldfish hybrids, and thyroid hyperplasia in coho salmon seem to be widespread in occurrence throughout the Great lakes. In all cases, however, tumor incidence increases near areas contaminated by industrial effluents such as polychlorinated biphenyls, and polynuclear aromatic hydrocarbons (PAHs). Liver tumors in bullhead occur frequently at a site with large amounts of PAH in the sediment, and liver tumors in auger and walleye occur in a lake which has been a dump site for copper mine wastes. Therefore, tumor incidence in certain species of fish may be a sensitive indicator of the level of carcinogenic compounds in the environment. The Great lakes apparently contain a number of localized areas in which carcinogenic contaminants are now affecting the health of resident fish species. (Baker-IVI)
W85-02886

INTERCOMPARISONS OF ANALYTICAL METHODOLOGY AND LABORATORY CAPABILITIES BETWEEN SOVIET AND AMERICAN LABORATORIES - 1973 AND 1977,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
M. D. Mullin, A. A. Matveyev, and A. M. Anikanov.
Journal of Great Lakes Research, Vol. 10. No. 3, p 254-260, 1984. 9 Tab, 8 Ref.

Descriptors: *International agreement, *Lake Baikal, *USSR, *United States, *Water analysis, Quality control, Sediments.

A comparison of analytical methodologies and laboratory capabilities was undertaken as part of the cooperative scientific efforts between the US and the USSR on aquatic ecosystems. The samples exchanged between participating laboratories in the two countries included water samples from Lake Baikal, and standard reference samples from the US EPA. From the results of the intercalibration of samples performed, two conclusions were drawn relative to a comparison of method of analysis: the first characterizes the satisfactory agreement of analytical methods which can be used as a basis for further joint studies in areas where hydrochemical information is used; the second relates to widely different results which were obtained and explains these differences as due to the inexperience of the Baikal Expedition in the determination of very high concentrations and the time increments involved in the exchange of samples between the two countries. (Baker-IVI)
W85-02887

COMBINATION OF CONTINUOUS MODE LIQUID-LIQUID EXTRACTION WITH COUPLED GC-MS FOR THE ANALYSIS OF PESTICIDES IN WATER (COMBINAISON D'UNE CELLULE D'EXTRACTION LIQUIDE-LIQUIDE EN CONTINU ET D'UN COUPLAGE CG-SM EN VUE DE L'ANALYSE DES PESTICIDES DANS LES EAUX),
Societe Lyonnaise des Eaux et de l'Eclairage, Paris (France).
A. Bruchet, L. Cognet, and J. Mallevialle.
Water Research, Vol. 18, No. 11, p 1401-1409, 1984. 10 Fig, 4 Tab, 13 Ref.

Descriptors: *Pesticides, *Chemical analysis, *Liquid-liquid extraction, *Gas chromatography, *Mass spectroscopy, Extraction, Chromatography, Instrumentation, Fragmentometry, Composite samples.

The occurrence of synthetic organic chemicals in drinking water supplies has prompted the European Economic Community to establish standards for pesticides. Currently, the limit on total pesticides is 500 ng/l with no individual pesticides to exceed 100 ng/l. The variability of pesticides, both in concentration and composition, indicates that composite rather than grab samples are desirable for analysis of the water quality. Furthermore, the variability in composition makes a broad spectrum analysis preferable to individual compound analysis so that many compounds can be analyzed simultaneously. Although composite broad spectrum samples are desirable from a collection point of view, the occurrence of many pesticides in one sample presents a problem for individual compound quantification and identificaton. For this reason, gas chromatography (GC) is used to separate the compounds and mass spectrometry (MS) is used to identify and quantify the compounds. Coupled GS-MS avoids interferences which may occur in GC by using a separate method (other than retention time or volume) to identify compounds. This research compared liquid-liquid extraction (LLE) in the batch and continuous mode. The LLE process is accomplished in a continuous mode by mixing the water and solvent in a coil, allowing the water and solvent to separate in a quiescent decantation cell, then recirculating the solvent by a separate distillation cell while the water goes to waste. Tap water was spiked with pesticides at 10, 50 and 100 ng/l. Extraction efficiency was compared at each of the three spiking concentrations. The extracts were analyzed on GC-MS using a moving needle injection technique to enhance sensitivity. The identification and quantification of compounds were accomplished by MS using fragmentometry technique which enhance sensitivity of the analysis. The results indicate that continuous LLE will recover an average of 75% (+/- 14%) of the pesticides in the 10-100 ng/l range recoverable by batch LLE. There was no significant difference in recovery for structurally different pesticides (chlorinated, nitrogenous or phosphoric) as all fell in the 75 +/- 14% range. Eighteen pesticides were identified and quantified by the GC-MS in a 25 min analysis. This demonstrates that the continuous LLE technique can be used to automate collection of composite samples if the reduction in extraction efficiency is taken into account. The continuous LLE can handle much larger volumes of water than the batch LLE. Composite samples can be continuously collected over time, a sampling regime not possible with batch LLE. This technique when coupled with GC-MS can be used to identify and quantify pesticides at the ng/l level and can be applied routinely for analysis of pesticides at approximately the same price as individual pesticides analysis. (Author's abstract)
W85-02913

GEL PERMEATION CHROMATOGRAPHY OF HUMIC ACID; PROBLEMS ASSOCIATED WITH SEPHADEX GEL,
South Australia Engineering and Water Supply Dept., Salisbury. State Water Labs.
P. T. Hine, and D. B. Bursill.
Water Research, Vol. 18, No. 11, p 1461-1465, 1984. 4 Fig, 26 Ref.

Descriptors: *Water analysis, *Gel permeation chromatography, *Humic acid, *Molecular structure, Evaluation, Chromatography, Natural waters.

Gel permeation chromatography with Sephadex gels has become a widely used method for analyzing naturally occurring organic materials in raw and treated waters. Several problems in the interpretation of molecular weight profiles from these gels have become apparent and the usefulness of the method is questioned. The validity of gel permeation is dependent on the extent to which gel-solute interactions other than purely size exclusion are operating. If alternative mechanisms interfere significantly then the fractionation is of little practical value. The effects of altering sample or eluant composition produced changes to Sephadex gel permeation chromatograms which were not open to unambiguous interpretation. Ionic strength and gel-solute interactions, either charge induced exclusions or adsorption can effect the transport of humic materials unpredictably through a gel column leading to incorrect molecular weight profiles. As a result, gel permeation chromatograhy using Sephadex gels is of limited value in the analysis and comparison of humic materials in natural waters. (Baker-IVI)
W85-02920

THORIUM 230 DETERMINATION IN POLLUTED LAKE WATER - A STUDY OF INTERFERENCES,
Carleton Univ., Ottawa (Ontario). Dept. of Chemistry.
I. G. De Jong, and D. R. Wiles.
Water, Air, and Soil Pollution, Vol. 23, No. 2, p 197-208, August, 1984. 5 Fig, 6 Tab, 16 Ref.

Descriptors: *Thorium, *Radioisotopes, *Lakes, *Nero Lake, *Saskatchewan, *Chemical analysis, Isotope studies, Chemical precipitation, Radium, Barium sulfate, Lanthanum, Uranium tailings.

One of the most attractive methods available for radiochemical determination of thorium isotopes involves coprecipitation of Th with BaSO4 in the presence of added K ions (Sill, C.W. and C.P. Willis, 1964. Anal. Chem., Vol. 36, p 622). The chemical recovery of Th in uncomplicated samples is usually nearly complete (90-95%) and is determined by measuring the recovery of a Th-234 spike added early in the analytical procedure. Too low a recovery causes diminished precision and may lead to cross-contamination of other isolated fractions by the unrecovered Th. Some environmental samples contain substances which cause the recovery of the Th-234 tracer, and presumably all the Th, to be extremely low - in some cases as low as 5%. The decreased recovery effect was illustrated by results obtained on water from Nero Lake, a uranium mine tailings dumping area in northern Saskatchewan. The effect was not caused primarily by volatile components, organic components, or silicates. Attempts to duplicate the effect using synthetic lake water were not successful; the lowest value of percent recovery for the synthetic water was 41.6% compared to 4.5% for undiluted lake water. The effect is very complex, with a lot of interraction among ions. The environmentally significant aspect of this work is to show that this method for sequestering traces of Th cannot be reliably used on water with a high ionic content. An alternative method was developed which avoids the problems of interference in the coprecipitation of Th by BaSO4; this method uses La(+3) to prevent coprecipitation, allowing Ra to precipitate uncontaminated. The same La functions subsequently as a carrier for Th. (Collier-IVI)
W85-02927

ELUTION OF ENTERIC VIRUSES FROM MISSISSIPPI ESTUARINE SEDIMENTS WITH LECITHIN-SUPPLEMENTED ELUENTS,
University of Southern Mississippi, Hattiesburg. Dept. of Biological Sciences.
R. A. Johnson, R. D. Ellender, and S.-C. Tsai.
Applied and Environmental Microbiology, Vol. 48, No. 3, p 581-585, September, 1984. 2 Fig, 8 Tab, 15 Ref. NOAA grant NA 81AA-D-00050.

Descriptors: *Enteroviruses, *Estuarine sediments, *Estuaries, *Lecithin, *Sediments, Coxsackie viruses, Echovirus, Poliovirus, Casein, Clay content.

Isoelectric casein supplemented with lecithin
tested for its ability to recover enteric viruses fr
estuarine sediments of varied sand, silt, and c
composition. Recoveries were higher when
cithin was incorporated into an eluent as compa
with trials with only the casein solution. Semip
fied soybean lecithin (3%) allowed the high
overall recovery of virus from all sediments test
crude soybean lecithin produced the lowest rec
ery. A difference in the percentage of virus able
be recovered from a sediment was related to
percentage of clay in the sample. Correlatio
statistics indicated a trend toward lower virus
covery as the clay composition of a sediment
creased. Virus adsorption to the four sedime
tested revealed differences between poliovir
coxsackievirus, and echovirus adsorption t
could not be explained on the basis of the c
content of a sediment. (Author's abstract)
W85-02934

COLIPHAGES AS INDICATORS OF ENTER
VIRUSES,
Health Effects Research Lab., Cincinnati, OH.
R. E. Stetler.
Applied and Environmental Microbiology, V
48, No. 3, p 668-670, September, 1984. 3 Tab,
Ref.

Descriptors: *Coliphages, *Enteroviruses, *Bio
dicators, Bacterial indicators, Viruses, Coliform
Streptococci.

Coliphages were monitored in conjuction with
dicator bacteria and enteroviruses in a drinkin
water plant modified to reduce trihalometha
production. Coliphages could be detected in t
source water by direct inoculation, and sufficie
coliphages were detected in enterovirus conce
trates to permit following the coliphage lev
through different water treatment processes. T
recovery efficiency by different filter types rang
from 1 to 53%. Statistical analysis of the da
indicated that enterovirus isolates were better co
related with coliphages than with total coliform
fecal coliforms, fecal streptococci, or standa
plate count organisms. Coliphages were not detec
ed in finished water. (Author's abstract)
W85-02936

COMPARISON OF METHODS OF ENUME
ATING COLIFORMS AFTER UV DISINFE
TION,
North Carolina Univ. at Chapel Hill. Dept.
Environmental Sciences and Engineering.
R. G. Qualls, J. C. H. Chang, S. F. Ossoff, and J.
D. Johnson.
Applied and Environmental Microbiology, Vo
48, No. 4, p 699-701, October, 1984. 1 Fig, 1 Ta
25 Ref. EPA grants R809593010 and R804770010

Descriptors: *Coliforms, *Ultraviolet radiatio
*Disinfection, *Bacterial analysis, Most probabl
number test, Membrane filtration, Wastewate
analysis, Wastewater treatment.

In view of the differences that have been foun
between the most-probable-number and membran
filtration methods for the recovery of coliform
from chlorinated samples, the survival of total an
fecal coliforms in UV-irradiated effluent sample
as tested by the most-probable-number and stand
ard single-step membrane filtration methods, wa
compared. There were no significant differences i
the survival of total and fecal coliforms, as teste
by the two methods. In a separate set of experi
ments comparing total and fecal coliform survival
as tested by the most-probable-number method
only a very small but statistically significant differ
ence of 0.1 log survival units was found. For UV
disinfected wastewater effluents, standard one-ste
membrane filtration procedures are comparable t
standard most-probable-number procedures. (Au
thor's abstract)
W85-02938

ANALYSIS OF SAMPLE PREPARATION PRO
CEDURES FOR ENUMERATING FECAL
COLIFORMS IN COARSE SOUTHWESTERN

J.S. BOTTOM SEDIMENTS BY THE MOST-ROBABLE-NUMBER METHOD,
Arizona Univ., Tucson. School of Renewable Natral Resources.
. D. Doyle, B. Tunnicliff, R. E. Kramer, and S. K. Brickler.
Applied and Environmental Microbiology, Vol. 8, No. 4, p 881-883, October, 1984. 1 Fig, 19 Ref. USDA Forest Service grant RM-81-161-GR.

Descriptors: *Coliforms, *Coarse sediments, *Most robable number test, *Bottom sediments, Bacteia, Saguaro Lake, Arizona, Sediments, Bacterial nalysis.

The determination of bacteria densities in aquatic ediments generally requires that a dilution-mixing reatment be used before enumeration of organisms y the most-probable-number fermentation tube nethod can be done. Differential sediment and rganism settling rates may, however, influence he distribution of the microbial population after he dilution-mixing process, resulting in biased bacerial density estimates. For standardization of ample preparation procedures, the influence of ettling by suspended sediments on the fecal coliorm distribution in a mixing vessel was examined. This was accomplish with both inoculated (Escherichia coli) and raw, uninoculated freshwater ediments from Saguaro Lake, Ariz. Both test sediments were coarse (> 90% gravel and sand). Coarse sediments are typical of southwestern U.S. akes. The distribution of fecal coliforms, as determined by the most-probable-number method, was ot significantly influenced by sediment settling nd remained homogenous over a 16-min postmix eriod. The technique developed for coarse sediments may be useful for standardizing sample prepration techniques for other sediment types. (Author's abstract)
W85-02942

BIODEGRADATION OF 4-NITROPHENOL IN STANDARDIZED AQUATIC DEGRADATION TESTS,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
For primary bibliographic entry see Field 5B.
W85-02944

SIMPLE ALGORITHM FOR ON-LINE PREDICTION OF BOD5 BY A MICROPROCESSOR-BASED SYSTEM,
Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Electrical and Computer Engineering.
R. Raviv, and S. Ben-Yaakov.
Biotechnology and Bioengineering, Vol. 26, No. 10, p 1239-1244, October, 1984. 9 Fig, 1 Tab, 16 Ref.

Descriptors: *Biological oxygen demand, *Computers, *Algorithms, Mathematical models, Automation, Water analysis, Dissolved oxygen.

The use of a microcomputer was investigated as an aid in the more rapid determination of BOD5. This can be accomplished if the DO consumption during the BOD5 incubation period is approximated by a mathematical model which can then be used to predict DO concentration after five days from the initial stage of the process. The on-line estimation and prediction algorithm, which assumes first order kinetics, was simulated on a CBM 3032 (Commodore) microcomputer programmed in BASIC to execute the data processing computation. Test runs on synthetic and experimentally derived raw data suggest that BOD5 can be predicted to within 15% in ca. 36 h. The first few hours of BOD incubation can not be used for BOD5 prediction because there are a number of phases before the DO consumption becomes regular. The method can be improved by filtering out, via a digital filter, noise from the raw data. The suggested algorithm does not require elaborate computations or large data storage and can therefore be implemented on a low-cost microcomputer for fast on-line determination of BOD5. (Collier-IVI)
W85-02951

CONSOLIDATION OF A STREAM QUALITY MONITORING NETWORK,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7A.
W85-02973

USING HEAT CAPACITY MAPPING MISSION (HCMM) DATA TO ASSESS LAKE WATER QUALITY,
Brigham Young Univ., Provo, UT. Dept. of Civil Engineering.
W. Miller, and A. Rango.
Water Resources Bulletin, Vol. 20, No. 4, p 493-501, August, 1984. 8 Fig, 11 Tab, 18 Ref.

Descriptors: *Satellite technology, *Lakes, *Water quality, *Reflectivity, *Infrared imagery, Remote sensing, Algae, Phytoplankton, Thermal properties, Utah Lake, Utah.

A water quality investigation on Utah Lake was conducted during the same time period that the Heat Capacity Mapping Mission (HCMM) satellite was collecting thermal infrared and reflectivity data. Relationships were established and evaluated among HCMM data and lake water quality parameters. Although remotely sensed reflective data has been previously utilized, this study was unique in that thermal emitted data were also correlated to algae concentrations and other indicators. Standard statistical evaluations were made along with utilization of color graphics techniques to identify and plot relationships. The emitted thermal energy was found to have high positive correlations with net algal concentrations and with the predominant species, Aphanizomenon flos-aquae, a blue-green alga. No continuous correlation was found for a less abundant red pigment phytoplankton, Ceratium hirundinella. Similar trends, though for negative correlations, were shown for reflectivity data and algal concentrations throughout the spring and summer. Coincidence of areas of warmer emitted energy and darker reflected energy on colorgraphics displays clearly indicate lake areas of high algal concentrations. Night thermal data display a strong negative correlation with algal concentration, opposite to day thermal data. Color graphics of warmer day emitted energy and cooler night emitted energy further verify areas of high algal concentrations. (Author's abstract)
W85-02975

MULTIVARIATE ANALYSIS OF SPECIES COMPOSITION OF SHORE-ZONE FISH ASSEMBLAGES FOUND IN LONG ISLAND SOUND,
Northeast Utilities Environmental Lab., Waterford, CT.
L. E. Bireley.
Estuaries, Vol. 7, No. 3, p 242-247, September, 1984. 1 Fig, 3 Tab, 11 Ref.

Descriptors: *Multivariate analysis, *Species composition, *Fish, *Millstone Point, *Connecticut, *Long Island Sound, Nuclear powerplants, Environmental effects, Water pollution effects.

Monitoring programs for the Millstone Nuclear Power Station were established as early as 1969 to assess the impact of operation and construction of the nuclear poser plants at Millstone Point, Connecticut, on the indigenous fish populations in nearby Long Island Sound. In the period 1969-1981 representatives of 41 taxonomic groups were found in the shore-zone finfish assemblage near Millstone Point. A nested design was used to analyze the variance of the proportions or percent species composition. The relative importance of five selected shore-zone species was found to be significantly influenced by both station and season within a year. Also included in the nested ANOVA model were effects due to period of plant operation (no units operating, one unit operating and two units operating) and year within period. Neither of these two effects was found to influence the percent species composition. The percent species composition of finfish did not change concurrent with startup of either Unit 1 or 2 at the Millstone Nuclear Power Station. A nested ANOVA of percent species composition can be useful for detecting changes in assemblages of finfish species over time and space. (Moore-IVI)
W85-02997

ARSENIC IN NOVA SCOTIAN GROUNDWATER,
Health and Welfare Canada, Ottawa (Ontario). Environmental Health Centre.
J. C. Meranger, and K. S. Subramanian.
Science of the Total Environment, Vol. 39, No. 1/2, p 49-55, October, 1984. 1 Fig, 2 Tab, 7 Ref.

Descriptors: *Water analysis, *Arsenic, *Pollutant identification, *Nova Scotia, Wells, Water quality control, Drinking water, Atomic absorption spectrometry.

The concentration of total soluble inorganic arsenic was measured in duplicate well water samples of 94 residents in Halifax County, Nova Scotia. The total arsenic content of the water samples was determined using two methods: (i) ammonium pyrrolidinedithiocarbamate-methyl isobutyl ketone graphite-furnace atomic-absorption spectrometry and (ii) automated hydride-evolution electrothermal atomization atomic absorption spectrophotometry. The good agreement obtained with each method clearly suggests that both procedures can be used to determine the total soluble inorganic arsenic content of these contaminated ground water samples. While the number of samples analyzed for each community in the study was not exhaustive, the values do indicate that the well waters in these communities are contaminated with arsenic. In at least 10% of the total number of samples (94) analyzed, the contamination level was approximately ten times the maximum acceptable limit of 50 ng/ml, and in 23% of the total number of samples analyzed, it is approximately five times the permissible limit. (Baker-IVI)
W85-03032

PERSONAL EXPOSURE TO VOLATILE ORGANIC COMPOUNDS; I. DIRECT MEASUREMENTS IN BREATHING-ZONE AIR, DRINKING WATER, FOOD, AND EXHALED BREATH,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
L. A. Wallace, E. Pellizzari, T. Hartwell, M. Rosenzweig, and M. Erickson.
Environmental Research, Vol. 35, No. 1, p 293-319, October, 1984. 10 Fig, 11 Tab, 19 Ref.

Descriptors: *Volatile organic compounds, *Pollutant identification, *Bayonne, *Elisabeth, *New Jersey, *Research Triangle Park, *North Carolina, Drinking water, Organic compounds, Estimating.

Individual exposures to about a dozen volatile organic compounds in air and drinking water were measured for nine volunteers in Bayonne and Elizabeth, New Jersey and from three volunteers in Research Triangle Park, North Carolina during three 3-day visits over the 6 month period. Breath samples were also collected from all subjects on each visit. About 230 personal air samples, 170 drinking water samples, 6 breath samples, and 4 food samples were analyzed for the target chemicals. Six of the target compounds were found in more than half of the air and breath samples, but seldom or never in food or water. Two compounds were transmitted primarily through drinking water or beverages. None was transmitted primarily through food. Two target compounds (vinyl chloride and 1,1,2-trichloroethane) were virtually never found. Median concentrations in air and breath were usually in the 1-10 micro g/cu m range, but air concentrations were highly variable, with maxima exceeding 100 micro g/cu m for five chemicals. Little day-to-day or person-to-person varability within a given geographic area was noted for trihalomethanes in drinking water, but a strong seasonal component was present, with summer values much greater than winter values. Beverages appeared to be an important route of exposure for chloroform and bromodichloromethane. Mean daily intakes of the four most prevalent chemicals were conservatively estimated to range from about 50 to 1000 micro g/day for 1,1,1-

trichloroethane, 25 to 600 micro g/day for tetrachloroethylene, 10 to 300 micro g/day for trichloroethylene, and 140 to 370 micro g/day for chloroform. (Baker-IVI)
W85-03041

ACUTE TOXICITY OF AMMONIA AND COPPER TO THE GASTROPOD POTAMOPYRGUS JENKINSI (SMITH),
Aston Univ., Birmingham (England).
A. J. Watton, and H. A. Hawkes.
Environmental Pollution (Series A), Vol. 36, No. 1, p 17-29, 1984. 1 Fig, 5 Tab, 29 Ref.

Descriptors: *Ammonia, *Copper, *Bioindicators, *Snails, Mollusks, Toxicity, Water pollution effects, Growth stages.

Acute toxicity tests (96 hr) were made using a flow-through system to determine the toxicity of ammonia and copper to Potamopyrgus jenkinsi. Both lethal and sub-lethal responses were monitored for three different age groups of snail; juvenile, prime adult and senescent. Of these three stages, the juveniles were least tolerant and the prime adults most tolerant to un-ionized ammonia. Juvenile snails were also generally less tolerant to copper than the adults. Whereas there was a marked difference between the LC50 and EC50 values for both prime and senescent adult snails, the difference between these values for juvenile snails was relatively small. Potamopyrgus jenkinsi was relatively intolerant of both ammonia and copper compared with other invertebrate taxa reported in the literature. Potamopyrgus jenkinsi could be a valuable indicator species for these pollutants. (Baker-IVI)
W85-03042

UPTAKE AND METABOLISM BY GOLDFISH CARASSIUS AURATUS OF PENTACHLORO-2-(CHLOROMETHYL SULPHONAMIDO)DIPHENYL ETHER (6-PCSD), THE MAJOR COMPONENT AND ACTIVE INGREDIENT OF THE MOTHPROOFING AGENT, EULAN WA NEW,
Stirling Univ. (Scotland). Dept. of Biology.
A. Machon, M. J. North, and N. C. Price.
Environmental Pollution (Series A), Vol. 36, No. 3, p 271-281, 1984. 6 Fig, 1 Tab, 9 Ref. Natural Environmental Research Council grant CR3/4129.

Descriptors: *Insecticides, *Pentachlorophenyl ethers, *Mothproofing agents, *Pollutant identification, *Chemical analysis, Industrial wastes, Fish, Water pollution effects, Fate of pollutants, Organic compounds, Chromatography.

High performance liquid chromatography was routinely used for the analysis of PCSD and and its metabolite, pentachloro-2-aminodiphenyl ether (5-PAD) in fish tissue in preference to the alternative gas-liquid chromatography-electron capture detector method. In the latter method, methylation is needed prior to analysis in order to stabilize thermolabile PCSD components. By contrast, no derivatization is needed with HPLC. Tissue coextractants absorbing at 230 nm interfere with the determination of PCSD by HPLC and, to remove these coextractants, the published tissue extract clean up procedure has been modified. These coextractants can be removed from the 6-PCSD by selective elution of the latter with methanol prior to acidification of the column. A simplified elution procedure was developed consisting of elution with 25 ml MTBE to remove PADs selectively, followed by elution with 25 ml methanol to remove PCSDs selectively. The coextractants could then be removed by elution with 10 ml MTBE following acidification of the column. This procedure is demonstrated for a liver sample taken from a goldfish dosed with 6-PCSD for 2 hr. (Baker-IVI)
W85-03048

ASSESSING HAZARDOUS WASTE PROBLEMS,
Nevada Univ., Reno.
R. B. Evans, and G. E. Schweitzer.
Environmental Science and Technology, Vol. 18, No. 11, p 330A-339A, November, 1984. 8 Fig, 1 Tab.

Descriptors: *Path of pollutants, *Leaching, *Groundwater pollution, Hazardous materials, Waste disposal, Plumes, Remote sensing, Computers.

Relatively inexpensive methods for delineating subsurface features near hazardous waste sites are needed. During the past 10 years the extensive development of remote-sensing geophysical equipment including field methods, analytical techniques, and associated computer processing, has greatly improved the ability to characterize hazardous waste sites. The use of seismic refraction and resistivity to investigate a subsurface geologic structure is illustrated. A second example is offered using ground-penetrating, electromagnetic induction, and magnetic surveys to locate and estimate the amount of buried wastes. Resistivity surveys have been conducted to map a landfill leachate plume. Electromagnetic induction has aided in the choice of locations of monitoring wells that were used to map another contaminant plume. While in the past most geophysical methods for plume detection have been applied to inorganic contaminants, such as chlorides and sulfates, in groundwater, attention is now being turned to the detection of organics. (Baker-IVI)
W85-03054

HYDROCARBON AND AZAARENE MARKERS OF COAL TRANSPORT TO AQUATIC SEDIMENTS,
Tetra Tech, Inc., Bellevue, WA.
R. C. Barrick, E. T. Furlong, and R. Carpenter.
Environmental Science and Technology, Vol. 18, No. 11, p 846-854, November, 1984. 4 Fig, 2 Tab, 38 Ref. EPA/DOE contract DE-AT06-76-EV-70040 and DOE contract DE-AT06-76-EV-7002.

Descriptors: *Coal, *Azaarenes, *Hydrocarbons, *Washington, Sediments, Minerals, Drainage basins, Erosion, Coal mining, Pollutant identification, Water pollution sources.

Hydrocarbons and azaarenes in 16 Western Washington coals display considerable compositional change over a vitrinite reflectance range of 0.34-3.5% Ro. None exhibit an unresolved complex mixture in aliphatic extracts common to many petroleums as well as urban residues in the Puget Sound region and so are distinguished easily. Complex azaarene compositions are found in all but the lowest and highest ranked coals. A decrease in two-ring relative to three-ring azaarene dominance occurs with increasing reflectance, and the overall azaarene fingerprint is a useful parameter in distinguishing coals of varying rank. Lipid extracts from bulk marine sediments collected near the Puyallup River delta and coal particles seived from a sediment core collected at the same site display similar azaarene fingerprints and contain hydrocarbon suites in similar relative amounts as some coals within the adjacent drainage basin. Dominant coal components include pristane, C19 and C20 tricyclic diterpanes, retene, methylated chrysenes and picenes, tetrahydrochrysenes, hydropicenes, and either 1- or 3-methylphenanthrene relative to other methyphenanthrenes. Molecular markers thus demonstrate the transport of specific local coals to aquatic sediments in adjacent drainage basins resulting from erosion and mining activity. (Baker-IVI)
W85-03056

INTEGRATED GROUND WATER MONITORING PROGRAM USING MULTILEVEL GAS-DRIVEN SAMPLERS AND CONVENTIONAL MONITORING WELLS,
NUS Corp., Pittsburgh, PA.
A. Nazar, J. Prieur, and D. Threlfall.
Ground Water Monitoring Review, Vol. 4, No. 4, p 43-47, Fall, 1984. 4 Fig.

Descriptors: *Monitoring, *Water sampling, *Groundwater pollution, Water quality control, Hazardous materials, Hazardous waste sites.

A comparison was made between hydrogeologic and ground water quality data obtained from a gas-driven multilevel sampler system and a polyvinyl chloride monitoring well nest with the same aquifer communication intervals. The study was conducted at an eight-acre uncontrolled hazardous waste site, located in an alluvial valley consisting of about 40 ft of alluvium overlying shale bedrock. There were several advantages of the multilevel gas-driven sampling system including the ability to obtain vertical point contamination concentrations; less purge water to collect and store vs. bailing or pumping; and less potential personnel dermal contact with the ground water during the sampling procedure. Gas-driven multilevel samplers become more cost effective with depth compared to conventional wells due to reduced drilling and materials costs. The primary disadvantage of the multilevel gas driven sampling system observed during the program was the volume of sample obtained during each purge of the system. This becomes critical when large sample volumes are required from each monitoring point. Both types of monitoring devices were useful during this project. Selection of the type of monitoring equipment to be used during other investigations should be based upon regulatory requirements; cost constraints; the need for specific data on vertical contaminant variability with depth within a plume; the number of chemical parameters and the amount of sample required for laboratory analysis; and the need for aquifer testing after the monitoring system is in place. (Baker-IVI)
W85-03173

SUCTION SIDE SAMPLE CATCHER FOR GROUND WATER QUALITY SAMPLING,
McLaren Environmental Engineering, Inc., Sacramento, CA.
R. Armstrong, and F. R. McLaren.
Ground Water Monitoring Review, Vol. 4, No. 4, p 48-53, Fall, 1984. 5 Fig, 3 Tab.

Descriptors: *Water sampling, *Water quality control, *Groundwater analysis, Water analysis, Water pollution control.

The construction and operational details of a suction side sample collector (SSSC) are described. It is fitted to a submersible pump with packer for use in a 6 inch cased borehole, an air lift pump with packer for use in a 1 inch or 2.5 inch cased borehole, a bladder pump for use in a casing of 4 inch or greater diameter, and a jet pump with packer for use in a 2 inch cased borehole. The SSSC is demonstrated to be superior to other methods of collecting volatile organic chemical samples owing to its freedom from contamination by the pump delivery line and to its mode of collecting the sample from a position in the well remote from disturbance by the pumping technique. Reproducibility of samples collected with the SSSC was confirmed by replicate sampling with the device. (Baker-IV)
W85-03174

UTILIZATION OF SHALLOW GEOPHYSICAL SENSING AT TWO ABANDONED MUNICIPAL/INDUSTRIAL WASTE LANDFILL ON THE MISSOURI RIVER FLOODPLAIN,
Ecology and Environment, Inc., Shawnee Mission, KS.
R. J. Rudy, and J. A. Caoile.
Ground Water Monitoring Review, Vol. 4, No. 4, p 57-65, Fall, 1984. 17 Fig, 3 Tab, 6 Ref. US EPA Contract No. 68-01-6692.

Descriptors: *Landfills, *Hazardous materials, *Water pollution sources, *Groundwater pollution, *Missouri River, Floodplains, Groundwater flow.

An effective technique to initially characterize ground water contamination at two abandoned hazardous waste landfills along the Missouri River in northwestern Missouri involved a combination of electrical resistivity and electromagnetic conductivity methods. Resistivity was used to obtain soundings of the alluvium by using a modified Wenner array and to corroborate shallow electromagnetic conductivity measurements by using short Wenner array electrode spacings. Upon confirmation of similar measurements of the upper soils for the two methods, numerous electromag-

netic conductivity traverses were made at each landfill site. The data generated from these surveys were graphed and contoured to delineate anomalous areas. Based on the geophysical study, a ground water monitoring well network was then designed for each landfill. A minimal number of wells were required to initially characterize the ground water quality at these two sites. In general, analysis of water samples from these wells displayed good correlation with the geophysical results. (Baker-IVI)
W85-03175

SPATIAL MAPPING OF CONDUCTIVE GROUND WATER CONTAMINATION WITH ELECTROMAGNETIC INDUCTION,
Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV.
D. D. Weber, J. F. Scholl, D. J. LeBrecque, E. G. Walther, and R. B. Evans.
Ground Water Monitoring Review, Vol. 4, No. 4, p 70-77, Fall, 1984. 12 Fig, 3 Ref.

Descriptors: *Groundwater, *Water quality control, *Water analysis, *Monitoring, Groundwater pollution, Henderson, Nevada.

A statistical technique is described which combines electromagnetic induction (EMI) survey data with hydrogeological data to reduce the effects of spatial variation of hydrogeological parameters and cultural interference. The product is a contour map of aquifer conductivity over the target area. The primary tools used are computer interpolation of spatially distributed data and one-dimensional modeling of EMI data. The method can be described as a pseudo three-dimensional statistical method, i.e. two-dimensional lateral averaging and one-dimensional EMI modeling. The name of the method is Aquicon, for aquifer conductivity. A conductive contaminant plume at Henderson, Nevada, was used to develop and test this method. With Aquicon, a plume can be identified in an area having a highly variable aquifer thickness, aquifer depth and cultural interference. One of the two plumes identified could possibly have been identified using only the contoured raw data, but the second would not have been so identified. (Baker-IVI)
W85-03177

5B. Sources Of Pollution

ENVIRONMENTAL MODEL SEGMENT APPROACH FOR ESTIMATING POTENTIAL ENVIRONMENTAL CONCENTRATIONS, I. THE MODEL,
Battelle-Inst. e.V., Frankfurt am Main (Germany, F.R.).
R. Frische, W. Klopffer, G. Rippen, and K. O. Gunther.
Ecotoxicology and Environmental Safety, Vol. 8, No. 4, p 352-362, August, 1984. 1 Fig, 13 Ref.

Descriptors: *Environmental Model Segment, *Fate of pollutants, *Path of pollutants, Water pollution effects, Model studies, Ecosystems.

Other than in the case of the distribution of persistent substances which which may approach the global equilibrium, the fate of less persistent compounds is highly dependent on the path of their penetration into the environment. The environmental effects caused by less persistent substances are only local or regional (close to the emission source), but not ubiquitous. Persistent substances may also cause effects here if they occur in relatively high concentrations. Such exposure concentrations can not be estimated by means of a global model assuming equilibrium. The Environmental Model Segment Approach (EMSA) was developed to obtain from the physical, chemical, and biological environment as a whole (the earth with air, water, land, and organisms) a practical environmental model for the evaluation of regionally effective environmental hazards. The basic concept underlying this model is that the globe is thought to be divided into a large number of segments. If hazardous effects of a chemical exist, they occur at least in one of these spatially localized segments with defined constituents, either because here the concentration of the chemical has it maximum value or because this segment contains contains the most sensitive species or ecosystem. The originally single segments of the have been combined in one Environmental Model Segment. This model segment contains all constituents relevant for the potentially hazardous substance under consideration. (Moore-IVI)
W85-02699

ENVIRONMENTAL MODEL SEGMENT APPROACH FOR ESTIMATING POTENTIAL ENVIRONMENTAL CONCENTRATIONS, II. APPLICATION OF THE MODEL TO P-DICHLOROBENZENE AND TRICHLOROETHENE,
Battelle-Inst. e.V., Frankfurt am Main (Germany, F.R.).
G. Rippen, W. Klopffer, R. Frische, and K.-O. Gunther.
Ecotoxicology and Environmental Safety, Vol. 8, No. 4, p 363-377, August, 1984. 7 Tab, 37 Ref.

Descriptors: *Fate of pollutants, *Path of pollutants, *Environmental Model Segment, *Dichlorobenzene, *Trichloroethene, Chlorinated hydrocarbons, Air pollution, Water pollution, Decomposition, Model studies.

The Environmental Model Segment Approach (EMSA) was developed to assess the regional environmental impact of chemicals. To assess exposure concentrations by means of the model, it is only necessary to have a few data on production and use patterns and of the distribution coefficients of compartmentalization between the environmental media, and at least one first-order rate constant for a relevant degradation mechanism. To examine the reliability of the estimates, the model is applied to estimate potential environmental concentrations of p-dichlorobenzene and trichloroethene. The claim of the model to yield values which apply to reasonable unfavorable environmental boundary conditions is satisfied for the air and for the biota (fish). Soil concentrations calculated by means of the model, assuming equilibrium with high air concentrations, are higher than the measured ones, while the calculated water concentrations are lower than the values often measured for river waters. This may be attributed to direct input of the substances into water, which is not being taken into account. Estimations of possible concentrations of volatile substances in the environment by means of most models have so far failed because of the necessity of taking into account many diffuse emission sources. The EMSA is suitable for estimating regional exposure concentrations for reasonable worst cases even in the case of such a use pattern. (Moore-IVI)
W85-02700

RELATIVE SOURCE CONTRIBUTIONS OF DIET AND AIR TO INGESTED ASBESTOS EXPOSURE,
Environmental Protection Agency, Washington, DC. Office of Pesticides and Toxic Substances.
J. N. Rowe.
Environmental Health Perspectives, Vol. 53, p 115-120, November, 1983. 5 Tab, 24 Ref.

Descriptors: *Asbestos, *Drinking water, *Epidemiology, Public health, Foods, Air pollution, Carcinogens.

The potential relative source contributions of diet, air and drinking water sources to ingested asbestos exposure are discussed. Information gaps in this area exist that preclude an accurate measure of the total ingested load of asbestos. Along with possible asbestos in food products and in the air, asbestos is also present in drinking water. The mean asbestos concentrations from a large number of drinking water sources in the United States have been reported to range from below detectable limits to over 1 billion fibers/liter. Most asbestos concentrations were below detectable limits or not statistically significant. Only 11% were greater than 1,000,000f/liter. Several different analyses of waterborne asbestos have been made and are tabulated. It might prove useful in the future studies to have geographic site-specific data on both ambient water and air concentrations of asbestos in order to make an accurate comparison of the relative contribution of each source to ingested asbestos exposure. (Baker-IVI)
W85-02711

HOW ARE THE PHYSICAL AND CHEMICAL PROPERTIES OF CHRYSOTILE ASBESTOS ALTERED BY A 10-YEAR RESIDENCE IN WATER AND UP TO 5 DAYS IN SIMULATED STOMACH ACID,
Arizona Univ., Tucson. Dept. of Metallurgical Engineering.
K. Seshan.
Environmental Health Perspectives, Vol. 53, p 143-148, November, 1983. 11 Fig, 2 Tab, 20 Ref. EPA grants CR80700 and BRSG S07 RR07002.

Descriptors: *Asbestos, *Chemical reactions, *Chrysotile, *Phvsical properties, Fate of pollutants, Acidity, Storage, Zeta potential, Magnesium, Refractive index, X-ray diffraction, Electron diffraction, Pollutant identification.

Various tests and techniques were used to study the effect of exposure to simulated gastric juices as well as the effect of long term storage in water on asbestos fibers. Changes were noted in the physical, chemical and surface properties of chrysotile asbestos as a result of exposure to water, strong acids, and simulated gastric juices. The charge on the surface (the zeta potential) was changed from positive to negative; the surface became silica-like; and the magnesium was lost from the asbestos fibers on exposure to water and acid. The smaller the fiber diameter, the faster the loss of the magnesium. Notable among the changes in physical properties is a change in the refractive index. Asbestos exposed to acids or water may not be detectable using the dispersion staining techniques that identify asbestos based on the refractive index. Other physical property changes include the destruction of the gross crystallinity of the fibers. The x-ray diffraction signal disappears when fibers are exposed to acid. The fibers may still be detected by electron diffraction. Upon acid exposure, the magnesium ions are leached out, leaving a magnesium-free silica network. A positive ion, possibly the proton or the hydronium ion, replaces the lost magnesium ion. (Baker-IVI)
W85-02713

HYDROLYSIS OF ALDICARB, ALDICARB SULFOXIDE, AND ALDICARB SULFONE AT PARTS PER BILLION LEVELS IN AQUEOUS MEDIUMS,
New York State Coll. of Human Ecology, Ithaca. Dept. of Design and Environmental Analysis.
A. T. Lemley, and W.-Z. Zhong.
Journal of Agricultural and Food Chemistry, Vol. 32, No. 4, p 714-719, July/August, 1984. 3 Fig, 8 Tab, 22 Ref. EPA grant R809867.

Descriptors: *Pesticides, *Fate of pollutants, *Aldicarb, *Aldicarb sulfoxide, *Aldicarb sulfone, *Hydrolysis, Organic compounds, Toxicity, Chemical reactions.

As part of a larger study to systematically investigate detoxification methodology for carbamate pesticides in drinking water, degradation rates of aldicarb, aldicarb sulfoxide, and aldicarb sulfone in aqueous solution were measured. Pseudo-first-order rate constants for base hydrolysis were determined for 25 ppb solutions of each species at 15 C. Second-order rate constants were calculated, and the order for rate of hydrolysis was found to be the same as that reported for ppm solutions: aldicarb sulfone > aldicarb sulfoxide > aldicarb. The temperature effect for hydrolysis of aldicarb sulfone was determined, and Arrhenius behavior was observed. An activation energy of 15.6 kcal/mol was calculated. Base hydrolysis rates of aldicarb sulfone in chlorinated water and in actual well water were measured and found to be slower than those measured in distilled water. Data for rates of hydrolysis were extrapolated to hydroxide ion concentrations equivalent to environmental pH values, and good agreement with experimental data ob-

tained in buffered pH solutions is shown. (Baker-IVI)
W85-02720

PHOTOCHEMISTRY AND VOLATILITY OF DREPAMON IN WATER,
California Univ., Davis. Dept. of Environmental Toxicology.
W. M. Draper, and D. G. Crosby.
Journal of Agricultural and Food Chemistry, Vol. 32, No. 4, p 728-733, July-August, 1984. 5 Fig, 3 Tab, 18 Ref.

Descriptors: *Fate of pollutants, *Herbicides, *Photochemical reactions, *Chemical reactions, Degradation, Drepamon, Volatility.

The aquatic environmental chemistry of the herbicide Drepamon was investigated in laboratory studies of photochemical reactivity and volatilization. The major dissipative processes for Drepamon in a rice field under typical field use conditions will be volatilization and photodecomposition. Drepamon transport to the atmosphere is most important with predicted half-life values of less than 5 days. At the recommended rate of application, however, insolubility may retard volatilization. Thiobencarb is considerably less volatile than molinate or Drepamon and is expected to remain in the aqueous compartment. In midsummer sunlight Drepamon will undergo direct photodecomposition through an identifiable pathway leading to benzaldehyde. Photochemical oxidants and other naturally occurring substances may significantly accelerate photodecomposition rates, possibly resulting in the formation of hydroxylated products, sec-butylamine, and sulfur-carbamoyl cleavage products. (Baker-IVI)
W85-02721

LEAVENWORTH, WASHINGTON CASE: ENVIRONMENTAL CONCERNS WITH A WATER TREATMENT PLANT FAILURE,
Bio Chem Environmental Services, Inc., Seattle, WA.
W. L. Carberry, J. R. Deffenbach, G. Schlender, A. Jensen, and T. F. Wetzler.
Journal of Environmental Health, Vol. 47, No. 1, p 10-14, July-August, 1984. 1 Fig, 4 Tab, 12 Ref.

Descriptors: *Water treatment facilities, *Public health, *Leavenworth, *Washington, *Protozoa, Human diseases, Water pollution effects, Yersinia, Giardia, Epidemiology.

In April of 1980, 4 cases of suspected giardiasis were reported from the Leavenworth area of Washington State. A review of these 4 initial, and 2 subsequent, cases indicated that the Leavenworth community water supply carried the infection. Multiple etiologic agents appeared responsible for the outbreak, including Giardia lamblia and Yersinia enterocolitica. Monthly sampling of the water supply a year before the outbreak showed a presence of virulent Y. enterocolitica. A filtered water sample yielded G. lamblia after the outbreak had been spotted. Failure of the sand filtration system and the absence of adequate chlorination and pretreatment at the Leavenworth water treatment plant allowed these pathogens to enter the distribution system. In areas where the primary water source is an undeveloped protected watershed with abundant wildlife, water treatment plant operators must be particularly careful to protect the public's health from the sporadic organisms indigenous to the particular area. Operators must be aware of the presence of potential disease causing agents and take necessary measures to prevent the occurrence and distribution of these organisms in the finished product. (Baker-IVI)
W85-02723

CONCENTRATION AND DEPOSITION OF ACIDITY, MAJOR IONS AND TRACE METALS IN THE SNOWPACK OF THE EASTERN CANADIAN SHIELD DURING THE WINTER OF 1980-1981,
Atmospheric Environment Service, Downsview (Ontario).
L. A. Barrie, and R. J. Vet.
Atmospheric Environment, Vol. 18, No. 7, p 1459-1469, 1984. 4 Fig, 7 Tab, 19 Ref.

Descriptors: *Trace metals, *Snowpack, *Canadian Shield, *Water pollution sources, *Acid precipitation, Sulfates, Nitrates, Snow, Lead, Ions, Air pollution, Metals.

Snowpack chemistry surveys are useful tools in determining atmospheric pollutant deposition rates, provided care is taken to avoid the confounding influence of pollutant loss during thaws and due regard is given to sample representativeness. A chemical survey of the snowpack in Eastern Canada, conducted in late January 1981, yielded the concentration of total deposition of major ions and several trace metals. It was observed that the snowpack which had accumulated during December 1980 and January 1981 over eastern Canada was acidic and had on the average 60% more nitrate ion equivalents than sulfate ion equivalents. Thus nitrogen oxides were a potentially greater source of meltwater acidity than sulfur oxides were. Quantitatively detectable concentrations of the metals Pb, Ni, Cu, V, Cr, Fe, Mn, Al and Ba were found. Of these Pb, Ni, Cu, V and Cr were of anthropogenic origin. By studying the representativeness of a snowcore chemistry measurement in an area of diameter 100 km, limitations of the observations were defined for each substance of interest. All the trace metals except Mn and Ba were significantly enriched in the snowpack relative to crustal rock composition. (Baker-IVI)
W85-02730

MEASUREMENTS OF S(IV) AND ORGANIC ANIONS IN MINNESOTA RAIN,
Minnesota Univ., St. Paul. Dept. of Plant Pathology.
S. F. Guiang III, S. V. Krupa, and G. C. Pratt.
Atmospheric Environment, Vol. 18, No. 2, p 1677-1682, 1984. 2 Fig, 3 Tab, 18 Ref.

Descriptors: *Acid rain, *Sample preservation, *Sulfur, *Minnesota, Pollutant identification, Rainfall, Organic compounds, Organic acids, Gas exchange, Hydrogen ion concentration.

In 167 fractions from 84 rain events collected at two sites in Minnesota during the summer of 1982, S(IV) accounted for 1.12% of the measured anions and thus usually contributed very little of the free acidity. A few events were observed, however, in which the S(IV) contribution was large. Organic acids were observed in nearly every fraction, with acetate being the most abundant. The samples were not preserved to prevent the loss of organic acids, which made an accurate assessment of the contribution of the organics to the acidity impossible and may have accounted for the low amounts of formate observed. The pH of samples in storage increased with time, a phenomenon which appeared to be related to gas exchange since the most dramatic changes in pH occurred when samples were first unsealed and exposed to outside air. Biological activity or dissolution of mineral material as possible causes for pH changes in storage cannot be ruled out. (Baker-IVI)
W85-02731

CHEMISTRY OF BULK PRECIPITATION AT A SITE IN SOUTHEAST ENGLAND - I. SMALL-SCALE SPATIAL VARIATION, FREQUENCY DISTRIBUTIONS AND VARIATION WITH TIME,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
For primary bibliographic entry see Field 2K.
W85-02732

CHEMISTRY OF BULK PRECIPITATION AT A SITE IN SOUTHEAST ENGLAND - II. RELATIONSHIPS BETWEEN IONS AND COMPARISON WITH OTHER SITES,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
For primary bibliographic entry see Field 2K.
W85-02733

EFFECTS OF PH ON THE RELEASE TO SO LUTION OF ZINC, COPPER AND NICKE FROM METAL-LOADED SEWAGE SLUDGE
Rothamsted Experiment Station, Harpenden (En land). Dept. of Soils and Plant Nutrition.
T. McM. Adams, and J. R. Sanders.
Environmental Pollution (Series B), Vol. 8, No p 85-99, 1984. 6 Fig, 3 Tab, 13 Ref.

Descriptors: *Acidity, *Metals, *Sludge, *Zin *Copper, *Nickel, Water pollution sources, Path pollutants, Hydrogen ion concentration, Heav metals.

The fertilizer value of sewage has been known fo a long time, but the associated problems of phyto toxic elements have only been recognized mos recently. The variation with pH of metal release from sludge was studied in sludges each containin significant amounts of only one contaminant meta Metal released from four sludges was studied a the pH of sludge-water suspensions was varied b the addition of nitric acid or potassium hydroxid As the pH decreased below a threshold value, th concentration of metal released from the sludge t the supernatant liquid increased. This threshol was about 5.8 for zinc loaded sludge, 6.3 for nicke loaded sludge, and 4.5 for copper loaded sludge The metal content of the supernatant was smal and relatively constant above these threshol values. In speciation experiments the proportion o soluble copper present and Cu(2+) in calcium chloride solution was related to pH, whereas th proportion of soluble zinc present as Zn(2+) wa scarcely correlated with pH. (Baker-IVI)
W85-02742

ENVIRONMENTAL AND CHEMICAL FAC TORS INFLUENCING THE BIODEGRADA TION OF PHTHALIC ACID ESTERS IN FRESHWATER SEDIMENTS,
Columbia National Fisheries Research Lab., MO
B. T. Johnson, and M. A. Heitkamp.
Environmental Pollution (Series B), Vol. 8, No. 2 p 101-118, 1984. 2 Fig, 5 Tab, 30 Ref.

Descriptors: *Phthalic acid esters, *Chemical reac tions, *Fate of pollutants, *Biodegradation, Lake sediments, Temperature, Microorganisms, Dissolved oxygen, Nutrients.

Phthalic acid esters (PAEs) are common aquatic contaminants in the environment. Environmental and chemical factors which may determine the fate and persistence of PAEs in natural ecosystems were investigated in lake sediments: type of ester side-chain; oxygen tension; concentration of the test chemical; temperature; organic and inorganic nutrient enrichment; and pre-exposure of PAEs to indigenous microbiota. The primary biodegradation of PAEs, although influenced by several environmental factors, was chiefly determined by the complexity of the diester alkyl group. Under various experimental conditions the biodegradation of PAEs consistently had an inverse relation to length and branching of their alkyl groups. The findings stress the importance of molecular structure in predicting the environental persistence of chemicals with a common moiety. The complex alkyl phthalate DEHP in sediments biodegraded under anaerobic conditions and even though the process was slow both primary and ultimate degradation did occur. (Baker-IVI)
W85-02743

RUNOFF WATER QUALITY FROM FRESH MINE SPOIL,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
K. W. Brown, J. C. Thomas, and K. W. Launius.
Environmental Pollution (Series B), Vol. 8, No. 2, p 119-131, 1984. 7 Fig, 1 Tab, 14 Ref. Bureau of Mines grant J0295016.

Descriptors: *Water quality, *Water pollution sources, *Mine wastes, *Runoff, Lignite, Iron, Manganese, Sediment load.

The pH of runoff from simulated spoil piles remained between 6 and 7 for 40 to 60 days and then

decreased slowly as the material weathered. The lowest runoff pH value measured was 5.0. Therefore, only slight acidification of the receiving waters is anticipated within the first 141 days. EC values of the runoff indicated no salt hazard to receiving waters. Some of the spoil materials, particularly in the Atascosa County and Grimes County locations may pose an initial salinity hazard to vegetation. Iron contents of the runoff from simulated spoil piles were low and only on one occasion exceeded 3.5 mg/liter. Manganese contents of runoff were also low. Therefore no excessive Fe or Mn additions to receiving waters are expected. The sediment content of the runoff water was very high, and all runoff form spoil piles will need to be managed to reduce sediment load prior to discharge. (Baker-IVI)
W85-02744

TRANSFER OF LEAD BY FRESHWATER SNAILS IN ULLSWATER, CUMBRIA,
Westfield Coll., London (England). Dept. of Botany.
M. Everard, and P. Denny.
Environmental Pollution (Series A), Vol. 35, No. 4, p 299-314, 1984. 5 Fig, 1 Tab, 17 Ref.

Descriptors: *Lead, *Snails, *Cumbria, *England, *Sediments, *Path of pollutants, Heavy metals, Water pollution effects, Food chain.

The cycling of lead by freshwater snails from primary producers and detritus, through the snails and snail-predators, and back into the sediment was investigated. The concentrations of lead in snails collected from Ullswater, Cumbrian, correlated with the degree of contamination at particular sites. When snails were fed on lead-enriched food in the laboratory, their digestive glands, feet and shells all accumulated the metal to some extent. It was not distributed equally among the tissures of Lymnaea peregra; the foot and digestive gland normally contained 2 to 4 and 3 to 10 times more lead than the shell, respectively. It appears that lead is laid down inexchangeably in the structural material of the shell while in soft tissues lead-containing granules are induced. These may be relocated and excreted and, when snails are transferred to lead-free conditions, their total lead content falls back to near-background levels. In Ullswater, contaminated snails, containing up to 5.6 mg Pb/g dry weight, are grazed by eels almost exclusively for some periods of the year but the majority of lead ingested by the fish passes straight through the gut. (Author's abstract)
W85-02747

QUANTITIES OF SOME DANGEROUS SUBSTANCES DISCHARGED TO BRITISH COASTAL WATERS,
Water Research Centre, Stevenage (England).
A. R. O'Donnell, and G. Mance.
Marine Pollution Bulletin, Vol. 15, No. 8, p 284-288, August, 1984. 1 Fig, 2 Tab, 2 Ref.

Descriptors: *England, *Wales, *Scotland, *Northern Ireland, *Coastal waters, *Tidewater, *Water pollution sources, *Pollutants, Cadmium, Mercury, Lindane, DDT, Aldrin, Dieldrin, Endrin, Polychlorinated biphenyls, Copper, Lead, Chromium, Nickel, Zinc, Arsenic, Trace metals, Chlorinated hydrocarbons, Pesticides, Path of pollutants.

The quantities of selected substances discharged into the tidal waters of the United Kingdom was estimated from 1980 data obtained from the Department of the Environment's Harmonized Monitoring and Surface Water archives. The substances surveyed for were cadmium, mercury, lindane, DDT, aldrin, dieldrin, endrin, PCBs, copper, lead, chromium, nickel, zinc and arsenic. Sub-totals of the estimated loads were determined for England, Wales, Scotland, and Northern Ireland and total flows were determined for river, sewage, and industrial inputs. Generally, the largest load component is derived from riverine inputs, with the loads from estuarine and coastal sources being of secondary and tertiary importance respectively. Direct industrial discharges into estuaries constitute the largest input of chromium and arsenic and the second largest input of mercury, copper, lead, and zinc. Within each of the home countries, the contribution of different sources to the load of each substance also varied. (Collier-IVI)
W85-02759

BEHAVIOUR OF HEXACHLOROCYCLOHEXANE ISOMERS AND ZN, CU AND CD IN THE FRESHWATER-SEAWATER MIXING AREA,
Texas A and M Univ., College Station. Dept. of Oceanography.
J. L. Sericano, H. V. Zubillaga, and A. E. Pucci.
Marine Pollution Bulletin, Vol. 15, No. 8, p 228-294, August, 1984. 5 Fig, 3 Tab, 14 Ref.

Descriptors: *Naposta Grande, *Blanca Bay, *Argentina, *Hexachlorocyclohexane, *Zinc, *Copper, *Cadmium, *Saline-freshwater interfaces, *Fate of pollutants, Suspended solids, Dissolved phase, Chemical precipitation, Dieldrin, DDT, Heptachlor, Lead, Coastal water.

During the freshwater-seawater mixing process, organochlorine and heavy metals may be redistributed between their dissolved and suspended forms. Because dissolved and suspended forms have different transport mechanisms through the mixing region out into the seawater, it is important to distinguish between the two forms to understand what effect pollutants derived from river systems may have on the levels in the marine environment. Concentrations of dissolved and suspended hexachlorocyclohexane isomers (alpha, gamma, and delta HCH), Zn, Cu and Cd were determined in the Naposta Grande stream, located in the Blanca Bay area, Argentina, for the purpose of studying the behavior of these compounds in the freshwater-seawater mixing zone. Dieldrin, o-p' DDT, p-p' DDT, heptachlor, and Pb were not present at detectable levels. The dissolved concentrations of hexachlorocyclohexane isomers and of heavy metals in both freshwater and in the mixing zone are much higher than those in suspension. Hexachlorocyclohexane isomers and Zn, Cu, and Cd seem to be removed from solution by suspended matter which is aferward precipitated during the freshwater-seawater mixing process. In relation to pollutants transported by freshwater streams, pollution in Blanca Bay is primarily a coastal problem since part of the load is deposited in the sediments when passing from the freshwater region through the mixing area to the coastal seawater. (Collier-IVI)
W85-02760

CHLORINATED HYDROCARBONS IN FISH-EATING BIRDS WINTERING IN THE GDANSK BAY, 1981-82 AND 1982-83,
Veterinary Hygiene Research Station, Gdansk (Poland).
J. Falandysz, and P. Szefer.
Marine Pollution Bulletin, Vol. 15, No. 8, p 298-301, August, 1984. 2 Tab, 18 Ref.

Descriptors: *Gdansk Bay, *Poland, *Chlorinated hydrocarbons, *Waterfowl, *Water birds, *Bioaccumulation, Birds, Hexachlorobenzene, Benzenehexachloride, DDT, Polychlorinated biphenyls, Auks, Mergansers, Divers, Grebes, Bays, Path of pollutants.

Seventy-four samples of adipose fat of 10 species of fish-eating birds commonly wintering in Gdansk Bay and one of little auk, a rare species in this area, have been analysed for residues of hexachlorobenzene (HCB), total-benzenehexachloride (BHC), total-DDT and polychlorinated biphenyls (PCBs). Auks (guillemot, black guillemot and razorbill), which probably stay a whole year in the Baltic area, contained in their fat twice the level of PCBs as mergansers, and 5-6 times as much as in divers and grebes-birds which stay in the sea mainly after the breeding season. Total-DDT levels were somewhat higher but comparable in auks and grebes, and lower in mergansers and divers. Total-BHC and HCB levels were 3-4 times and 5-10 times higher, respectively, in auks than in birds from other families studied. When comparing residue levels found in adipose fat of birds taken during the wintering seasons of 1981-82 and 1982-83 with those taken in 1975-76 or 1980-81, an initially rapid, but in recent years a rather slow decline in total-DDT level is detectable for grebes, mergansers and divers, and in the case of PCBs the residue levels fell slightly. In auks, the total-DDT residue level fell by half, but remains rather stable in recent years, while there are only minor fluctuations in the residue level of PCBs. (Author's abstract)
W85-02762

HEAVY METALS IN RECENT SEDIMENTS FROM THE BAY OF CADIZ, SPAIN,
Cadiz Univ. (Spain). Dept. de Quimica-Fisica.
A. Gomez Parra, R. Establier, and D. Escolar.
Marine Pollution Bulletin, Vol. 15, No. 8, p 310-311, 1984. 6 Fig, 2 Tab, 6 Ref.

Descriptors: *Bays, *Heavy metals, *Sediments, *Fate of pollutants, *Bay of Cadiz, *Spain, Water pollution sources, Shipping, Traffic, Lead, Manganese, Organic matter.

Stations in the bay to the west of the study area are characterized by compact sediments with very low levels of organic matter and heavy metals. An exception is noted in a high Mn content at a sampling staion near to an important effluent from Cadiz city. The area east of the bay is characterized by high levels of organic matter, phosphates and heavy metals. Values in the channels show an increase in the concentration of metals and phosphates and a decrease in the solid content of the wet samples. This is due to the greater stagnancy of the water which also produced greater uniformity in the physical characterisics of the bottoms and greater homogeneity in the chemical composition of the sediments of the 10 sampling stations. In each channel the highest organic matter, phosphate and metal content coincided with finer sediment granulometry. High values for lead were found in the vicinity of some sampling stations and are attributed to road traffic or the naval industry. (Baker-IVI)
W85-02764

BROMINATED PHENOL PRODUCTION FROM THE CHLORINATION OF WASTEWATER CONTAINING BROMIDE IONS,
Osaka Prefecture Inst. of Public Health (Japan).
I. Watanabe, T. Kashimoto, and R. Tatsukawa.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 4, p 395-399, October, 1984. 1 Fig, 2 Tab, 10 Ref.

Descriptors: *Bromine, *Water pollution sources, *Chlorination, *Wastewater treatment, Disinfectants, Water treatment, Brominated phenols, Phenols, Organic compounds.

Non-chlorinated wastewater samples were obtained from a sewage treatment plant in Osaka, Japan. Calcium hypochlorite was used to chlorinate the samples, with potassium bromide as the source of bromide ions. The results indicate that brominated phenols are possibly formed through chlorination of wastewater. Also the production of brominated phenols along with chlorinated phenols had been reported earlier. The formation of brominated phenols in the chlorination of sea water used as coolant at power plants is also expected, because of the high level of bromide ions in sea water, about 65 ppm. Consequently, environmental pollution by brominated phenols formed in the chlorination of water is suspected. Brominated phenols present in the environment should be carefully controlled when using chlorine oxides as water disinfectants. (Baker-IVI)
W85-02776

RELATIVE IMPORTANCE OF DIETARY AND ENVIRONMENTAL SOURCES OF LINDANE IN FISH,
Liege Univ. (Belgium). Zoology Inst.
C. Marcelle, and J.-P. Thome.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 4, p 423-429, October, 1984. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Pesticides, *Fish, *Toxicity, Organic compounds, Water pollution effects, Path of pollutants, Lindane, Fish food, Food chain.

Under laboratory conditions the importance of both dietary and environmental paths of entry of pesticides into fish was evaluated. Gudgeons (Gobio gobio) were fed with contaminated and noncontaminated Chironomidae larvae. Fish and larvae kept in tanks containing 1.1 ppb lindane for an 18 day intoxication period, followed by a 30 day detoxification period in tap water. Fish were fed once every two days during the intoxication period and were not fed during the detoxication period. The lindane concentration in Chironomidae larvae at the beginning of the experiment was 50 ppb; this concentration reached 100 ppb after a week of exposure. The decimal lindane concentration in the brain increased exponentially with the time of exposure to lindane; on the other hand, lindane concentration in liver increased linearly with the time of exposure to the toxicant. For detoxication, a two way analysis of variance of the results obtained for liver did not show significant differences in lindane contents found in liver of fish fed with normal or contaminated food. Thus the detoxication rate in liver did not depend on the nature of food. A significant logarithmic correlation was found between pesticide content in liver and duration of detoxication. In brain, detoxication rate seemed to depend on the type of food given during the intoxication period. When fish were fed with contaminated food, the detoxication in brain was slower than in fish fed with non contaminated food. This chronic intoxication study has shown that the transfer of pesticide via the food chain was of lesser importance to the accumulation of pesticide than the direct uptake from water. (Baker-IVI)
W85-02779

TRANSFORMATION AND FATE OF ORGANIC ESTERS IN LAYERED-FLOW SYSTEMS: THE ROLE OF TRACE METAL CATALYSIS,
California Inst. of Tech., Pasadena. W.M. Keck Lab. of Engineering Materials.
M. Plastourgou, and M. R. Hoffmann.
Environmental Science and Technology, Vol. 18, No. 10, p 756-764, October, 1984. 5 Fig, 5 Tab, 27 Ref.

Descriptors: *Fate of pollutants, *Organic compounds, *Trace metals, *Stratified flow, Model studies, Mass transport model, Lakes, Estuaries.

A simple mass transport model with chemical and biochemical reactions was developed to predict the relative degree of degradation of organic esters in a layered-flow or density-stratified system. A numerical method was used to solve a system of differential equations involved when metal-catalyzed hydrolysis, biodegradation, and adsorption were assumed to be major pathways for ester transformation. The relative importance of each pathway for the time-dependent concentration profiles of an organic ester was examined by use of dimensionless parameters given a known initial concentration profile across the depth of the water column for a catalyst, for a microbial population, for particles, and for a hypothetical ester. The model as presented is applicable to transformations which are likely to occur in density-stratified lakes, in estuarine waters, and in surface organic microlayers. The model is useful for the inflow of wastewater or estuarine water at a specific depth in a density-stratified water system; for well-mined estuarine water that flows into a lake and forms a stable layer at its neutral bouyancy point which can be assumed to be vertically well mixed; for a layer in which the suspended particles or biomass concentrations are high in the water column; or atmospheric deposition of organic and inorganic components into a surface organic microlayer. (Baker-IVI)
W85-02805

CHLORINE UTILIZATION DURING TRIHALOMETHANE FORMATION IN THE PRESENCE OF AMMONIA AND BROMIDE,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
G. L. Amy, P. A. Chadik, P. H. King, and W. J. Cooper.
Environmental Science and Technology, Vol. 18, No. 10, p 781-786, October, 1984. EPA contracts CR810277-01 and R809935-01.

Descriptors: *Chlorination, *Humic acids, *Bromide, *Trihalomethanes, *Ammonia, Water pollution sources, Chloroform, Disinfection, Water treatment, Chloramines.

The chlorination of humic substances in the presence of ammonia and bromide and the resultant formation of trihalomethanes (THM) are described. The presence of ammonia substantially reduced but did not eliminate THM production during the chlorination of waters containing humic substances. The presence of bromide ion in waters containing humic substances leads to increased THM formation, both in the presence and in the absence of ammonia. In waters containing ammonia, bromide, and humic substances, brominated haloforms can form upon chlorination. Brominated species comprise a larger portion of the total THMs at higher chlorine doses within the free chlorine region of the breakpoint curve than at lower doses in the subbreakpoint region. Although the THM formation reaction is slow and may not be complete even after 1 week of reaction time, the initial rate of formation is competitive with the relatively rapid reactions of bromide oxidation and chloramine formation. After free chlorine is converted to chloramines, THM production should theoretically cease. THMs will form in parallel with chloramine formation. This behavior has important implications for water utilities that use a raw water source containing low but significant levels of ammonia such as the Biscayne Aquifer, or are considering chloramine disinfection as a THM control strategy. (Baker-IVI)
W85-02806

HYDROLYTIC AND METABOLIC PRODUCTS OF ACEPHATE IN WATER AND MOUSE LIVER,
California Univ., Riverside. Div. of Toxicology and Physiology.
A. C. Chukwudebe, M. A. Hussain, and P. C. Oloffs.
Journal of Environmental Science and Health, Vol. B19, No. 6, p 501-522, August, 1984. 5 Fig, 3 Tab, 14 Ref.

Descriptors: *Fate of pollutants, *Acephate, *Insecticides, *Organophosphorus compounds, *Water analysis, Metabolism, Organic compounds, Water pollution sources, Toxicity, Hydrolysis.

Acephate is an organophosphorus insecticide used against infestations of the western spruce budworm in British Columbia forests. Aerial application of the chemical may result in contamination of lakes and streams and may have an impact on aquatic insects and fish. Hydrolytic and metabolic products of acephate in water and in mammals were assessed for their anticholinesterase properties. The pattern of hydrolysis of acephate in water is biphasic, with a fast and then a very slow phase. The major metabolite in water is O,S-dimethyl phosphorothiolate (DMPT) which increases almost proportionately to the decrease in acephate concentration. The next two metabolites in water are methamidophos and O-methylacetyl phosphoramidothiolate (OMPT), and are not produced to any major degree. In mouse liver metabolism of acephate produces methamidophos as an early metabolite, followed by DMPT and S-methylacetyl phosphoramidothiolate (SMPT). The amount of methamidophos formed in the water and mouse liver was too low to have any direct effect on the toxicity of acephate. Acephate toxicity to aquatic insects depends on its persistence in water, its uptake by the insects, its conversion to methamidophos, and the combined inhibitory effect of acephate and methamidophos on the cholinesterase enzyme. The toxicity of acephate to mammals depends on the direct anticholinesterase effect of the chemical and to a small extent on methamidophos. (Baker-IVI)
W85-02813

UNDERSTANDING SIMPLIFIED LA ACIDIFICATION MODELS,
Virginia Univ., Charlottesville. Dept. of Civil E gineering.
W.-S. Lung.
Journal of Environmental Engineering, Vol. No. 5, p 997-1002, October, 1984 2 Fig, 7 R

Descriptors: *Lakes, *Acidification, *Model stu ies, *Reviews, Sulfates, Calcium, Magnesium, D cision making, Reservoirs, Hydrogen ion conce tration, Mixing, Seasonal variation.

A number of analytical models has been develop to examine the degree of acidification in lakes a impoundments. These models are reviewed evaluating their assumptions, demonstrating th merits and pointing out their limitations. Specif models reviewed include simplified lake acidific tion models using the excess sulfate method a the pre-acidification alkalinity methods, pH vers calcium model, and the calcium and magnesiu versus sulfate model. All these models are no mo than statements of ionic balance in which mar ions are negligible, cancel one another out, or c not contribute to acid-base reactions. All the empirical plots are based on chemical equilibriu assuming steady-state conditions. In reality, a la rarely reaches a steady-state, but has season cycles for various phenomena. Therefore, the simplified models cannot be used to examine th seasonal variation of acidity in lakes. The simpl fied models treat a lake as a completely mixe water body. This assumption is difficult to meet many lakes are stratified during summer month and inversely stratified during winter months. Th models described are very easy to use tools identify lake acidification and to estimate th degree of acidification. However, such graphs pro vide no analysis capability beyond the finding tha many surface waters can be positioned on the sam graph. Without additional information, their pre dictive capability is highly limited because infe ring acidification or the reverse of acidification ar not accounted for. If significant decisions are to b made as to acidification control, more quantitativ analysis techniques than these simple models ar needed. (Baker-IVI)
W85-02822

NUMERICAL SOLUTION OF THE DISPER SION EQUATION USING A VARIABLE DIS PERSION COEFFICIENT; METHOD AND AP PLICATIONS,
Hong Kong Univ. Dept. of Civil Engineering
A. W. Jayawardena, and P. H. Lui.
Hydrological Sciences Journal, Vol. 29, No. 3, 293-309, 1984. 5 Fig, 9 Tab, 12 Ref.

Descriptors: *Streamflow, *Dispersion, *Fate o pollutants, Water pollution sources, Model studies Mathematical models.

The study forms part of a wider research projec on dispersion prediction in open channel flow which include laboratory, field and numerical in vestigations. A numerical model is presented which uses finite elements in space and finite dif ferences in time for the solution of the convective dispersion equation. The dispersion coefficient i considered as a function of time during the initia period. It is represented by a modified Fickian type model which has been calibrated by the author using laboratory data. The numerical model has been used to predict concentration profiles o tracer studies carried out in the laboratory as well as in the field. (Baker-IVI)
W85-02828

MAJOR ION AND CARBONATE SYSTEM CHEMISTRY OF A NAVIGABLE FRESHWA TER CANAL,
Liverpool Univ. (England). Dept. of Inorganic, Physical and Industrial Chemistry.
J. R. Howard, G. Skirrow, and W. A. House.
Freshwater Biology, Vol. 14, No. 5, p 515-532, October, 1984. 7 Fig, 10 Tab, 14 Ref.

Descriptors: *Water quality, *Carbonates, *Water analysis, *Leeds-Liverpool Canal, *England, Diur-

al distribution, Canals, Carbon dioxide, Calcite, upersaturation.

Water quality was examined in a 50 km length of he Leeds-Liverpool Canal from Wigan to Lither- and using 17 sampling stations over a 15 mo eriod. Three principal contributory water types ave been recognized, and the observations have llowed estimates to be made of their relative ontributions ot the total water flux in the lower eaches of the system. Linear flow rates of about .6 km/day near Litherland are consistent with revious reports. Estimates of the partial pressure f carbon dioxide in the water, the degree of aturation of the water with respect to calcite and he major ion speciation in the water were ob- ained using the combined field and laboratory neasurements. The program WATEQ was used or the estimates as it takes into account ion pair- ng. Diurnal and annual cycles with respect to pH, artial pressure of CO2 in the water, and degree of aturation of the water with respect to calcite ccur, these being most marked in the lower parts f the study length when, for a large proportion of he spring and summer, partial pressure of CO2 as below the atmospheric level and noticeable upersaturation with respect to calcite occurred. In ontrast, two of the contributory water types, the River Douglas input and the Creek, showed low pH and low degrees of saturation of the water with respect to calcite and high partial pressure of carbon dioxide values throughout the year. (Baker-IVI)
W85-02841

CONCENTRATIONS AND ANNUAL LOADING OF DISSOLVED ORGANIC MATTER IN A SMALL MOORLAND STREAM,
Stirling Univ. (Scotland). Dept. of Environmental Science.
I. C. Grieve.
Freshwater Biology, Vol. 14, No. 5, p 533-537, October, 1984. 3 Fig, 1 Tab, 14 Ref.

Descriptors: *Source of pollutants, *Dissolved solids, *Water analysis, *Peat, *Moorlands, Seasonal variation, Temperature effects, Erosion, Sediment load, Streams, Wetlands, Scotland.

Short-term variations in the concentrations and loadings of dissolved organic matter (DOM) in a moorland stream near Stirling, Scotland, sampled over a period of 1 yr are reported. The DOM was measured at 8 hr intervals in a stream draining 51 ha of moorland with peaty soils. DOM concentrations increased with increasing stream discharge from low flow values of 0-3 mg/l to a maximum value of 30 mg/l. There were also seasonal differences of up to 13 mg/l between August and February, and differences of about 2.5 mg/l between rising and falling stage samples. Seasonal variation was closely related to mean temperature. Total loss over the year was 168 kg/ha DOM larger than previous estimates for upland sites. Seasonal and stage differences combined with discharge control of DOM concentration make the estimation of annual DOM loss based on limited sample numbers or time-periods subject to potentially large errors. (Baker-IVI)
W85-02842

SALINITY DEPENDENT ACCUMULATION OF ZN, CO AND MN IN SCYTOSIPHON LOMENTARIA (LYNGB.) LINK AND ENTEROMORPHA INTESTINALIS (L.) FROM THE ADRIATIC SEA,
Slovenska Akademija Znanosti in Umetnosti, Ljubljana (Yugoslavia). Biological Inst.
I. M. Munda.
Botanica Marina, Vol. 27, No. 8, p 371-376, August, 1984. 3 Fig, 1 Tab, 44 Ref.

Descriptors: *Algae, *Heavy metals, *Accumulation, *Salinity, *Adriatic Sea, Zinc, Manganese, Cobalt, Fate of pollutants.

The uptake of Zn, Mn and Co was studied in two seasonal species from the North Adriatic Sea at three different salinities. Results indicate a dilution-enhanced metal accumulation in Scytosiphon lomentaria and Enteromorpha intestinalis for Zn, Mn, and Co. Under experimental conditions Zn exhibited the highest accumulation rate and Co the lowest. There are inconspicuous differences between the brown and green alga used in the present experiment. On the basis of these data it is not yet possible to advance an ecologically valid explanation for the observed phenomena. It is possible that cations added to the experimental media were accumulated on the surface, bound to polysaccharides which act as ion-exchange media, that is, alginic acid in brown algae and diverse sulfated polysaccharides in green algae. (Baker-IVI)
W85-02844

MERCURY IN SOME HIGHER AQUATIC PLANTS AND PLANKTON IN THE ESTUARY OF THE RIVER KOKEMAENJOKI, SOUTHERN FINLAND,
Helsinki Univ. (Finland). Dept. of Botany.
V.-R. Cajander, and R. Ihantola.
Annales Botanici Fennici, Vol. 21, No. 2, p 151-156, 1984. 2 Fig, 3 Tab, 31 Ref.

Descriptors: *Estuaries, *Mercury, *Fate of pollutants, *Finland, *River Kokemaenjoki, Aquatic plants, Sediments, Bioindicators, Monitoring, Dredging.

Eight species of higher aquatic plants, and seston and zooplankton were collected from 16 sampling sites in the eutrophic estuary of the River Kokemaenjoki and analyzed for mercury. The Kokemaenjoki has a length of 110 km and a mean discharge of 206 cu m/s. The quality of water is poor as it receives agricultural runoff, and waste waters from the wood processing, metal and chemical industries and domestic effluents from urban centers. The mean Hg concentration in the aquatic plants was 0.43 ppm of dry weight, in the seston 0.71 ppm and in the zooplankton 1.19 ppm. Among the aquatic plants, the highest Hg values were recorded in small bottom-rooted submerged Eleocharis acicularis (0.77 ppm) and Elatine spp. (0.80). The lowest Hg concentrations were found in the floating leaves of Nuphar lutae (0.04 ppm). The Hg concentrations of aquatic plants in the estuary were 5-20 times as high as those reported from unpolluted watercourses in Finland. The Hg contents of the seston and zooplankton were 5-20 times as high as the natural background levels. Submerged aquatic plants, seston and zooplankton appeared to be valuable indicators of mercury contamination in the delta area. The dredging operations planned for this area could harm the biota by releasing more Hg from the sediments to the overlying water and thus increasing the amounts circulating in the food webs. (Baker-IVI)
W85-02845

ELECTRICAL METHODS OF DETECTING CONTAMINATED GROUNDWATER AT THE STRINGFELLOW WASTE DISPOSAL SITE, RIVERSIDE COUNTY, CALIFORNIA,
California Univ., Riverside. Dept. of Earth Sciences.
D. J. Stierman.
Environmental Geology and Water Sciences, Vol. 6, No. 1, p 11-20, 1984. 2 Fig, 1 Tab, 6 Ref.

Descriptors: *Riverside, *California, *Stringfellow Waste Disposal Site, *Groundwater pollution, *Electrical studies, *Hazardous waste sites, Testing procedures, Geophysics, Electric potential, Mise-a-la-masse, Spontaneous potential, Electrical sounding, Dipole-dipole resistivity profiles, Path of pollutants.

At the Stringfellow Class I waste-disposal site near Riverside, California, the influence of variations in groundwater chemistry and saturation on electrical measurements made from the surface was tested. Spontaneous potential, D.C. electrical sounding, dipole-dipole resistivity profiles, and mise-a-la-masse measurements were employed to investigate the sub-surface migration of the acidic fluids deposited in this site between 1956 and 1972. Mise-a-la-masse exploration conducted at the downstream edge of the site detected a major anomaly which, on excavation, proved to be the signature of a previously unsuspected leak from the surface disposal ponds on the site. Downstream from the site, a dipole-dipole profile and electrical soundings correlate well with electrical conductivity of groundwater obtained from monitoring wells. This study demonstrates that geophysical methods may be used to search for and map leaks from toxic chemical waste dumps. (Author's abstract)
W85-02858

PROTECTION OF GROUNDWATER FROM OIL POLLUTION IN THE VICINITY OF AIRPORTS,
For primary bibliographic entry see Field 5G.
W85-02859

HYDROCARBONS IN THE SURFICIAL SEDIMENTS OF LAKES ST. CLAIRE, ERIE, AND ONTARIO,
Canada Centre for Inland Waters, Burlington (Ontario).
E. Nagy, P. Mudroch, A. Mudroch, and R. L. Thomas.
Environmental Geology and Water Sciences, Vol. 6, No. 1, p 31-37, 1984. 4 Fig, 4 Tab, 14 Ref.

Descriptors: *Lake Erie, *Lake St. Claire, *Lake Ontario, *Hydrocarbons, *Lake sediments, Lakes, Fate of pollutants, Path of pollutants, Sediments, Detroit River, Great Lakes.

Although the long-term effects and the fate of petroleum hydrocarbons in marine and freshwater environments are not fully understood, it is generally recognized that much of the oil released by accidental spills or by various land sources ends up in the sediment where it may remain for at least several years. The present study was undertaken to collect some initial data on the hydrocarbon concentrations in surficial sediments of lakes St. Claire, Erie, and Ontario. The distribution of hydrocarbons in these lakes followed the general patterns found for a number of contaminants, in that the distribution tended to coincide with the outlines of the sedimentary basins. The highest concentrations were found in the Western Basin of Lake Erie and in the inshore zone around the west end of the lake, suggesting major inputs from the Detroit River. Apart from some spots of high concentration around known dumping grounds, the concentrations gradually diminish toward the east. The distribution pattern in Lake Ontario may be more readily ascribed to water circulation patterns than to any specific source around the lake. The hydrocarbon levels were found to be significantly lower than those in Lake Erie. In Lake St. Clair only trace quantities of hydrocarbons were found, suggesting either low inputs or low sedimentation/accumulation rates due to its shallowness. Although the present survey was limited to the top 3 cm of the sediments, the resulting distribution patterns indicate the western end of the Lake Erie as the area with the heaviest hydrocarbon loadings. The results may also facilitate the selection of specific areas where core sampling coupled with more complete analysis of the extracts could yield significant information on the long-term accumulation of anthropogenic hydrocarbons, and on their persistence and transformations in Great Lakes sediments. (Author's abstract)
W85-02860

ROLE OF INLAND WATER SEDIMENTS AS SINKS FOR ANTHROPOGENIC SULFUR,
National Water Research Inst., Burlington (Ontario).
J. O. Nriagu.
Science of the Total Environment, Vol. 38, p 7-13, 1984. 1 Fig, 1 Tab, 34 Ref.

Descriptors: *Sulfur, *Reservoirs, *Sediments, *Sinks, *Lake sediments, Sedimentation, Fate of pollutants, Iron, Great Lakes.

The possibility that the accumulation of sulfur in lake and reservoir sediments is sizeable and can account for some of the missing sulfur in the global sulfur budgets is explored. Typically, lake sediments are deficient in S and any sulfate ions transferred into this milieu are quickly reduced to the sulfide below the oxidized microzone. The pollu-

tion contribution to the SO4 concentrations in the waters of the Great lakes can be estimated using the change in the sulfur content of the recent sediments. From the rates of sediment accumulation and the S concentrations, the rates of S accumulation in recent and precolonial sediments of the Great Lakes have been derived. S accumulation rates in recent sediments of the Great Lakes are typical of values reported in other lakes. The ratio of organic carbon to sulfur provides a second estimate of the global S flux into sediments. The global flux of S to the reservoir sediment is estimated to be 8 Tg/y. This accounts for some, if not a large portion, of the missing sulfur in the global budget calculations, which has variously been estimated to be 28-280 Tg/y. Since the construction of new reservoirs continues, the reservoir sediments will likely increase in importance as the repository for S from the anthropogenic sources. (Baker-IVI)
W85-02864

FLUORITE PRECIPITATION IN A CALCAREOUS SOIL IRRIGATED WITH HIGH FLUORIDE WATER,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 2G.
W85-02873

METALS IN FISH AND SEDIMENTS FROM THE RIVER KOLBACKSAN WATER SYSTEM, SWEDEN,
Umea Univ. (Sweden). Dept. of Physical Geography and Geoecology.
L. Hakanson.
Archiv fur Hydrobiologie, Vol. 101, No. 3, p 373-400, September, 1984. 10 Fig, 20 Tab, 35 Ref.

Descriptors: *Kolbacksan River, *Sweden, *Lakes, *Trace metals, *Fish, *Sediments, Mercury, Cadmium, Lead, Copper, Chrome, Zinc Pike, Perch, Roach, Hydrogen ion concentration, Alkalinity, Bioindicators.

Sediment samples and muscle and liver from pike, perch and roach from seven Swedish lakes were analyzed for Hg, Cd, Pb, Cu, Cr and Zn. All comparisons are based on contamination factors, i.e., quotients between empirically determined mean values and natural background levels. As there are no data available on metals in fish from uncontaminated environments today, preindustrial levels of the metals in fish have been derived indirectly by using the 10th percentile values from the cumulative distribution curves for the given metals in the lakes investigated. Natural background levels for the metals in the sediments have been determined from sediment cores. The variability in metal concentrations in fish was found to depend primarily on the fish contamination factor (BK) and not on fish age, weight, species, organ, metal or lake. Stationary pike does not display less variability in metal concentrations than its prey. The sediments reflect the integrated dose of metals to the lake. The concentration in fish may be regarded as a response to the given dose. There are no clear-cut relationships between dose and response and the many environmental factors (e.g., pH, alkalinity, water retention time, level of bioproduction and type of 'carrrier particles') that govern the spread and the uptake of metals in fish. A pollution index (PI) illustrating the slope of the cumulative distribution curves has been used to quantify the range of contamination in fish and sediments. The PI-values reveal that pike liver and roach muscle give the best differentiating effect and pike muscle the least resolution, on average, for the investigated metals. For certain metals, like Cu and Zn, there is even a negative correlation between the dose factor, i.e., the sediment contamination factor, SC, and the response factor, e.g., the pike liver contamination factor. The correlation between the fish contamination factors is generally markedly positive. The strongest relationship with the sediment contamination are obtained for roach muscle (r = 0.57) and pike liver (r = 0.52). (Author's abstract)
W85-02896

SEDIMENTATION OF POLYCHLORINATED BIPHENYLS (PCBS) IN LIMNIC AND MARINE ENVIRONMENTS,
Lund Univ. (Sweden). Limnological Inst.
P. Larsson.
Water Research, Vol. 18, No. 11, p 1389-1394, 1984. 2 Fig, 2 Tab, 27 Ref.

Descriptors: *Polychlorinated biphenyls, *Sedimentation, *Sweden, *Lakes, *Bays, Chlorinated hydrocarbons, Air pollution, Water pollution sources, Path of pollutants.

The sedimentation rates of PCBs in two southern Swedish lakes and a coastal bay in the southern Baltic were determined using sediment traps. The rates were similar at the three locations and ranged from 1.2 to 10.9 micro g PCBs/sq m/month during summer. The source for PCBs in sedimenting material is probably the atmosphere. PCB concentrations in sedimenting material were higher than those in surface sediment. This may be due to recirculation of sediment-bound PCBs. The reproducibility of collecting by sediment traps was examined by deploying duplicate traps simultaneously. There were no significant differences in PCB concentration of sedimenting material between traps in duplicate. Concentrations of PCBs in the different collecting vessel was similar within one trap. (Author's abstract)
W85-02911

FATE OF CHLORINE AND CHLORAMINES IN COOLING TOWERS; HENRY'S LAW CONSTANTS FOR FLASHOFF,
Exxon Research and Engineering Co., Annandale, NJ. Corporate Research Labs.
G. Holzwarth, R. G. Balmer, and L. Soni.
Water Research, Vol. 18, No. 11, p 1421-1427, 1984. 7 Fig, 1 Tab, 17 Ref.

Descriptors: *Chlorine, *Chloramines, *Cooling towers, *Henry's law, *Flashoff, Hypochlorous acid, Volatility, Ammonia.

Chlorine and chloramines are volatile compounds which are stripped ('flashed off') from recirculating cooling water systems by the large volumes of air which flow through the water cooling tower. The fraction of a volatile gas, such as hypochlorous acid (HOCl), which is removed by stripping is determined by Henry's constant H for that gas: H = (X sub G)/(X sub L), where X sub G is the mole fraction of the gas in the air and X sub L is the mole fraction of the gas in the water. H was measured for HOCl, OCl(-), NH3, NH2Cl, NHCl2 and NCl3 at 20 and 40 C. H = 0.076 for HOCl, compared to 0.71 for NH3, at 20 C. At 40 C, H was about 2.5-fold larger for HOCl. This means that 10-15% of the HOCl is stripped from cooling water on each passage through a typical cooling tower. The measured flashoff of free available chlorine (HOCl + OCl(-)) was markedly pH-sensitive with a pK of 7.5, exactly as expected if HOCl is volatile but OCl(-) is not. The data permit a quantitative understanding of the fate of chlorine in cooling systems. The values of H at 40 C for NH2Cl, NHCl2 and NCl3 were 1.28, 3.76 and 1067. This means that all the chloramines are quickly stripped in cooling tower. (Author's abstract)
W85-02915

STUDY OF LANDSCAPE-AGROGEOCHEMICAL BALANCE OF NUTRIENTS IN AGRICULTURAL REGIONS: PART III. NITROGEN,
Institut Fotosinteza, Pushchino (USSR).
V. N. Kudeyarov, and V. N. Bashkin.
Water, Air, and Soil Pollution, Vol. 23, No. 2, p 141-153, August, 1984. 9 Tab, 38 Ref.

Descriptors: *Russia, *Nitrogen, *Oka River, *Gorodnyanka River, *Skigna River, *Itska River, *Sokhna River, *Nutrient balance, *Groundwater pollution, Crop yield, Fertilization, Source of pollutants.

The small river basins of the Oka River (Russia) tributaries - the Gorodnyanka, Skigna, Itska, and Sokhna basins - are regions of different agricultural land use, soils erosion processes and level of fertilization. The landscape-agrogeochemical balance of nitrogen was estimated for each of the regions. The input values were shown to be considerably higher than output values during the 1969-1 period. This was due to an increase in mine fertilizer application with no commensurate rise the export of agricultural production from regions. The insignificant increase in the crop yi with the increasing amounts of N fertilizers appl may serve as a main reason of the observed accu lation. A significant positive correlation betw the content of nitrates in the groundwater and rates of N fertilizers was shown. Using the mo lus of flow of groundwater of the upper wa levels in the given basins, it was estimated t from 20 to 50% of accumulated N may leach i the groundwater. (Collier-IVI)
W85-02923

COMPUTED AND MEASURED LEACHING O THE INSECTICIDE METHOMYL FRO GREENHOUSE SOILS INTO WATE COURSES,
Institute for Pesticide Research, Wageninj (Netherlands).
M. Leistra, A. Dekker, and A. M. M. van der Burg.
Water, Air, and Soil Pollution, Vol. 23, No. 2, 155-167, August, 1984. 5 Fig, 4 Tab, 10 Ref.

Descriptors: *Methomyl, *Leaching, *Insecticid *Soils, *Greenhouses, Water pollution sourc Fate of pollutants, Model studies.

The adsorption of methomyl onto three gree house soils was measured and was found to weak to moderate. The transformation rates three greenhouse soils were reasonably high wi half-lives ranging from about 3 to 14 days. The data were introduced into two computation models of pesticide behavior in simplified gree house systems. The computed leaching of meth myl ranged from nil to very small (0.03% of t dose), depending on the transformation rate a the amount of irrigation water. The concentratio measured by HPLC in drainage water from thr greenhouses were somewhat higher than compu ed, although they remained below 1 micro g/ Various concentrations measured in water cours in an area with many greenhouses were distinct higher than those measured in drainage wat which may be the result of discharge of surplus of spray liquid into the water courses. (Autho abstract)
W85-02924

INTERACTION OF CLAYS WITH DILUT FLUORIDE SOLUTIONS,
Newcastle Univ. (Australia). Dept. of Chemistr
For primary bibliographic entry see Field 2K.
W85-02928

MECHANISMS AND PATHWAYS OF AN LINE ELIMINATION FROM AQUATIC ENV RONMENTS,
Rutgers - The State Univ., New Brunswick, N Dept. of Biochemistry and Microbiology.
C. D. Lyons, S. Katz, and R. Bartha.
Applied and Environmental Microbiology, Vo 48, No. 3, p 491-496, September, 1984. 4 Fig, Tab, 36 Ref.

Descriptors: *Aniline, *Biodegradation, *Aquati environment, Fate of pollutants, Ponds, Aryla mines, Gas chromatography, Mass spectrometry Humic acids, Catechol.

The fate of aniline, a representative of arylamin pollutants derived from the manufacture of dye coal liquefaction, and pesticide degradation, wa comprehensively evaluated by use of unpollute and polluted pond water as model environments Evaporation plus autoxidation proved to mino elimination mechanisms, removing ca. 1% of th added aniline per day. Instantaneous binding t humic components of a 0.1% sewage sludge inocu lum removed 4%. Biodegradation of aniline i pond water was accelerated by the sewage sludg inoculum. A substantial portion of the degrade aniline carbon was mineralized to CO2 within a l week period, and microbial biomass was formed a a result of aniline utilization. Biodegradation wa

clearly the most significant removal mechanism of polluting aniline from pond water. A gas chromatographic-mass spectrometric analysis of biodegradation intermediates revealed that the major pathway of aniline biodegradation in pond water involved oxidative deamination to catechol, which was further metabolized through cis, cis-muconic, beta-ketoadipic, levulinic, and succinic acid intermediates to CO2. Minor biodegradation pathways involved reversible acylation to acetanilide and formanilide, whereas N-oxidation resulted in small amounts of oligomeric condensation products. (Author's abstract)
W85-02932

HUMAN PATHOGENIC VIRUSES AT SEWAGE SLUDGE DISPOSAL SITES IN THE MIDDLE ATLANTIC REGION,
Minnesota Univ., St. Paul. Coll. of Veterinary Medicine.
S. M. Goyal, W. N. Adams, M. L. O'Malley, and D. W. Lear.
Applied and Environmental Microbiology, Vol. 48, No. 4, p 758-763, October, 1984. 3 Fig, 4 Tab, 31 Ref. NOAA grant NA80AA-D00049.

Descriptors: *Viruses, *Ocean dumping, *Atlantic Ocean, *Sludge disposal, Crabs, Sediments, Indicator bacteria, Pathogens, Fate of pollutants.

Human enteric viruses were detected in samples of water, crabs, and bottom sediments obtained from two sewage sludge disposal sites in the Atlantic Ocean. Viruses were isolated from sediments 17 months after the cessation of sludge dumping. These findings indicate that, under natural conditions, viruses can survive for a long period of time in the marine environment and that they may present potential public health problems to humans using these resources for food and recreation. The isolation of viruses in the absence of fecal indicator bacteria reinforces previous observations on the inadequacy of these bacteria for predicting the virological quality of water and shellfish. (Author's abstract)
W85-02939

ISOLATION OF LEGIONELLA SPECIES FROM DRINKING WATER,
Michigan Dept. of Public Health, Lansing. Bureau of Lab. and Epidemiological Services.
S. C. Hsu, R. Martin, and B. B. Wentworth.
Applied and Environmental Microbiology, Vol. 48, No. 4, p 830-832, October, 1984. 2 Tab, 12 Ref.

Descriptors: *Legionella, *Bacteria, *Drinking water, Coliforms, Chlorination, Disinfection, Water treatment, Sodium hypochlorite, Escherichia coli.

Three different species of Legionella were recovered from samples of water taken from chlorinated public water supplies where no coliform bacteria were simultaneously detected. Five of 856 samples yielded Legionella isolates. Three isolates were identified as Legionella pneumophila serogroup 1, the fourth was identified as Legionella dumoffi, and the fifth was identified as Legionella jordanis. Studies to determine the survival of L. pneumophila Flint 1 serogroup 1 in tap water at various temperatures and in tap water with added sodium hypochlorite were done. These organisms were found to survive for 299 days in tap water at 24 and 5 C but not at 35 C. A concentration of at least 0.2 mg of residual chlorine per ml was required to eliminate at least 90% of L. pneumophila and Escherichia coli inocula in 2 h. (Author's abstract)
W85-02941

BIODEGRADATION OF 4-NITROPHENOL IN STANDARDIZED AQUATIC DEGRADATION TESTS,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
N. Nyholm, P. Lindgaard-Jorgensen, and N. Hansen.
Ecotoxicology and Environmental Safety, Vol. 8, No. 5, p 451-470, October, 1984. 7 Fig, 4 Tab, 36 Ref.

Descriptors: *Nitrophenols, *Biodegradation, *Chemical analysis, Toxicity, Bacteria, Degradation, Microbial degradation, Fate of pollutants.

During the years 1978-1981 both the European Economic Community (the EEC) and the Organization for Economic Cooperation and Development (the OECD) organized various interlaboratory comparison programs on standarized screening methods to study the biodegradability of chemicals in water. While the ring test results were generally rather heterogenous, one of the compounds studied, 4-nitrophenol, turned out to be particularly problematic as the compound was found either easily biodegradable or not biodegradable by various laboratories in various tests. This paper describes some more detailed studies on 4-nitrophenol degradation in two different tests, the Modified OECD Screening Test (MOST test) and the Zahn-Wellens test, respectively. The test variables investigated include inoculum characteristics and pretreatment, test duration, and 4-nitrophenol concentration. The results are discussed in relation to toxicity and degradation pathways of 4-nitrophenol. In order to improve the comparability of results from standardized aquatic biodegradation tests, test strategies should allow the option of performing a test with a preadapted inoculum in the event of negative test results with freshly collected inocula. Increasing the inoculated concentration of microorganisms in some tests may also contribute to the attainment of more consistent test results. (Author's abstract)
W85-02944

FATE AND BIOLOGICAL EFFECTS OF METHYL PARATHION IN OUTDOOR PONDS AND LABORATORY AQUARIA; I. FATE,
Shell Research Ltd., Sittingbourne (England). Sittingbourne Research Centre.
N. O. Crossland, and D. Bennett.
Ecotoxicology and Environmental Safety, Vol. 8, No. 5, p 471-481, October, 1984. 2 Fig, 5 Tab, 15 Ref.

Descriptors: *Parathion, *Fate of pollutants, *Water pollution effects, Tissue analysis, Sediments, Aquatic plants, Biodegradation.

Three outdoor ponds were treated with methyl parathion (MEP) applied beneath the water surface at a concentration of 100 micro g/liter. Laboratory aquaria containing either tap water, pond water, tap water plus plants, tap water plus sediment, or tap water plus sediment and plants were similarly treated. Samples of water, sediment, and fish were analyzed for residues of MEP. The rate of loss from water and concentrations found in sediment were compared with predictions based on a calculated rate of biodegradation and a sediment:water partition coefficient. The rate of loss of MEP from pond water isolated in an aquarium was similar to the predicted rate. However, the rate of loss from outdoor ponds, or from aquaria containing plants and sediment, was greater than predicted. MEP was not detected in sediment even though predicted concentrations far exceeded the limit of detection. These results are discussed and it is suggested that the rate of biodegradation in shallow bodies of water may be determined predominantly by bacteria attached to sediments and plants, rather than by planktonic bacteria. Bioaccumulation in fish was predicted from empirical equations based on the octanol:water partition coefficient. Observed values were in good agreement with predictions. (Author's abstract)
W85-02945

TRACE METAL CONTENT OF LIVE TISSUES IN HALIMIONE PORTULACOIDES FROM COASTAL AREAS OF THE SADO ESTUARY, PORTUGAL,
Universidade Nova de Lisboa (Portugal). Dept. of Chemistry and Biotechnics.
F. H. S. Reboredo.
International Journal of Environmental Studies, Vol. 23, No. 1, p 49-53, July, 1984. 1 Fig, 2 Tab, 16 Ref.

Descriptors: *Fate of pollutants, *Trace metals, *Bioindicators, *Halophytes, *Water pollution effects, *Sado Estuary, *Portugal, Aluminum, Zinc, Iron, Copper, Vegetation, Estuaries.

Trace metal concentration (Al, Cu, Fe, and Zn) in Halimione portulacoides from the coastal areas of the River Sado estuary were investigated. This area receives the untreated domestic sewage from a populous city - Setubal, and an important input of residual elements due to the high agricultural and industrial activity around and upstream from Setubal. The results clearly demonstrate that the live tissues of H. portulacoides from different sampling points present different degrees of metal accumulation. The highest levels of Al, Cu and Fe were always found in roots, while the lowest levels were always observed in stems. Copper and iron levels were highly correlated in all tissues while for Al and Zn high correlations were noted between the leaf and the stem. (Baker-IVI)
W85-02959

CHLORIDE BUDGET FOR THE MISSISSIPPI RIVER HEADWATERS TO MOUTH,
Syracuse Univ., NY. Dept. of Geology.
D. I. Siegel, and D. Livermore.
Water Resources Bulletin, Vol. 20, No. 2, p 503-509, August, 1984. 5 Fig, 2 Tab, 21 Ref.

Descriptors: *Mississippi River, *Chlorides, *Mass budget, *Water pollution sources, Ohio River, Rivers, Flow discharge, Precipitation, Road salting, Snowpack, Leaching, Dam effects, Reservoirs.

The chemical mass balance approach for the chemically conservative solute, chloride, is especially useful to differentiate between natural and anthropogenic source of solutes to river waters. Monthly data from 1974-1979 on river discharge and chloride concentrations were obtained at 16 sites along the Mississippi River and major tributaries for the data base of NASQAN and from annual data reports of the USGS. Chloride deposition from precipitation in the Mississippi river watershed generally reflects the proximity of a given location to the Gulf Coast, where precipitation is greater and contains higher concentrations of sea salt. Mass budgets for chloride were estimated for the Mississippi River from headwaters to near the mouth to determine the magnitudes of natural and anthropogenic sources. Annual chloride input from precipitation ranged from about 200 kg sq mi/yr at Royalton, Minnesota, to about 350 kg sq mi/yr at Vicksburg, Mississippi. Mass export ranged from about 900 kg sq mi/yr at Royalton to about 8000 kg sq mi/yr at Vicksburg. As much as 80% of the residual, the difference between input and export, probably is contributed by anthropogenic sources. Semi-logarithmic scatterplots of monthly total discharge against chloride concentration show that, during early spring, chloride elevations in the Mississippi River and the Ohio River are elevated, possibly because of flushing of road salt and leaching of chloride from the accumulated snowpack. Scatterplots of chloride versus discharge for sites on the Mississippi River show great scatter, without the definition of discrete straightline segments. This suggests numerous sources of anthropogenic chloride unrelated to season and the effects of hydrologic control of river discharge through reservoirs and dams. (Moore-IVI)
W85-02976

MULTIVARIATE ANALYSIS OF PARAMETERS RELATED TO LAKE ACIDIFICATION IN QUEBEC,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
B. Bobee, and M. Lachance.
Water Resources Bulletin, Vol. 20, No. 4, p 545-556, August, 1984. 7 Fig, 5 Tab, 26 Ref.

Descriptors: *Lake acidification, *Quebec, *Multivariate analysis, Canadian shield, Acid rain, Acidification, Lakes.

Multivariate methods were used for the statistical analyses both of Quebec as a whole and of the shield area, based on physico-chemical data from 234 lakes collected during the spring and summer of 1980. A statistical method, based on the joint use

of factorial correspondence analysis and cluster analysis, was applied to these data to obtain a general picture of the spatial variability of a number of physico-chemical parameters related to the sensitivity or acidification of lakewaters. The part of Quebec lying on the Canadian shield is especially vulnerable to acidification. The southwestern portion of this area of Quebec was more substantially affected by acid fallout. A detailed study of spatial variability over the shield area revealed the existence of greater spatial heterogeneity. It was possible to pinpoint zones which are highly vulnerable to acid precipitation and zones whose lakes show clear signs of acidification resulting from such precipitation. The results of these statistical analyses should also affect the design of future sampling surveys. They delimit the regions where network density needs to be increased if a more accurate description of the spatial variability of the acidification is sought. (Moore-IVI)
W85-02981

EIGENVALUE TECHNIQUE FOR SOLUTE TRANSPORT,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
J. C. Hwang, R. M. Koerner, W. C. Cho, and K. S. Yeung.
Journal of Hydraulic Engineering, Vol. 110, No. 10, p 1302-1314, October, 1984. 1 Fig, 1 Tab, 18 Ref, 2 Append.

Descriptors: *Solute transport, *Path of pollutants, *Eigenvalue technique, Groundwater pollution, Modelling, Groundwater management, Boundary conditions, Computer programs.

Detailed procedures are presented for applying the eigenvalue technique to solutions of the linear equation for solute transport in groundwater. The time invariant boundary conditions generally encountered in groundwater contamination problems are concentrated sources, impermeable boundaries, boundaries with known influx and outward flow-through boundaries with vanishing normal concentration gradient. Time dependent boundary conditions are excluded. Using the eigenvalue technique the dynamic system equation is decoupled and the time integration can be done independently and continuously for each nodal point. An explicit expression is obtained for each nodal point as a function of time. The Eispack computer package can be used to calculate a general real matrix, whether it is symmetric or asymetric, with satisfactory results. The computed results that use the eigenvalue technique for solving a 2-D groundwater solute transport problem compare well with the analytic solution. This method can provide convenience of data retrieval, particularly in groundwater management modeling. (Moore-IVI)
W85-03004

POLYCHLORINATED DIBENZO-P-DIOXINS AND DIBENZOFURANS IN SEDIMENTS FROM SISKIWIT LAKE, ISLE ROYALE,
Indiana Univ. at Bloomington. School of Public and Environmental Affairs.
J. M. Czuczwa, B. D. McVeety, and R. A. Hites.
Science, Vol. 226, No. 4674, p 568-569, November, 1984. 1 Tab, 13 Ref.

Descriptors: *Path of pollutants, *Lake sediments, *Siskiwit Lake, *Isle Royale, *Michigan, *Dibenzo-p-dioxins, *Dibenzofurans, Organic compounds, Incineration, Dioxins, Furans, Air pollution, Water pollution sources.

Dioxins and dibenzofurans have several sources and can thus enter the environment either through the atmosphere or through the water. The atmospheric path was investigated by measuring polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) in sediments from Siskiwit Lake, located on Isle Royale in northern Lake Superior. Three sediment cores taken from sections of Siskiwit Lake indicate that octachlorodioxin (OCDD) predominates, and the heptachlorodioxins (HpCDD) and the heptachlorofurans (HpCDF) are also abundant cogeners. These findings suggest that PCDD and PCDF are ubiquitous environmental contaminants that are transported through the atmosphere much in the same way as pesticides and certain heavy metals. The most significant source of PCDD and PCDF to the atmosphere is the combustion of wastes that contain chlorinated compounds. (Baker-IVI)
W85-03025

STUDIES ON A SELECTED INDUSTRIAL EFFLUENT AND THE RECEIVING STREAM,
Ife Univ. (Nigeria). Dept. of Civil Engineering.
O. Ogedengbe, H. O. Fapohunda, and M. B. Gotau.
Water International, Vol. 9, No. 2, p 58-61, 1984. 3 Tab, 6 Ref.

Descriptors: *Industrial wastes, *Waste disposal, *Wastewater treatment, *Water quality, *Nigeria, *Ona River, Water management, Decision making, Planning, Developing countries.

Efforts at producing water quality standards have been largely unsuccessful in many developing countries. Attempts to establish such standards in Nigeria are reviewed. Nigeria has some very large rivers around which it has established a number of River Basin Authorities. While the waters in these rivers used to be clean, recent advancements in several industries have changed this situation. Effuents from bottling and canning factories have impaired the quality of Ona stream to such an extent that the water is unsuitable for irrigation or for any other use. The canning waste is amenable to biological treatment, preferably aerobic, or possibly facultation. Studies are continuing to determine just what approach will be used to solve this problem. It is essential in such areas that specific conditions for water to be used must be defined in the future such as crops being grown, soil properties and others. No plant should be constructed unless, and until there is proof, that it would make a positive difference to downstream waters. (Baker-IVI)
W85-03027

WATER - THE SILENT MESSENGER BETWEEN CAUSE AND EFFECT IN ENVIRONMENTAL PROBLEMS,
Swedish Natural Science Research Council, Stockholm.
M. Falkenmark.
Water International, Vol. 9, No. 2, p 62-65, 1984. 1 Fig, 1 Tab, 5 Ref.

Descriptors: *Water quality control, *Planning, Decision making, Water management, Developing countries.

An array of meetings to discuss the environmental problems emerging for the 80s have been held during the 10 year period after the Stockholm Conference on the Human Environment. Several ten year anniversary celebrations included presentations of overviews on progress and concerns which have been addressed during the interim period. One crucial advancement has been the increasing role of public awareness. The role of water most frequently mirrored in environmental discussions is water as a physical environment. However, a second role, invisible, but of extreme importance, is the role of water as a carrier of solutes and sediments. The third role of water is its action as a local vector tying together land and water. This function implies that many of man's activities at the ground surface will sooner or later be reflected in the groundwater or in the river system. A fourth role of extreme importance for the human environment is the role as disease vector, transmitting pathogens of various kinds from various sources and along different pathways. A fifth role is the physiological role of water as a basic substance for support of body functions or living beings including heat balance and tissue stiffening, unbalance having far reaching impacts on health and well being. (Baker-IVI)
W85-03028

MERCURY POLLUTION IN MARINE SEDIMENTS NEAR A CHLORALKALI PLANT: DISTRIBUTION AND AVAILABILITY OF THE METAL,
Siena Univ. (Italy). Dipt. di Biologia Ambien
F. Baldi, and R. Bargagli.
Science of the Total Environment, Vol. 39, No
2, p 15-26, October, 1984. 3 Fig, 6 Tab, 28

Descriptors: *Mercury, *Fate of pollut
*Marine sediments, *Tyrrhenian Sea, *I
Heavy metals, Cinnabar, Industrial wastes, W
pollution sources, Sinks, Marine pollution.

Sediments near the chlor-alkali plant of Rosig
Solvay, Tuscany, were collected and examined
mercury content. The distribution of mercury
marine sediments of the Tyrrhenian contine
shelf showed that the area just off the chlor-al
plant gave the highest values of the whole
pling zone, 4.06 micro g/g. A few stations to
north of Piombion registered values of 1 micro
which is perplexing as neither industries nor cin
bar deposits are associated with this zone.
significant concentrations of mercury in the sou
ernmost part of the sampling area can be explai
by the Albegna and Ombrone river outflows, si
both rivers drain the cinnabar deposits and
mercury mining area of Mount Amiata. The c
centrations on the inner continental shelf are
general greater than 0.5 micro g/g. Only a f
stations, located on the outer shelf and near
mouth of the Arno River, have background valu
Sequential leaching studies suggest that mar
sediments off the chlor-alkali plant are a good si
for mercury and chemico-physical changes of
marine environment cannot easily remove this e
ment into the water column. Hence, the mercu
of the sediment shoul not be able to enter into
food chain. The lack of agreement of this findi
with those of earlier studies indicates that
sequential leaching technique is not an adequa
approach for testing the availability of mercu
which undergoes microbial transformatio
(Baker-IVI)
W85-03030

**CHLORINATED CONTAMINANTS IN THE N
AGARA RIVER, 1981-1983,**
National Water Research Inst., Burlington (Onta
io). Environmental Contaminants Div.
B. G. Oliver, and K. D. Nicol.
Science of the Total Environment, Vol. 39, No.
2, p 57-70, October, 1984. 4 Fig, 6 Tab, 19 Re

Descriptors: *Water analysis, *Niagara Rive
*Chlorinated hydrocarbons, *Niagara-on-th
Lake, *Ontario, *Lake Erie, Organic compound
Pesticides, Agricultural chemicals, Rainfal
Runoff.

Large volume (16 liter) water samples were co
lected weekly from the Niagara River at Niagara
on-the-Lake and analyzed for 31 chlorinated con
taminants for the period September 1981 to Sep
tember 1983. The analysis of water at the sourc
(Lake Erie) of the Niagara River at Fort Erie an
at the river mouth at Niagara-on-the-Lake show
that significant inputs of contaminants to the rive
are occurring. At least an order of magnitud
increase in the concentration of chlorobenzene
takes place over the river's course. Many halog
nated compounds not detected at Fort Erie were
readily detected at Niagara-on-the-Lake. A signifi
cant amount of the PCBs and pesticides in the
river may originate in Lake Erie. The most pre
dominant class of halogenated compounds in the
river appears to be the chlorobenzenes. A fairly
steady background concentration was observed for
most compounds, likely due to steady leaching
from waste disposal sites along the river's course.
Superimposed on these background levels were
numerous unpatterned concentration spikes, indi
cating direct dumping into the river. Only crude
estimates of contaminant loadings from the Niaga
ra River to Lake Ontario could be made because of
the large concentration variability in the river.
(Baker-IVI)
W85-03033

**SOLUTE TRANSPORT IN HETEROGENEOUS
POROUS FORMATIONS,**
Tel-Aviv Univ. (Israel). Faculty of Engineering.

or primary bibliographic entry see Field 2F.
/85-03036

TOCHASTIC APPROACH TO MODELS FOR HE LEACHING OF ORGANIC CHEMICALS N SOIL,
echnical Univ. of Denmark, Lyngby. Lab. of nvironmental Science and Ecology.
. Gydesen.
cological Modelling, Vol. 24, No. 3/4, p 191-205, eptember, 1984. 7 Fig, 1 Tab, 14 Ref.

escriptors: *Stochastic process, *Model studies, Organic compounds, *Soil leaching, Diffusion, tatistical analysis, Leaching, Path of pollutants.

common way to study the movement of a chem-al in a given soil type is to set up soil columns of given length, apply a chemical and pass a known ater flow through the column. One approach to odelling the results of such an experiment is to se a deterministic model, formulated as a partial fferential equation for the concentration of the hemical interpreted as a function of both time and osition. A procedure is given to determine wheth-r leaching data from a given experiment can be id to follow the basic diffusion model. The un-erlying principle is that it is valuable to attempt e simplest model first. Thus if the data fit the the mple model well, then a more complicated model unnecessary, and the use of a more general odel may overinterpret existing data. If the basic odel describes the data satisfactorily, statistical sts for hypotheses concerning homogeneity or nearity of different chemical or soil columns may e developed. (Moore-IVI)
/85-03076

RELATIONSHIP BETWEEN ATMOSPHERIC NITROGEN DEPOSITION AND THE STREAM NITROGEN PROFILE,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water nd Land Resources.
M. D. Moore, and J. R. Nuckols.
ournal of Hydrology, Vol. 74, No. 1/2, p 81-103, October, 1984. 2 Fig, 7 Tab, 34 Ref.

Descriptors: *Nitrogen, *Water pollution sources, Atmospheric deposition, *Little Millseat water-hed, *Kentucky, West Fork Walker Branch wa-ershed, *Tennessee, Linear regression analysis, Forest watersheds, Water chemistry, Streams, Or-ganic nitrogen, Acid rain.

Linear regression analysis techniques were used to tudy the relationship between the stream nitrogen hemistry profile and atmospheric deposition of itrogenous compounds to two small forested wa-ersheds linear. The 81.7-ha Little Millseat (LM) nd 38.4-ha West Fork Walker Branch (WFWB) watersheds are located in eastern Kentucky and astern Tennesee, respectively. Both are character-zed by steep slopes. Vegetation in the watersheds consists predominantly of the oak-hickory type, nd soils have moderately rapid permeabilities. Precipitation on the WFWB watershed is evely distributed throughout the year, whereas in the LM watershed it peaks in late winter and is lowest n late summer. A relationship exists between at-nospheric deposition of nitrogen compounds and stream nitrogen chemistry in these watersheds. It is highly dependent on the hydrologic response po-tential of the watershed. Measured levels of atmos-pheric deposition of nitrogen compounds in the wetfall to the LM and WFWB watersheds were significantly above values reported in other stud-ies. The proximity of the watersheds to pollution sources, such as fossil fuel combustion power sta-tions and surface-mining sites, appeared to be a major factor contributing to these differences. Or-ganic-nitrogen was measured in significant quanti-ties for both watersheds and should be considered as a major input parameter for future depositional research in the study region. (Moore-IVI)
W85-03084

EFFECTS OF SIMULATED ACID PRECIPITA-TION ON DECOMPOSITION AND LEACHING OF ORGANIC CARBON IN FOREST SOILS,
Bemidji State Univ., MN. Center for Environmental Studies.
For primary bibliographic entry see Field 5C.
W85-03095

CADMIUM SORPTION AND MOBILITY IN SLUDGE-AMENDED SOIL,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5E.
W85-03097

CHARACTERISTICS OF AUTOPURIFICATION IN THE OSSAM RIVER, A TRIBUTARY OF THE DANUBE (EINIGE BESONDERHEITEN IN DER SELBSTREINIGUNG DES DONAUZUFLUSSES OSSAM),
Bulgarian Academy of Sciences, Sofia. Inst. of Zoology.
B. K. Russev, I. J. Janeva, and R. B. Detcheva.
Hydrobiology (Bulgarian Academy of Science), Vol. 21, p 14-28, May 1984. 3 Fig, 4 Tab, 11 Ref.

Descriptors: *Ossam River, *Bulgaria, *Autopurification, *Fate of pollutants, *Biodegradation, Microbial degradation, Macrobenthos, Wastewater disposal, Dissolved oxygen, Water temperature, Saprobic conditions.

The autopurification capacity of the Ossam River, a tributary of the Danube in Bulgaria, below the cities of Troyan and Lovec was studied. In order to achieve this, it was important to establish a relationship between oxygen saturation on the river bottom and on the surface and the quantitative development of Ciliata in stony deposits and sludge, the macrozoobenthos composed of the lithorheophilic zoozonose, and the saprobic condition of the river. These parameters were measured in the Ossam in March, May and September 1978. Results showed that oxygen content in water at the surface and on the bottom was not the same despite a relatively high degree of turbulence in the shallow (< 0.5 m) river. Greater or lesser differences in oxygen content/saturation between the surface and the bottom reflected a respectively greater or lesser degree of pollution. A correlation was observed between Rothschein's saprobiological index (indicating the saprobic condition and autopurification processes on the basis of the macrozoobenthos) and oxygen content/saturation at the bottom and, to a lesser extent, at the surface. The maximal effect of autopurification occurs when the destruction of organic bottom sediment is largely accomplished or, in other words, when oxygen saturation near the bottom increases sharply and approaches that of the surface. The effects of pollution, expressed by the saprobiological index, are most intense not at the site of wastewater discharge but several kilometers downstream. Comparable studies of pollution and autopurification of the Ossam conducted in 1968-1969 and 1971-1972 showed that both pollution and the level of autopurification were greater in 1968-1969 than in 1971-1972 or 1978. In 1978, the number of hydrobiological organisms was greatly decreased despite a low level of pollution and better autopurification. Autopurification was significantly less effective in March than in May or September, probably due to lower temperatures and correspondingly less hydromicrobiological activity. (Gish-IVI)
W85-03100

CHANGING MACROINVERTEBRATE COMMUNITY STRUCTURE AND DIVERSITY IN AN ORGANICALLY LOADED RIVER DURING ITS SELFPURIFICATION,
Bulgarian Academy of Sciences, Sofia. Inst. of Zoology.
For primary bibliographic entry see Field 5C.
W85-03101

BIOLOGICAL STATE OF UNDERGROUND WATERS IN THE INDUSTRIAL ZONE OF THE EASTERN PART OF THE SOFIA PLAIN (BIOLOGICHIO S'STOYANIE NA PODZEMNITE VODI V INDUSTRIALNATA ZONA NA UZTOCHNOTO ZOFIIZKO POLE),
A. A. Petrova, E. B. Angelkova, and R. L. Tsvetkova.
Hydrobiology, Vol. 21, p 42-55, May, 1984. 1 Fig, 6 Tab, 9 Ref.

Descriptors: *Sofia Plain, *Bulgaria, *Groundwater pollution, Bacteria, Domestic wastes, Industrial wastes, Agricultural wastes, Wastewater.

The groundwaters most strongly affected by industry, agriculture and households in the Eastern Sofia Plain (Bulgaria) were studied. A general background pollution level and some cases of local household pollution by private and co-operative farms without sewage were established. The bacteriological and stygobiological evidence showed no toxic pollution. (Author's abstract)
W85-03103

MICROBIOLOGICAL SURVEY ON THE EFFECT OF THE BLAGOEVGRADSKA BISTRITSA RIVER ON THE STRUMA RIVER WATER QUALITY (MIKROBIOLOGICHNO IZSLEDVANE NA VLIYANIETO NA REKA BLAGOEVGRADSKA BISTRITSA V'RKHU KACHESTVOTO NA VODATA NA REKA STRUMA),
S. M. Naumova, and T. P. Todorov.
Hydrobiology (Bulgarian Academy of Science), Vol. 22, p 25-38, June, 1984. 5 Fig, 4 Tab, 11 Ref.

Descriptors: *Microorganisms, *Blagoevgradska Bistritsa River, *Struma River, *Water quality, Bacteria, Seasonal variation, Razumov index, Organic matter, Water pollution, Biodegradation.

Below the point of inflow of the Blagoevgradska Bistritsa river into the Struma river, the total count of microorganisms after Razumov increases 1.3 fold in spring, 1.5 fold in summer and 4.1 fold in fall. The morphological index (the ratio between rod-like and cocci-like bacterial cells) reaches its highest value in summer (1.7 fold) while in spring and fall it is much lower. The number of oligocarbophiles grows 1.2 fold in spring, 1.5 fold in summer and 3.8 fold in fall. Their relative share slightly diminishes in spring, strongly - in summer and somewhat - in fall. The c.f.u. number just under the point of inflow grows 1.4 fold in spring, 2.2 fold in summer and 5.4 fold in fall while the Razumov index reaches its highest value in summer. The number of the spores of heterotrophs is low and follows the c.f.u. number variation pattern with their share growing in fall. The Struma river microflora is oligocarbophilic but under the influence of the Blagoevgradska Bistritsa the amount and significance of the carbophilic components increases. Biodegradation of organic matter in the Struma below the inflow of the Blagoevgradska Bistritsa, even having been intensified, does not reach the final stage of mineralization. The Struma microbiological indices are altered considerably by the strongly organically polluted Blagoevgradska Bistritsa and its microflora. The strongest negative effect of the Blagoevgradska Bistritsa is observed in summer and the lowest, in spring. In 1980 when the water levels of both rivers were very low the strongest polluting effect of the Blagoevgradska Bistritsa was observed. However 12 km downstream the effect of the latter is overcome and the Struma river water quality is completely restored. (Author's abstract)
W85-03105

HYDROBIOLOGICAL AND SAPROBIOLOGICAL ALTERATIONS IN THE TUNJA RIVER. I. 1955 - 1967 (TENDENTSII V IZMENENIYATA NA KHIDROBIOLOGICHNOTO I SAPROBIOLOGICHNOTO S'STOYANIE NA REKA TUNDZHA. I. 1955-1967 G),
B. K. Russev, M. I. Nikolova, and M. A. Dimitrova.
Hydrobiology (Bulgarian Academy of Science), Vol. 22, p 59-73, June, 1984. 2 Fig, 2 Tab, 20 Ref.

Descriptors: *Tunja River, *Bulgaria, *Saprobity, *Aquatic life, Water pollution effects, Aquatic insects, Benthic flora, Algae, Invertebrates, Water level, Resuspension, Organic matter, Hydrologic aspects.

Group 5B—Sources Of Pollution

A total of 237 hydrobionts were found in 14 locations along the river in 1955, 1966 and 1967. Thirty nine benthic algae (18 Bacillariophyta and 16 Chlorophyta) and 198 benthic invertebrates (55 Ephemeroptera, 36 Chironomidae, 22 Trichoptera, 16 Odonata, etc.) were established. In 1955 the entire river was in a good saprobiological condition with the lowest saprobiological index being 46.64 (beta-mesosaproby) indicating that the river was near the normal, nonpolluted condition. In 1966 alpha-mesosaproby was established near Kazanluk and in 1967 - after the point of inflow of the Asenovitsa river and the Yambol waste water. However, at the state border the river was in beta-mesosaproby during all three years. In 1967 in 55% of the cases of changes in the water level, directly proportional changes in the saprobiological index occurred and in 45% these changes were inversely proportional indicating that improved saprobiological conditions were observed more frequently when the water level went up mostly because of the dilution of organic pollutants. The inverse correlation may be due to the stronger effect of pollution compared to the higher water level, the washing off of bottom clay and sedimented pollutants by rapidly increasing flow rates thus increasing the amounts of resuspended organic substances as well as by the carrying away of insect larvae and other benthic organisms by the high flow rates and thus altering the structures of benthic cenoses and the saprobiological river characteristics. Further studies on the correlation between the saprobiological index and the water amounts are needed during the period of high water level. (Author's abstract)
W85-03106

HEAVY METALS IN A CONTAMINATED AUSTRALIAN ESTUARY - DISPERSION AND ACCUMULATION TREND,
Aix-Marseille-1 Univ. (France).
P. S. Roy, and E. A. Crawford.
Estuarine, Coastal and Shelf Science, Vol. 19. No. 3, p 341-358, September, 1984. 7 Fig, 4 Tab, 44 Ref.

Descriptors: *Estuaries, *Heavy metals, *Dispersion, *Accumulation, *Lake Macquarie, *Australia, Zinc, Lead, Copper, Cadmium, Manganese, Nickel, Cobalt, Silver, Iron, Estuarine sediments, Lagoons, Fate of pollutants, Bioturbation.

Very high concentrations of Zn, Pb, Cu and Cd occur in the muddy bottom sediments of Lake Macquarie, a saline coastal lagoon in southeastern Australia. The trace metals emanate from industrial sources, especially a lead-zinc smelter, at the northern end of the lake. Individual metal concentrations decrease progessively away from the source area but at differing rates; Zn is most mobile and Cd appears to be deposited first. They approach natural background levels in the southern part of the lake. Mn shows a reverse trend but Ni, Co, Ag and Fe rarely rise above background levels. Shallow cores in the lake bed penetrated a metal enriched surface zone 15-35 cm thick underlain by uncontaminated sediments with natural (background) metal concentrations. Sedimentation rates determined from radiocarbon ages on shells in the cores mainly range between 0.15 and 0.5 mm/yr. Over the 85 years since industrialization commenced, less than 5 cm of mud has accumulated on the lake bed. Bioturbation is invoked to account for the depth to which the sediment has been enriched in heavy metals. (Author's abstract)
W85-03109

MINERAL SUBSTANCES OF AQUATIC AND TERRESTRIAL VEGETATION IN THE STORAGE TANK AT KISKORE,
Allatorvostudomanyi Egyetem, Budapest (Hungary).
Gy. Tolgyesi, and A. Kozma.
Tiscia (Szeged), Vol. 19, No. 2, p 157-163, 1984. 2 Tab, 10 Ref.

Descriptors: *Aquatic plants, *Littoral plants, *Kiskore, *Hungary, Potassium, Phosphorus, Sulfur, Magnesium, Sodium, Aluminum, Iron, Manganese, Zinc, Copper.

On June 30, 1982, 18 water plant samples were collected from the water of the Kiskore storage tank, and 54 littoral vegetation samples were collected from the sides of a canal. The 72 plant specimens were analyzed for 11 elements: K, Ca, P, S, Mg, Na, Al, Fe, Mn, Zn and Cu. For the more critical elements the averages of the 54 terrestrial specimens were as follows: P = 2.0 g/kg, Mg = 1.9 g/kg, Na = 0.8 g/kg, Zn = 42.6 mg/kg and Cu = 7.5 mg/kg. The littoral vegetation is in every respect of normal composition. At the time of the study, both the aquatic and terrestrial vegetation contained the mineral substances in the customary concentration. The values can be regarded as essentially basic values to which future data can be compared. (Moore-IVI)
W85-03119

BLACK ACIDIC SNOW IN THE REMOTE SCOTTISH HIGHLANDS,
University of East Anglia, Norwich (England). School of Environmental Sciences.
T. D. Davies, P. W. Abrahams, M. Tranter, I. Blackwood, and P. Brimblecombe.
Nature, Vol. 312, No. 5989, p 58-61, November 1984. 3 Fig, 2 Tab, 46 Ref.

Descriptors: *Acidic snow, *Scotland, *Acid deposition, *Snow, Chemistry of precipitation, Hydrogen ion concentration, Snowpack, Acidic flushes, Water pollution sources, Fate of pollutants.

Parts of Scotland experience large acidic depositions which may result in ecological damage. Some highland areas appear to suffer enhanced acidic input which frequently exhibits pronounced episocidicity. Acidic snowfall leads to acidic flushes during snow-pack melting. Polluted grey snow layers have been previously reported in Scandinavia. The distinctive black, acid snowfall episode with pH 3.0, reported here, is the first documented case remote from major pollution sources. The particulate deposit was very large and consisted of approximately 29% carbon; the remaining fraction included particles which could be identified as coal fly-ash. The heavily polluted air originated to the south-south east and was probably transported at an altitude of approximately 1,000-1,500 m in association with a stable atmospheric layer whereupon particles were efficiently scavenged by snow. Such transport and deposition mechanisms may produce the greater pollutant deposition sometimes observed in mountain areas. Similar events may not be rare and could make an important contribution to the annual pollutant input. (Author's abstract)
W85-03127

INTERVENTION ANALYSIS OF WATER QUALITY RECORDS,
Inland Waters Directorate, Vancouver (British Columbia). Water Quality Branch.
For primary bibliographic entry see Field 7B.
W85-03131

HYDROGEOCHEMICAL INTERACTION BETWEEN A MUNICIPAL WASTE STABILIZATION LAGOON AND A SHALLOW AQUIFER,
North Dakota Univ., Grand Forks. Dept. of Geology.
For primary bibliographic entry see Field 5G.
W85-03154

AMMONIUM ION, HUMIC MATERIALS, AND TRIHALOMETHANE POTENTIAL IN NORTHEASTERN KANSAS GROUND WATERS,
Kansas State Geological Survey, Lawrence.
For primary bibliographic entry see Field 2K.
W85-03155

ANALYSIS OF DISPERSION IN A STRATIFIED AQUIFER,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W85-03160

MODEL FOR INVESTIGATING MECHANICAL TRANSPORT IN FRACTURE NETWORKS,
California Univ., Berkeley. Lawrence Berkel
Lab.
For primary bibliographic entry see Field 2F
W85-03163

INCORPORATION OF TRIVALENT CHROM UM INTO RIVERINE AND ESTUARINE CO LOIDAL MATERIAL,
Maine Univ. at Orono, Walpole. Dept. of Oce ography.
For primary bibliographic entry see Field 2K.
W85-03206

SEASONAL VARIATIONS OF 210-PB AND 21 PO CONCENTRATIONS IN AN OLIGOTR PHIC LAKE,
Wisconsin Univ.-Madison. Water Chemistry La
For primary bibliographic entry see Field 2H.
W85-03212

5C. Effects Of Pollution

TOXICOLOGICAL INVESTIGATION AN EVALUATION OF DRINKING-WATER PO LUTION CAUSED BY CHEMICAL WASTE
Orszagos Kozegeszegugyi Intezet, Budapest (Hu gary).
For primary bibliographic entry see Field 5F.
W85-02696

EFFECTS OF 2,4-DICHLOROPHENOXYACI TIC ACID IN ARTIFICIAL ACID RAIN O BRASSICA NAPUS AND SINAPIS ALBA,
Technical Univ. of Denmark, Lyngby. Lab. Environmental Science and Ecology.
H. Lokke.
Ecotoxicology and Environmental Safety, Vol. No. 4, p 328-338, August, 1984. 2 Fig, 5 Tab, Ref.

Descriptors: *Acid rain, *Herbicides, *Rap *Mustard, *Dichlorophenoxyacetic acid, Plan growth, Herbicides, Water pollution effects.

The effect of 2,4-dichlorophenoxyacetic (2,4-D acid in artificial rain at pH 3.3 was examined fo young plants of rape (Brassica napus L.) and whit mustard (Sinapis alba L.). Plants were treated in closed simulation chamber system with varyin CO2 supply (198-418 ppm). Single or daily show ers were applied for 20-30 min at varying 2,4-D concentrations (0, 0.03, 0.1, 0.5, and 2.5 mg/l). Th plants were sampled 5 days after the last treatment Epinasty was observed for Brassica at 0.5 mg/l an for Sinapis at 0.1 mg/l 2,4-D. Leaf to stem dry weight ratios increased with increasing CO2 con centrations in the air and decreased following single treatments with 0.5 or 2.5 mg/l 2,4-D in th rain. Dose-effect relationships are proposed fo both plant species. Leaf dry matter weights pe area unit decreased with increasing CO2 concen trations, but were not significantly affected by the 2,4-D treatments. (Author's abstract)
W85-02697

ENVIRONMENTAL MODEL SEGMENT AP PROACH FOR ESTIMATING POTENTIAL EN VIRONMENTAL CONCENTRATIONS, I. THE MODEL,
Battelle-Inst. e.V., Frankfurt am Main (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W85-02699

ENVIRONMENTAL MODEL SEGMENT AP PROACH FOR ESTIMATING POTENTIAL EN VIRONMENTAL CONCENTRATIONS, II. AP PLICATION OF THE MODEL TO P-DICH LOROBENZENE AND TRICHLOROETHENE,
Battelle-Inst. e.V., Frankfurt am Main (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W85-02700

EFFECTS OF CADMIUM-ENRICHED SEDIMENT ON FISH AND AMPHIBIAN EMBRYO-LARVAL STAGES,
Lilly (Eli) and Co., Indianapolis, IN. Lilly Research Lab.
P. C. Francis, W. J. Birge, and J. A. Black.
Ecotoxicology and Environmental Safety, Vol. 8, No. 4, p 378-387, August, 1984. 2 Fig, 4 Tab, 33 Ref.

Descriptors: *Cadmium, *Sediment contamination, *Immature growth stages, *Goldfish, *Frogs, *Bass, Heavy metals, Water pollution effects, Mortality, Bioaccumulation, Toxicity.

Aquatic toxicity tests were conducted to evaluate the effects of cadmium-enriched sediment on embryo-larval stages of the goldfish (Carassius auratus), leopard frog (Rana pipiens), and largemouth bass (Micropterus salmoides). Natural stream sediment was collected and enriched with cadmium to nominal concentrations of 1.0, 10.0, 100 and 1000 mg/kg. Enriched sediments were placed on Pyrex dishes and covered with 350 ml of reconstituted water. Fertilized eggs were placed in the dishes and maintained through 4 days posthatching, giving a total exposure time of 6 to 7 days. For all tests the cadmium concentrations ranged from 1.1 to 76.5 micro g/liter in water above sediments containing 1 to 1000 mg Cd/kg, respectively. Although low frequencies of mortality were observed in all tests, goldfish, leopard frog, and bass exposed to sediments enriched to 1000 mg Cd/kg accumulated 4.61, 12.55, and 60.0 micro g Cd/g, respectively. No significant correlations ($P < 0.05$) were found between mortality of the goldfish and leopard frog and the cadmium concentrations in either water or sediment. However, all three species showed strong correlations ($r >$ or $= 0.98$) between cadmium concentrations in water and tissue, sediment and tissue, and water and sediment. Tissue cadmium concentrations were related to the length of time test organisms were in direct contact with cadmium-enriched sediment. (Author's abstract)
W85-02701

QUANTITATIVE STRUCTURE-ACTIVITY RELATIONSHIPS AND MIXTURE TOXICITY STUDIES OF CHLORO- AND ALKYLANILINES AT AN ACUTE LETHAL TOXICITY LEVEL TO THE GUPPY (POECILIA RETICULATA),
Utrecht Rijksuniversiteit (Netherlands). Dept. of Veterinary Pharmacology, Pharmacy and Toxicology.
J. Hermens, P. Leeuwangh, and A. Musch.
Ecotoxicology and Environmental Safety, Vol. 8, No. 4, p 388-394, August, 1984. 5 Tab, 19 Ref.

Descriptors: *Structure-activity relationships, *Toxicity, *Anilines, *Guppy, Octanol partition coefficient, Hydrophobicity, Electronic properties, Chloroanilines, Alkylanilines.

Correlations were calculated between the acute lethal toxicity to the guppy (Poecilia reticulata) of a series of anilines (chloro- and alkylanilines) with different characteristics of hydrophobicity (calculated and experimental octanol partition coefficients and Π constants) together with Hammett sigma constants. Quantitative structure-activity relationships (QSARs) were determined. The acute lethal toxicity of anilines to guppies is a function of the hydrophobic and electronic properties of these compounds because a QSAR with octanol partition coefficient and Hammett constants yielded a significant better correlation than octanol partition coefficient alone. The three characteristics of hydrophobicity result only in small differences in the calculated QSARs. Only the correlations between the three hydrophobicity characteristics and the Hammett constants influence the statistical reliability of the improvements of the QSARs with Hammet constans as parameter. The toxicities of mixtures of the anilines corresponded to concentration addition. (Moore-IVI)
W85-02702

CRITICAL REVIEW OF EPIDEMIOLOGIC STUDIES RELATED TO INGESTED ASBESTOS,
Pittsburgh Univ., PA. Dept. of Biostatistics.
G. M. Marsh.
Environmental Health Perspectives, Vol. 53, p 49-56, November, 1983. 7 Tab, 25 Ref.

Descriptors: *Water pollution effects, *Epidemiology, *Asbestos, Cancer, Mortality, Carcinogens, Human diseases, Public health.

Thirteen epidemiologic studies of ingested asbestos conducted in five areas of the US and Canada were evaluated for the definitiveness and applicability regarding the development of ambient water quality standards. Associations between asbestos in water supplies and cancer mortality or incidence in humans were found in one or more studies dealing with neoplasms in the esophagus, stomach, small intestine, colon, rectum, gallbladder, pancreas, peritoneum, lungs, pleura, prostate, kidneys, brain and thyroid as well as leukemia. However, no single study nor aggregate of studies existed that would establish risk levels from ingested asbestos. It is recommended that the integrated ecologic data to date be used to generate a rough priority of specific etiologic hypotheses that should be tested in the original settings or in independent study populations using studies designed at the more definitive individual level, such as case-control studies. (Baker-IVI)
W85-02704

CANCER RISK FROM ASBESTOS IN DRINKING WATER: SUMMARY OF A CASE-CONTROL STUDY IN WESTERN WASHINGTON,
Fred Hutchinson Cancer Research Center, Seattle, WA.
L. Polissar, R. K. Severson, and E. S. Boatman.
Environmental Health Perspectives, Vol. 53, p 57-60, November, 1983. 20 Ref. EPA grant 805846.

Descriptors: *Asbestos, *Carcinogens, *Epidemiology, *Drinking water, *Sultan River, *Everett, *Washington, Human diseases, Public health, Water quality control, Chrysotile, Water pollution effects.

A case-controlled, interview-based study of the risk of developing cancer from asbestos in drinking water was conducted. Cases and controls were selected from the Everett, Washington, area which has used the Sultan River as a source of drinking water since 1918. Sultan River tapwater has concentrations of chrysotile asbestos around 200 million fibers/liter. Through a population based tumor registry, 382 individuals with cancer of the buccal cavity, pharynx, respiratory system, digestive system, bladder, or kidneys, diagnosed between 1977 and 1980, were identified. Data on asbestos exposure were collected based on residence and workplace history, and on individual water consumption. Logistic regression was used to estimate cancer risk. Summarizing the findings for imbibed asbestos, very few elevated risks of statistical significance were found. Considering the relative risk for each of the sites and for each of the four asbestos exposure variables, no instance was found in which the risk was elevated for both males and females. The only statistically significant elevated risks occurred for male pharynx and male stomach. (Baker-IVI)
W85-02705

OBSERVATIONS OF CANCER INCIDENCE SURVEILLANCE IN DULUTH, MINNESOTA,
Minnesota Dept. of Health, Minneapolis.
E. E. Sigurdson.
Environmental Health Perspectives, Vol. 53, p 61-67, November, 1983. 5 Tab, 19 Ref.

Descriptors: *Human diseases, *Asbestos, *Drinking water, *Epidemiology, *Duluth, *Minnesota, Water quality control, Water supply, Carcinogens, Amphibole, Public health, Cancer.

Amphibole asbestos fibers were discovered in the municipal water supply for Duluth, Minnesota in 1973. From the late 1950s through 1976 the entire city population of about 100,000 persons was exposed to asbestos at levels of 1-65 million fibers per liter of water. Surveillance of cancer incidence in the area was initiated to determine the health effect from asbestos ingestion. While statistically significant excesses are present in several primary cancer sites in Duluth residents, lung cancer in Duluth females is the only primary site considered also of biological significance. The mesothelioma incidence was no more than expected. Problems of long-term surveillance of exposed populations considered at risk of environmental cancer are defined and the need for improved study methodologies is emphasized. Use of federal records for follow up of exposed individuals is suggested. (Baker-IVI)
W85-02706

EFFECT OF POPULATION DENSITY ON THE RESULTS OF THE STUDY OF WATER SUPPLIES IN FIVE CALIFORNIA COUNTIES,
California Univ., Berkeley. Group in Biostatistics.
P. M. Conforti.
Environmental Health Perspectives, Vol. 53, p. 69-78, November, 1983. 13 Tab, 4 Ref. EPA grant C2455NTET.

Descriptors: *Asbestos, *Population density, *Epidemiology, *San Francisco, *California, *Drinking water, Cancer, Epidemiology, Water pollution effects, Public health, Human diseases, Chrysotile, Carcinogens.

The association between cancer incidence and chrysotile asbestos ingested through drinking water in the San Francisco-Oakland Standard metropolitan Statistical Area (SMSA) was investigated in two previous studies in 1969-1971 and 1969-1974. An important covariable in the association between cancer and environmental agents, population density, was not included in the analyses of these studies. The original and reanalyzed results are compared to reassess the association between cancer and asbestos. The only change in the regression procedures of the original studies was the addition of population density as an independent variable in the reanalysis. The inclusion of population density in the analysis had little effect on the results. Therefore, the conclusion is that a positive association between ingested asbestos and cancer existed in the San Francisco-Oakland SMSA for 1969-1974 for certain cancer sites. The associations observed in these analyses are indirect, the number of cancers is small for the number of body sites studied, and the 35 body sites analyzed were not independent. It is recommended that more research of a direct nature be done regarding digestive cancers and ingested asbestos. (Baker-IVI)
W85-02707

GRAPHICAL ANALYSIS OF THE INTERRELATIONSHIPS AMONG WATERBORNE ASBESTOS, DIGESTIVE SYSTEM CANCER AND POPULATION DENSITY,
California Univ., Berkeley. Dept. of Biomedical and Environmental Health Sciences.
M. E. Tarter, R. C. Cooper, and W. R. Freeman.
Environmental Health Perspectives, Vol. 53, p 79-89, November, 1983. 25 Fig, 24 Ref. NCI grant 1 RO1 CA 28142-01A2, EPA contract 68033130.

Descriptors: *Asbestos, *Population density, *Drinking water, *Cancer, *Epidemiology, San Francisco, California, Statistical studies, Carcinogens, Public health, Human diseases.

Five statistical procedures were used to partial the correlation between waterborne asbestos and digestive site cancer for the putative effects of population density. These include: analysis based on a data subset with roughly homogeneous population density; standard residual analysis (partial correlation); conditional probability integral transformation; analysis based upon ranked data, and use of logarithmic transformation. To examine the nature or shape of the asbestos-cancer dose-response curve, nonparametric regression graphical techniques are applied. There appears to be a considerable difference between analyses involving non-high-density tracts and non-San Francisco tracts. Evidence is also presented that the modal-type nonparametric regression curve forks or bifurcates when adjustment is made for population density. (Baker-IVI)
W85-02708

EPIDEMIOLOGY STUDY OF THE USE OF ASBESTOS-CEMENT PIPE FOR THE DISTRIBUTION OF DRINKING WATER IN ESCAMBIA COUNTY, FLORIDA,
Environmental Protection Agency, Cincinnati, OH. Toxicology and Microbiology Div.
J. R. Millette, G. F. Craun, J. A. Stober, D. F. Kraemer, and H. G. Tousignant.
Environmental Health Perspectives, Vol. 53, p 91-98, November, 1983. 2 Fig, 7 Tab, 15 Ref.

Descriptors: *Asbestos cement, *Pipes, *Drinking water, *Epidemiology, *Escambia County, *Florida, Public health, Human diseases, Cancer, Water pollution effects, Mortality, Asbestos, Carcinogens.

Cancer mortality for the population census tracts of Escambia County, Florida was compared with cancer mortality data collected from census tracts elsewhere within the same county. In the first group asbestos-cement (AC) pipe was used for public potable water distribution. In the second group other types of piping material are used. The differences in standard mortality ratios for seven cancer sites among three potential asbestos exposure groups based on AC pipe usage was tested using an analysis of covariance. Twelve variables representing nonexposure-related influences on disease rates were combined in four independent factors and used as covariates in these analyses. To the level of sensitivity imposed by the limitations of the study no evidence was found for an association between the use of AC pipe for carrying drinking water and deaths due to gastrointestinal and related cancers in Escambia County, Florida. (Baker-IVI)
W85-02709

COMPARING EPIDEMIOLOGIC STUDIES OF INGESTED ASBESTOS FOR USE IN RISK ASSESSMENT,
Environmental Protection Agency, Cincinnati, OH. Environmental Criteria and Assessment Office.
L. S. Erdreich.
Environmental Health Perspectives, Vol. 53, p 99-104, November, 1983. 4 Tab, 16 Ref.

Descriptors: *Risk assessment, *Asbestos, *Drinking water, *Epidemiology, Public health, Cancer, Human diseases, Water quality control, Carcinogens.

Risk assessment studies make use of epidemiologic data in various ways to calculate the dose-response relationship between exposure levels and adverse effects; to establish ranges of exposure known to be safe or unsafe; to verify an endpoint in humans derived from a route or species extrapolation; to support assumptions necessary for performing extrapolation procedures. Cohort studies of inhalation exposure were used to devise the EPA's Ambient Water Quality Criteria (AWQC) for Asbestos. Epidemiological studies of ingested asbestos, all of geographical correlation design, were compared on the basis of their ability to add information in support of both the route extrapolation and low-dose extrapolation used in this risk assessment. (Baker-IVI)
W85-02710

RELATIONSHIPS OF TOTAL COLIFORM, FECAL COLIFORM, AND ORGANIC POLLUTION LEVELS IN THE TAMAGAWA RIVER,
Tokyo Univ. of Fisheries (Japan). Dept. of Food Science and Technology.
A. Hiraishi, K. Saheki, and S. Horie.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 50, No. 6, p 991-997, June, 1984. 4 Fig, 4 Tab, 21 Ref.

Descriptors: *Tamagawa River, *Japan, *Bacteria, *Coliforms, Pollution indicators, Water pollution effects, Fecal coliforms, Biochemical oxygen demand.

The Tamagawa River is typical of the watershed system of freshwater rivers in Japan, and has increasingly received inflow of domestic sewage and industrial waste effluents. The population dynamics of total coliform (TCs) and fecal coliform (FCs) in relation to biochemical oxygen demand (BOD) levels in this river system are described. Particular importance is placed on the multiplication of the indicator bacteria in heavily polluted river environments. The levels of the indicator bacteria and BOD markedly increased from the upper streams towards the lower reaches of this river system. There were statistically significant positive correlations among TCs, FCs, and BOD. Also the FC/TC ratios were highly correlated with BOD. The proportion of thermotolerant coliforms and Escherichia coli constituting the TC population increased with increasing BOD levels, whereas the relative concentration of E. coli to the FC population decreased with increasing BOD levels. These results suggest that the population densities of FCs or thermotolerant coliforms in the river environment are directly proportional to the degree of sewage and human waste pollution, which is reflected by BOD levels, but their occurrence in polluted river and estuary waters is due in part to regrowth of some FC members such as Klebsiella pneumoniae. (Baker-IVI)
W85-02717

METAL-BINDING PROTEINS AND ACTIVITY OF ALKALINE PHOSPHATASE IN THE OYSTER CRASSOSTREA GIGAS IN ANTHROPOGENICALLY POLLUTED ENVIRONMENT (METALLSVYAZYVAYUSHCHIE BELKI I AKTIVOST' SHCHELOCHNOI FOSFATAZY V GIGANTSKOI USTRITSE, OBITAYUSHCHEI V USLOVIYAKH ANTROPOGENNOGO ZAGRYAZNENIYA),
Akademiya Nauk SSSR, Vladivostok. Inst. Biologii Morya.
Z. S. Evtushenko, N. K. Khristoforova, and O. N. Lukyanova.
Marine Biology (USSR Acad. of Sciences), No. 3, p 66-71, 1984. 2 Fig, 2 Tab, 10 Ref.

Descriptors: *Water pollution effects, *Oysters, *Metals, *Enzymes, Zinc, Copper, Cadmium, Proteins.

The nature of the binding of zinc, copper and cadmium with cytoplasmic proteins by the hepatopancreas of the oyster Crassostrea gigas dwelling under conditions of anthropogenic pollution was studied. The proteins were chromatographed on Sephadex G-75. Zinc was bound with high and low-molecular proteins; metallothionein-like proteins were not discovered. A decrease was noted in the activity of alkaline phosphatase in the hepatopancreas and gonads of oyster inhabiting Skrebtsov Island in comparison with the activity of the enzyme from the same organs of oyster dwelling on Popov Island. (Author's abstract)
W85-02719

EFFECT OF MERCURIC CHLORIDE ON SOME BIOCHEMICAL AND PHYSIOLOGICAL PARAMETERS OF THE FRESHWATER MURREL, CHANNA PUNCTATUS,
D.A.V. Coll., Muzaffarnager (India). Dept. of Zoology.
K. V. Sastry, and D. R. Rao.
Environmental Research, Vol. 34, p 343-350, 1984. 4 Tab, 42 Ref.

Descriptors: *Mercuric chloride, *Toxicity, *Water pollution effects, *Murrel, Mercury compounds, Enzymes, Heavy metals, Fish.

The freshwater murrel, Channa punctatus, was exposed to a sublethal concentration of mercuric chloride at 3 micro g/liter of water for 120 days. An insignificant decrease was noted in the body weight of control as well as mercuric chloride-exposed fish afer 120 days. Blood glucose and lactic acid levels fell significantly in mercury-exposed fish. No marked change was noted in glycogen content of liver and muscles. The concentration of lactic acid in liver was unaltered but in muscles the lactic acid level decreased significantly. There was a significant decrease in the rate of absorption of glucose by the intestine of fish exposed to mercury in comparison to control fish. Of the different enzymes examined, G-6-Pase activity was decreased in all five tissues examined. Hexokinase activity in all six tissues of mercury-exposed fish was lower than in control fish, but the d crease was significant only in intestine, kidney, a liver. Dehydrogenases LDH, PDH, SDH, a MDH were decreased significantly in all the tiss examined except LDH in brain and MDH kidney where an insignificant decrease and an significant increase, respectively, were record GDH activity increased in all tissues except g where a significant decrease was noted. AO acti ty showed a significant decrease in gills and m cles but in the remaining tissues the enzyme acti ty increased. An increase in XO activity was no in brain, gills, and kidney, but no marked alterati was recorded in other tissues. (Baker-IVI)
W85-02727

EFFECTS OF DICHLOBENIL AND ATRAZIN TO THE POPULATION DENSITY OF ZO PLANKTON IN AN AQUATIC OUTDOO SYSTEM (WIRKUNG VON DICHLOBEN UND ATRAZIN AUF DIE POPULATION DICHTE VON ZOOPLANKTERN IN EINE AQUATISCHEN FREILANDSYSTEM),
Gesellschaft fuer Strahlen- und Umweltforschu m.b.H. Muenchen, Neuherberg (Germany, F.R
L. Peichl, J. P. Lay, and F. Korte.
Zeitschrift fur Wasser und Abwasser Forschun Vol. 17, No. 4, p 134-145, August, 1984. 12 Fig, Tab, 12 Ref.

Descriptors: *Zooplankton, *Population dynamic *Water pollution effects, *Herbicides, Atrazin Dichlobenil, Organic compounds, Agricultur chemicals.

A long term outdoor study was made in compar ments of an experimental pond concerning t effects of two herbicides, atrazine and dichloben on the population density of selected zooplankte including rotifers, crustaceans, and insect larva The experiment consisted of a three week preapp cation period and a nineteen week postapplicatio period. The chemically induced effects were stati tically evaluated compared to controls. The max mum concentrations of atrazine and dichloben detected in the water were 200 micrograms and 4 mg per liter. Most of the taxa investigated showe significant changes in their population densiti following chemical treatment which can be bett referred to as secondary effects because of the late occurrence. A direct correlation of these fin ings to toxicity data from short term lab tests coul not be found. (Author's abstract)
W85-02739

ARYLSULPHATASE ACTIVITY IN POLLUT ED LAKE SEDIMENTS,
National Water Research Inst., Burlington (Onta io).
J. O. Nriagu, and Y. K. Soon.
Environmental Pollution (Series B) Vol. 8, No. 2 p 143-153, 1984. 3 Fig, 2 Tab, 33 Ref.

Descriptors: *Lake sediments, *Water pollution ef fects, *Enzymes, *Arylsulfatase, Sulfur, Organi matter, Sediments, Lakes, Great Lakes.

Arylsulfatase activities have been determined in wide variety of lake sediments to see whether the provide any clues on past changes in lake acidit or sediment quality. The variation in arylsulfatas activity with depth of sediments is depicted for th Great Lakes and for the soft-water lakes of north ern Ontario. In general, the activity decreased rapidly with depth in the top 10 cm. The arylsulfa tase activity was also determined in five agricultur al soils from southern Ontario. In these soils, th activities ranged from 0.56 to 0.71 micromol o substrate released per gram of soil per hour and ar very similar to those of the surface sediment of th Great Lakes and Turkey Lake. The variations i arylsulfatase activity did not parallel those of or ganic carbon in the sediment, with the possible exception of Lake Ontario sediments. No apparent relationship between the sulfur content and the enzyme activity could be demonstrated. (Baker-IVI)
W85-02745

ADMIUM TOXICITY AND ACCUMULATION
Y TETRAHYMENA PYRIFORMIS IN CON-
AMINATED RIVER WATERS,
ege Univ. (Belgium). Dept. of Botany.
Berhin, C. Houba, and J. Remacle.
nvironmental Pollution (Series A), Vol. 35, No.
p 315-329, 1984. 6 Fig, 2 Tab, 25 Ref.

escriptors: *Cadmium, *Toxicity, *Rivers, leavy metals, *Tetrahymena, Metals, Water pol-tion effects, Protozoa, Carbon, Dissolved solids.

wo methods were used to study the responses of trahymena pyriformis to cadmium added to er waters. One depends on the ciliate's growth te, the other is evaluated from the uptake of dmium by the cell. In the first test, the supply of coli as food could change the characteristics of er waters. It is clear that the level of toxicity is ntrolled particularly by dissolved carbon con-nt. A comparison of the river waters studied ing this test would infer that the less toxic river ould be the one which is in reality the most lluted of those sampled because of its organic d and heavy metals concentrations. In the cond test, the river water is not modified except the addition of cadmium and there is no food pply. The level of accumulation is governed by ny physico-chemical parameters which depend the initial cadmium concentration. Moreover, hen killed by 500 micro cadmium/liter, T. pyri-rmis appeared to adsorb cadmium like an inert rticle and accumulated more than living cells. hese cadmium loaded cells would settle on the ttom of a river and become another source of dmium contamination. It is therefore difficult to t values that might be used as reference limits for ality control in rivers, especially as river charac-ristics depend much more on the sampling time an on the sampling site. (Baker-IVI)
85-02748

OMPARISON OF GROWTH, POPULATION
TRUCTURE, AND FOOD OF THE CREEK
HUB SEMOTILUS ATROMACULATUS IN
NDISTURBED AND SURFACE-MINING-DIS-
URBED STREAMS IN TENNESSEE,
ience Applications, Inc., Oak Ridge, TN.
. M. Stair, V. R. Tolbert, and G. L. Vaughan.
nvironmental Pollution (Series A), Vol. 35, No.
p 331-343, 1984. 2 Fig, 1 Tab, 29 Ref. DE
ntract ET-72-S-05-4946 and Union Carbide
rp. contract W-7405-eng-26.

escriptors: *Mining wastes, *Water pollution ef-cts, *Streams, *Chubs, *Tennessee, Population ynamics, Environmental effects, Bioindicators, ish, Growth, Fish food.

opulations of the creek chub Semotilus atromacu-tus were examined to determine the effects of rface mining on growth, population structure d food. The extent of changes in population ructure and diet of creek chubs correspond to the ttent and duration of mining disturbance and sub-quent habitat alterations. These results, coupled ith examination of water-quality changes over me following the termination of mining activity, an be used to determine the long-term effects and me needed for fish populations to recover from ining related disturbances. Once factors that ffect fish populations are identified using tolerant pecies measures can be taken during mining and eclamation processes to minimize both long term nd short term impacts to aquatic communities. Baker-IVI)
85-02749

OXICITY OF FLUCYTHRINATE TO GAM-
MARUS LACUSTRIS (AMPHIPODA), PTER-
ONARCYS DORSATA (PLECOPTERA) AND
RACHYCENTRUS AMERICANUS (TRICHOP-
ERA): IMPORTANCE OF EXPOSURE DURA-
ION,
Environmental Research Lab.-Duluth, MN.
. L. Anderson, and P. Shubat.
Environmental Pollution (Series A), Vol. 35, No.
p 353-365, 1984. 2 Fig, 2 Tab, 12 Ref.

Descriptors: *Toxicity, *Invertebrates, *Insecti-ides, *Flucythrinate, Organic compounds, Pyr-ethroids, Water pollution effects, Crustacea, Aquatic insects, Pesticide toxicity.

The effect of synthetic pyrethroid flucythrinate on three non-target aquatic invertebrates was evaluated using continual and short-time exposure methods. Both methods show toxic action at measured concentrations of less than 0.100 micro g/liter. The use of both approaches pointed toward the importance of exposure time in hazard assessment. The results of the continuous exposure experiments showed that Grammarus, Pteronarcys and Brachycentrus are sensitive to low concentrations of the pesticide and that each species responded differently to the length of exposure and exposure concentration. All animals were quickly immobilized at concentrations which ultimately resulted in death for many of the continually exposed, immobilized animals. The Gammarus were the most sensitive followed by Pteronarcys and Brachycentrus. In all cases of continuous exposure, the LC50 decreased with increased exposure time. Exposures for a short time followed by an extended observation period in insecticide free water show that a lethal exposure can occur in less time than estimated from continually exposed animals. (Baker-IVI)
W85-02750

ACUTE TOXICITY OF SELECTED SUBSTI-
TUTED PHENOLS, BENZENES AND BENZO-
IC ACID ESTERS TO FATHEAD MINNOWS
PIMEPHALES PROMELAS,
Environmental Research Lab.-Duluth, MN.
G. W. Holcombe, G. L. Phipps, M. L. Knuth, and T. Felhaber.
Environmental Pollution (Series A), Vol. 35, No. 4, p 367-381, 1984. 4 Tab, 17 Ref.

Descriptors: *Water pollution effects, *Fish, *Phenols, *Benzenes, *Benzoic acid esters, *Toxicity, Organic compounds, Fathead minnows, Trout, Catfish, Snails.

Flow-through acute toxicity tests were conducted with 24 organic compounds using fathead minnows Pimephales promelas as test organisms. The tested toxicants consisted of 11 substituted phenols, four substituted benzenes and nine esters. Ethyl salicylate and phenyl salicylate concentrations of 25.9 and 3.44 mg/liter respectively, killed less than 50% of the exposed snails, and the LC50 values for these compounds are greater than the highest exposure concentrations used. Fish sensitivity differences were small for the two substituted phenols, one substituted benzene and the three esters tested with more than one species. Rainbow trout were slightly more than twice as sensitive to 2,3,4,5-tetrachlorophenol than fathead minnows. Channel catfish were about 1.1 times less sensitive than fathead minnows to 2-ethoxyethylacetate, phenyl salicylate and 1,4-dinitrobenzene. Catfish were about 1.3 and 2.7 times more sensitive than fathead minnows to ethyl salicylate and 4-nitrophenol, respectively. In all snail tests the snails were less sensitive than either fathead minnows or channel catfish. Nonylphenol and methyl-4-chloro-2-nitrobenzoate produced hemorrhaged areas in fathead minnows, and methyl-4-chloro-2-nitrobenzoate, 2-allylphenol, 4-t-butylphenol, 4-t-pentylphenol and naphthalene caused slight to severe cases of snail deformities. Some loss of equilibrium was noted in fathead minnows exposed to toxicant concentrations below the 96 hr LC50 values with 4-phenylazophenol, 4-choro-3-methylphenol, nonylphenol, nitrobenzene, 1-chloro-3-nitrobenzene, naphthalene, methyl-4-chlorobenzoate, methyl-4-chloro-2-nitrobenzoate and methyl-2,5-dichlorobenzoate. (Baker-IVI)
W85-02751

POLLUTION INDICATOR SPECIES OF MA-
CROBENTHOS IN A COASTAL LAGOON,
Rutgers - The State Univ., Piscataway, NJ. Dept. of Biological Sciences.
R. E. Grizzle.
Marine Ecology - Progress Series, Vol. 18, No. 3, p 191-200, 1984. 4 Fig, 3 Tab, 36 Ref.

Descriptors: *Indicator species, *Lagoons, *Sykes Creeks, *Banana River, *Florida, *Macrobenthos, Bioindicators, Species composition, Dissolved oxygen, Water temperature, Water pollution effects, Wastewater pollution.

Life history differences and effects of physicochemical changes on macrobenthos of coastal lagoons were studied for 2 yr at one site in the sewage-polluted, moderately enriched Sykes Creek and a comparison site in the less-polluted Banana River, Florida, USA. Monthly and bi-monthly quantitative sediment samples for faunal analyses were taken from the natural substratum, and recolonization of defaunated sediments set out at 4 different times in 1 yr was monitored concurrently. The top 4 numerical dominants in natural substratum samples from Sykes Creek, i.e. the indicator species, were: Corophium ellisi, Haploscoloplos foliosus, Capitella capitata, Anomalocardia auberiana. Based on recolonization experiments all 4 were identified as opportunistic. However, the top 2 numerical dominants in the Creek (C. ellisi, H. foliosus) also relied on their abilities to exploit food and/or space. Banana River benthos contained a greater relative abundance of equilibrium species and fewer opportunistic species compared to Sykes Creek, suggesting that there has been a shift toward a life history strategy of opportunism in the enriched area. With a lag shift of 2 mo, dissolved oxygen and temperature from the Creek were strongly correlated with macrobenthic density. Also, drastic declines involving most species present were observed in early summer in 1978 and 1979 coinciding (no 2-mo lag) with oxygen/temperature extremes of < 2.5 mg/L and 29 C. These data suggest that the pollution indicator species were as intolerant of oxygen/temperature extremes as non-indicator species. Thus, the numerical dominance of the indicator species in shallow water and sand sediments in Sykes Creek can likely be explained by some combination of superior abilities related to quick invasion and exploitation of food and/or space, competitive interactions could be important. Further concurrent testing of hypotheses is needed. Investigation of the indicator concept was posed as one of the best ways to determine the effects of organic pollution on benthos. (Author's abstract)
W85-02757

ACCUMULATION AND TOXICITY OF CD, ZN,
AG, AND HG IN FOUR MARINE PHYTO-
PLANKTERS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
N. S. Fisher, M. Bohe, and J.-L. Teyssie.
Marine Ecology - Progress Series, Vol. 18, No. 3, p 201-213, 1984. 9 Fig, 6 Tab, 48 Ref.

Descriptors: *Cadmium, *Zinc, *Silver, *Mercury, *Bioaccumulation, *Toxicity, *Trace metals, Diatoms, Chlorophyta, Coccolithophora, Cyanophyta, Adsorption, Water pollution effects, Path of pollutants.

Accumulation and toxicity of Cd, Zn, Ag, and Hg were measured in the diatom Thalassiosira pseudonana, the chlorophyte Dunaliella tertiolecta, the coccolithophore Emiliania huxleyi, and the cyanophyte Oscillatoria woronichinii. Bioaccumulation of the metals was measured over a wide (up to 10 to the 5th power) range of metal concentrations, using gamma-emitting radioiostopes of each metal. Metal content of cells was related to total external metal concentration in all cases, in accordance with Freundlich adsorption isotherms. Dead cells accumulated metals comparably to living cells, indicating that the initial association of metal with the cell is governed by adsorption. Volume/volume concentration factors computed at equilibrium ranged from 300 for Cd in T. pseudonana to 95,000 for Hg in E. huxleyi. Metal toxicity, as measured by depression of cell division rate, could generally be described as an exponential function of the log of the external (or cellular) metal concentration, consistent with the concept of cell thresholds of safe metal accommodation. Regression analyses of the data were used to calculate EC sub 50 and EC sub 0 metal concentrations for each alga/metal combination. The general order of accumulation and metal toxicity vs. external metal concentration was Hg $>$ Ag $>$ Zn $>$ or $=$ Cd. Expressed on a cellular metal basis, Hg was usually

the most toxic, but there was no clear trend for the other metals for all species. Upon normalizing cellular metal data on the basis of cellular weight, volume, and surface area, interspecific comparisons revealed that these algal species can have markedly different surface affinities for metals and that cellular EC50 values ranged from 0.000079 M for Hg in O. woronichinii cells to 0.2 M for Zn in D. tertiolecta cells. The most resistant species to Zn, Ag and Hg was D. tertiolecta. Enhanced metal tolerance in D. tertiolecta was partly attributable to metal exclusion, however these cells were able to tolerate cellular metal concentrations of up to 10 (Zn) or 100 (Ag and Hg) times those in other species. Since the toxicity of any metal was correlated with its concentration factor in a given cell, these data may provide a basis for predicting the toxicity of other metals to algae from metal concentration factors in the cells. (Author's abstract)
W85-02758

USE OF POLYCHAETE FEEDING GUILDS AS BIOLOGICAL VARIABLES,
Old Dominion Univ., Norfolk, VA. Dept. of Biological Sciences.
D. M. Dauer.
Marine Pollution Bulletin, Vol. 15, No. 8, p 301-305, August, 1984. 2 Fig, 2 Tab, 21 Ref. A.C.O.E. contract DACW 65-81-R-0009.

Descriptors: *Polychaetes, *Feeding guilds, *Ecological distribution, *Chesapeake Bay, Ecological effects, Annelids, Macrobenthos, Estuarine environment.

Macrofaunal components of the marine benthic community are often quantified to indicate environmental health; the use of guilds as the primary biological variables is a new approach to data reduction. Feeding guilds presumably form functional groups that have predictable environmental distributions with utility in predicting or identifying impacts. Densities of polychaete species from three studies in the lower Chesapeake Bay were classified into feeding guilds and correlated with water depth, median phi size and percent silt-clay of the sediment. Polychaete densities were also grouped randomly and correlated with environmental variables. For two of the three studies a feeding guild classification did not give significantly more correlations than expected from random groupings. The present polychaete feeding guilds are too broad in definition to be useful for estuarine systems; many polychaete families contain more than one guild and deciding which guild to use for a particular species may be arbitrary. (Collier-IVI)
W85-02763

OXYGEN DEMAND AND LONG TERM CHANGES OF PROFUNDAL ZOOBENTHOS,
Copenhagen Univ., Hilleroed (Denmark). Det Ferskvands-Biologiske Lab.
P. M. Jonasson.
Hydrobiologia, Vol. 115, p 121-126, August, 1984. 5 Fig, 11 Ref.

Descriptors: *Benthos, *Oxygen demand, *Ecological effects, *Lake Esrom, *Denmark, *Dissolved oxygen, Midges, Oligochaetes, Annelids, Sulfur, Metabolism.

Uptake of oxygen by the zoobenthos of Lake Esrom, Denmark, was investigated using data from 1953 to 1973 in an effort to determine the effect of the declining oxygen content in the hypolimnion and its effect upon the dynamics and composition of the profundal zoobenthos. The profundal zoobenthos consists mostly of monocultures of Chironomus anthracinus, Potamothrix hammoniensis, Chaoborus flovicans, and Procladius pectinatus and also consists of Pisidium casertanum, Pisidium subtruncatum and Pisidium henslowanum. Between 1930 and 1970, the oxygen depletion period increased from 1 week to 3 months. The Psidia are seriously affected by the oxygen decline because their respiration declines rapidly at two critical limits, 30 and 15% air saturation. Their numbers declined in 1971-73 to one tenth of the numbers recorded in 1955-57. C. anthracinus had no decline in respiration from 100 to 24% air saturation; a decline occurred between 24 and 2.5% air saturation. This species is extremely well adapted to low oxygen tensions, which was shown by its importance in the profundal community. Potamothrix hammonienis survives the oxygen free conditions better than C. anthracinusdue possibly due to the lower metabolism of the former species and the fact that oligochaetes lower their respiration rate in mixed populations. Another reason might be a different sulfer metabolism between oligochaetes and chironomids. (Collier-IVI)
W85-02770

OLIGOCHAETE COMMUNITIES AS BIOLOGICAL DESCRIPTORS OF POLLUTION IN THE FINE SEDIMENTS OF RIVERS,
Centre National de Machinisme Agricole du Genie Rural, des Eaux et des Forets, Lyon (France). Lab. d'Hydrobiologie.
M. Lafont.
Hydrobiologia, Vol. 115, p 127-129, August, 1984. 2 Tab, 14 Ref.

Descriptors: *France, *Ecological distribution, *Sediments, *Oligochaetes, Bioindicators, Water quality, Water pollution effects, Annelids.

Oligochaeta communities are useful as descriptors of pollution in the fine sediments of large rivers. Forty sampling sites situated in rivers of the East of France were studied to determine the relationship between water quality and Oligochaeta species distribution. Of the most abundant species in the polluted fine sediments, six species are known to be pollution tolerant and five are not known to be (in large rivers). Consequently, the number of resistant Oligochaeta is probably much greater than generally believed. Two indices of biological quality of fine bottoms - pollution impact and a biological parameter - were defined and used for an empirical classification of polluted fine sediments. (Collier-IVI)
W85-02771

LETHAL AND SUBLETHAL TOLERANCES OF AQUATIC OLIGOCHAETES WITH REFERENCE TO THEIR USE AS A BIOTIC INDEX OF POLLUTION,
E.V.S. Consultants Ltd., North Vancouver (British Columbia).
P. M. Chapman, and R. O. Brinkhurst.
Hydrobiologia, Vol. 115, p 139-144, August, 1984. 2 Fig, 4 Tab, 11 Ref.

Descriptors: *Oligochaetes, *Bioindicators, *Ecological effects, Water pollution effects, Pollution index, Toxicity.

A series of recent studies have been completed by the authors involving: 1) determining the lethal tolerances of 12 oligochaete species classified (from ecological studies) as tolerant, moderately tolerant and intolerant to selected chemical toxicants and environmental factors under defined bioassay conditions with and without sediment; 2) determining lethal tolerances of candidate species to toxicants in combination with a range of abiotic factors; 3) measuring respiratory stress imposed by exposure to individual and combined sublethal concentrations of toxicants and environmental factors; and, 4) determining differences in lethal tolerance and respiratory stress between individual and mixed species. Surprisingly few previous studies have been done in this area considering the importance of oligochaetes as field pollution indicators. The results of the above major studies coupled with histopathological work are reviewed. Data from these studies substantiate the present use of oligochaete species assemblages as indicators of organic pollution and suggest their use in the laboratory for toxicant screening tests. The range of responses of different oligochaete species to individual and combined stress is complex, particularly in mixed species, which provides useful indications of specific stress factors. The application of these experimental laboratory studies to field situations is described. (Author's abstract)
W85-02773

COMPARISON OF DIFFERENT METHODS OF WATER QUALITY EVALUATION BY MEANS OF OLIGOCHAETES,
Akademiya Nauk SSSR, Leningrad. Inst. Ozerov deniya.
T. D. Slepukhina.
Hydrobiologia, Vol. 115, p 183-186, August, 198 2 Tab, 18 Ref.

Descriptors: *Lake Ladoga, *Russia, *River Su hona, *North Caucasus, *Oligochaetes, *Bioindic tors, *Water quality, Lakes, Population densit Species diversity, Tubificids, Aquatic anima Water pollution effects.

The oligochaetes are the group of invertabrat most often enlisted for bioindication purposes, b cause their mass development is enhanced in plac of strong organic contamination. In Lake Ladog on some stations subjected to human influenc accumulation of oligochaetes, particularly Tubif tubifex, Limnodrilus hoffmeisteri, or Potamothr hammoniensis, at total population densities of 4,0 ind./sq m has been observed. In the River Sukho the density of Limnodrilus udekemianus and tubifex exceeds 5,000 ind./sq m, reaching a ma mum of 22,000 and a biomass of 475 g/sq m. hoffmeisteri was present in smaller amounts. In t most contaminated pools of 147 pools studied North Caucasus, near the inflow of runoff fro farms, the number of oligochaetes fluctuated average between 6,000 and 8,000/sq m, with maximum value of 31,800. Only the following sp cies were present: L. hoffmeisteri, Limnodrilus he veticus, T. tubifex, P. hammoniensis and Psammo yctides albicola. There is no unique univers method of pollution bioindication. In water bodi of all types the mass development of oligochaet and the reduction of their species diversity a indications of: (1) large quantities of organi matter; (2) favorable oxygen regime; (3) absence insignificant quantities of heavy metal solids, petr leum substances and agricultural chemicals; (4) i tensive self-purification of the water body by t ingestion of sediment by the oligochaetes. (Collie IVI)
W85-02775

TOXICITY OF THE HERBICIDES ENDOTH ALL AND DIQUAT TO BENTHIC CRUSTA CEA,
Hamilton Coll., Clinton, NY. Dept. of Biolog
E. H. Williams, E. L. Mather, and S. M. Carter.
Bulletin of Environmental Contamination an Toxicology, Vol. 33, No. 4, p 418-422, Octobe 1984. 1 Fig, 20 Ref.

Descriptors: *Herbicides, *Toxicity, *Benthic en vironment, *Crustacea, Endothall, Diquat, Wate pollution effects, Aquatic weed control.

Endothall and diquat are herbicides commonly ap plied in lakes to control macrophytes. Endotha and diquat were tested with a flow-through proto col designed to approximate field conditions t determine possible toxicity to benthic crustacea The highest mortality observed for both Hyalell azteca and Asellus communis was 10% at 120 h Dipotassium endothall has a negligible effect o the representative benthic macroinvertebrates Once applied, endothall normally disappears fro the water after 10 to 12 days, with slow initia degradation followed by rapid breakdown. Th small effects of endothall seem to be restricted t the dipotassium and disodium salts. Mortality i diquat differs significantly from that in endothall Results are in agreement with earlier studies tha indicated crustacea to be highly susceptible t diquat. (Baker-IVI)
W85-02778

EFFECTS OF REDUCED PH ON THREE LIFE STAGES OF SUNAPEE CHAR SALVELINUS ALPINUS,
Maine Univ. at Orono. Dept. of Zoology.
C. H. Jagoe, T. A. Haines, and F. W. Kircheis.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 4, p 430-438, October 1984. 4 Tab, 27 Ref.

Descriptors: *Acidity, *Water quality, *Toxicity *Char, Water pollution effects, Hydrogen ion con centration, Growth stages, Mortality, Fish eggs

our experimental pH levels were tested: 4, 4.5, 5, nd 5.5. Sac fry exposed to pH 4 water rapidly ecame hyperactive. One fry died within 1 hr and ore than half were dead after a 17 hr exposure. t pH 4.5 mortalities were first noted after 117 hr f exposure. No mortality was noted at pH 5 or .5. Egg mortality was noted during the first 10 hr not be related to hydrogen ion concentration. alculated LC50s for exposures of 96 and 192 hr nd for an indefinite period differed among life ages. There was lttle difference among the repli- ates for a given stage. Yearlings were the most esistant of the three groups to acid stress, and eggs ie most sensitive. (Baker-IVI)
V85-02780

NFLUENCE OF ANIONIC SURFACE-ACTIVE GENTS ON THE UPTAKE OF HEAVY IETALS BY WATER HYACINTH (EICHHOR- IA CRASSIPES),
kayama Univ., Kurashiki (Japan). Inst. for Agri- ultural and Biological Sciences.
. Muramoto, and Y. Oki.
ulletin of Environmental Contamination and oxicology, Vol. 33, No. 4, p 444-450, October, 984. 4 Fig, 3 Tab, 14 Ref.

escriptors: *Detergents, *Water pollution effects, Heavy metals, *Water hyacinths, Lakes, Ponds, ndustrial wastes, Nutrients, Aquatic plants, Cad- ium, Nickel.

ifteen groups of water hyacinths were prepared. ix were kept in cadmium or nickel alone at con- entrations of 1.0, 4.0, 8.0 ppm of cadmium or ickel. Six groups were kept with each metal plus 5 ppm of sodium dodecyl sulfate. One group ontained metal mixed anionic detergents, Cd 1.0 pm + Ni 1.0 ppm + SDS 25 ppm. One group ontained SDS 25 ppm alone and there was one ontrol group. No effects of SDS on the increasing atio of root length were indicated within 25 ppm DS in water, but significant decreases were ob- erved for concentrations of SDS above 30 ppm. n both Cd and Ni metal alone groups, the weight f whole plants was decreased with an increase in ie concentration of metals in water compared vith those at the beginning of the experiments. In ie Cd plus SDS, and Ni plus SDS group, no articular effects on the plant growth were noted. he uptake of cadmium in plants was higher in oot than those in metal plus SDS group. The resence of SDS decreased Cd concentrations in lants at various concentrations of cadmium. The bsorption of nickel by water hyacinth was slightly ower compared with that of cadmium. Addition f SDS to nickel containing water did not signifi- antly increase the absorption of nickel. (Baker- VI)
V85-02781

FFECTS OF PUGET SOUND SEDIMENTS ND THEIR ELUTRIATES ON THE LIFE YCLE OF CAPITELLA CAPITATA,
E.V.S. Consultants Ltd., North Vancouver (British Columbia).
. M. Chapman, and R. Fink.
ulletin of Environmental Contamination and oxicology, Vol. 33, No. 4, p 451-459, October, 984. 3 Tab, 13 Ref.

escriptors: *Sediments, *Puget Sound, *Wash- ngton, *Water pollution effects, *Polychaetes, An- elids, Toxicity, Marine sediments.

he survival of all life stages, abnormalities, rowth rate, and time from trochophore larvae to eproduction was examined for Capitella capitata xposed to sediments from Puget Sound, Washing- on. Despite high initial mortalities in some sam- les, C. capitata was able to complete its life cycle n all sediments. The ability to survive and repro- luce in contaminated sediments may be partly due o this species' opportunistic nature, which in- ludes the ability to increase populations rapidly lespite high larval mortalities. All tested sediments were able to cause death, and affect growth and eproduction. (Baker-IVI)
W85-02782

DIFFERENTIAL RESPONSE OF MARINE ORGANISMS TO CERTAIN METAL AND AGRICHEMICAL POLLUTANTS,
Toledo Univ., OH. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W85-02783

DISTRIBUTION OF FENITROTHION RESIDUES IN BROOK TROUT (SALVELINUS FONTINALIS) AND LAKE TROUT (SALVELINUS NAMAYCUSH) TISSUES FOLLOWING AERIAL APPICATIONS TO LAC STE-ANNE, QUEBEC,
Forest Pest Management Inst., Sault Sainte Marie (Ontario).
S. B. Holmes, P. D. Kingsbury, G. Mamarbachi, and P. Mathieu.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 4, p 468-475. October, 1984. 2 Tab, 17 Ref.

Descriptors: *Insecticides, *Toxicity, *Water pollution effects, *Trout, *Fenitrothion, *Lac Ste-Anne, *Quebec, Pesticide residues, Lakes, Organic compounds, Bioaccumulation.

The accumulation and partitioning of fenitrothion residues among different tissues and organs in wild trout were followed after an operational application of this insecticide to a lake. Lac Ste-Anne is a 142 ha oligotrophic lake located at an elevation of 366 m in the Chic Choc Mountains of the Gaspe Peninsula, Quebec, Canada. Fenitrothion was applied as an oil formulation at a dosage of 280 g active ingredient/ha in a total volume of 0.84 L/ha. Fenitrothion rapidly dispersed throughout the lake. One hr after treatment, residues in the north basin were concentrated near the surface, but had already penetrated to the bottom in small amounts. A total of 27 lake trout and 12 brook trout were collected for insecticide residue analysis. All post-spray tissue samples contained measurable levels of fenitrothion. Residues in fat, muscle, intestine and ovaries gradually increased to peak levels 4 days after first application of 280.0, 96.8, 96.3, and 48.2 ng/g, respectively. Residues in the liver peaked 16.1 ng/g 2 days after the first application, but were still almost as high 4 days after treatment. The highest level of fenitrothion was 665.0 ng/g in the visceral fat of lake trout. Fenitrothion residues in the muscle of brook trout peaked at 107 ng/g 2 days after application. (Baker-IVI)
W85-02784

RESPONSES OF PHYTOPLANKTON TO EXPERIMENTAL NUTRIENT ENRICHMENT IN AN AMAZON FLOODPLAIN LAKE,
California Univ., Santa Barbara. Dept. of Biological Sciences.
F. V. Setaro, and J. M. Melack.
Limnology and Oceanography, Vol. 29, No. 5, p 972-984, September, 1984. 6 Fig, 5 Tab, 24 Ref.
NSF grants DEB78-23642 and DEB81-11398.

Descriptors: *Phytoplankton, *Lake Calado, *Brazil, *Nitrogen, *Phosphorus, *Nutrients, *Algal growth, Water pollution effects, Floodplains, Seasonal variation, Chlorophyll, Primary productivity.

The relative importance to phytoplankton of nitrogen and phosphorus supply in Amazonian floodplain lakes was investigated in Lake Calado using two complementary approaches over the full range of conditions during a year. While fertilization with phosphate consistently caused increases in chlorophyll and particulate carbon and nitrogen concentrations during the period of rising water, enrichments with ammonium or nitrate elicited mixed responses. From late March through mid-April, samples enriched with nitrogen produced more chlorophyll and particulate nitrogen and carbon than the controls but never more than those augmented with phosphorus. In May, controls and samples fertilized with nitrogen were similar, influenced by the considerable ammonium and nitrate in the epilimnion at this time. Although samples fertilized simultaneously with nitrogen and phosphorus produced more algae than controls, their responses relative to phosphorus additions were inconsistent. A major shift in responses to enrichment with N and P occurred between September and October. In September both N and P stimulated algal growth. In early October, ammonium clearly enhanced algal productivity and abundance, and phosphate enrichment was ineffective. During a period with relatively high nitrate and ammonium concentrations in late October, enrichment with N or P effected no increase in algal biomass. Response to N or P enrichment appears to be different during high and low water in Lake Calado. (Baker-IVI)
W85-02785

PHOTOSYNTHESIS OF SUBMERSED MACROPHYTES IN ACIDIFIED LAKES. I. CARBON FLUXES AND RECYCLING OF CO2 IN JUNCUS BULBOSUS L.,
Uppsala Univ. (Sweden). Limnologiska Institutionen.
For primary bibliographic entry see Field 2H.
W85-02794

EFFECT OF PESTICIDES ON PHOTOSYNTHESIS AND RESPIRATION OF MARINE MACROPHYTES,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
S. Ramachandran, N. Rajendran, R. Nandakumar, and V. K. Venugopalan.
Aquatic Botany, Vol. 19, No. 3-4, p 395-399, September, 1984. 2 Tab, 18 Ref.

Descriptors: *Pesticides, *Water pollution effects, *Macrophytes, Phytotoxicity, Organic compounds, Sevin, DDT, Lindane, Dimethoate, Methyl parathion, Endosulfan, Agricultural chemicals, Marine plants.

The effects of a low concentration (50 ppb) of six commonly used pesticides, p,p'-DDT, endosulfan, lindane, methyl parathion, dimethoate, and sevin, on the net photosynthesis and dark respiration activities of six prominent marine macrophytes were examined. Macrophytes showed differential responses in their activities to different pesticides. Organochlorine pesticides inhibited photosynthesis and respiration to a greater extent than organophosphorus and carbamate compounds. Among the organochlorine pesticides, DDT reduced photosynthesis significantly in three of the six macrophytes studied. Endosulfan was apparently less toxic at this concentration to all six macrophytes. Lindane reduced photosynthesis and respiration in E. intestinalis to levels below 50% and photosynthesis in Halodule univervis to levels below 70%. Dimethoate and methyl parathion affected the halophytes H. uninervis more than the other macrophytes. The carbamate pesticide sevin exerted no significant effect on photosynthesis, but increased respiration in four of the six macrophytes. The pesticides DDT and lindane exerted a more toxic effect to the macrophytes than the other pesticides. These pesticides are persistent and can cause acute toxicity. (Baker-IVI)
W85-02795

INFLUENCE OF LOW CONCENTRATIONS OF CADMIUM, COPPER AND ZINC ON PHYTOPLANKTON OF NATURAL WATER SAMPLES,
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
K. Wolter, U. Rabsch, P. Krischker, and A. G. Davies.
Marine Ecology, Progress Series, Vol. 19, No. 1 and 2, p 167-173, August, 1984. 7 Fig, 18 Ref.

Descriptors: *Heavy metals, *Phytoplankton, *Water pollution effects, Cadmium, Copper, Zinc.

Water samples from different areas were investigated after addition of varying concentrations of heavy metals, zinc, cadmium, and copper. Accumulation of metals by phytoplankton was measured, using the radioisotopes Cd-109, Zn-65, and Cu-64. The influence of metal on the carbon fixation rate of phytoplankton and on glucose incorporation by bacteria was determined. Metal accumulation by the phytoplankton examined was higher at low Cd concentrations and the enrichment

factor (EF) values are related to biovolume concentration in water. In most cases, accumulation was accompanied by a measureable loss in phytoplankton activity. No saturation was reached at concentrations up to 50 micro g/l. EF values were higher at concentrations below 10 micro g/l. This was due to the metabolism of the organisms tested. Cells were affected at higher Cd concentrations so that their activity decreased and active accumulation of Cd stopped. Further uptake of Cd at higher concentrations was due to passive accumulation. Corresponding data of metal content per chlorophyll a unit for the point when accumulation changes are compared for different samples. (Baker-IVI)
W85-02803

SUSCEPTIBILITY OF ENVIRONMENTALLY IMPORTANT HETEROCYCLES TO CHEMICAL DISINFECTION: REACTIONS WITH AQUEOUS CHLORINE, CHLORINE DIOXIDE, AND CHLORAMINE,
Minnesota Univ.-Duluth. Dept. of Chemistry.
S. Lin, and R. M. Carlson.
Environmental Science and Technology, Vol. 18, No. 10, p 743-748, October, 1984. 7 Fig, 2 Tab, 61 Ref. EPA grants R807455 and R809695.

Descriptors: *Disinfection, *Chloramines, *Chlorine dioxide, *Chlorine, *Water pollution effects, Water pollution sources, Chemical reactions, Chlorination, Water treatment, Disinfection.

Eighteen environmentally significant heterocycles were subjected to dilute aqueous solutions of chlorine, chlorine dioxide, and chloramine to examine those chemical transformations anticipated during water renovation. Reactions with hypochlorous acid/hypochlorite generate products that incorporate chlorine as well as introduced oxygen into the molecule. Chlorine dioxide gave predominantly oxygenation products. The reactions involving chloramines proceed at such a very slow rate relative to chlorine dioxide or hypochlorous acid/hypochlorite that significant amounts of reaction products from hetero-PAH should not be observed during normal water disinfection processes. Where the pH may be lowered to about 5, a significant increase in product formation should be anticipated. An aqueous reaction medium has a significant impact on the nature of the products. For example, dimerization products often seen in the oxidation of indole, 2-phenylindole, and N-phenylpyrrole in organic solvents were not detected in this study. Some of the products of chemical disinfection of hetero-PAH have adverse biological activity. This observation may offset the positive effect of eliminating some of the hetero-PAH which themselves are reported to possess possible mutagenic properties. (Baker-IVI)
W85-02804

SUBSTRATE-MEDIATED RESPONSE OF STREAM INVERTEBRATES TO DISTURBANCE,
Georgia Univ., Athens. Dept. of Entomology.
M. E. Gurtz, and J. B. Wallace.
Ecology, Vol. 65, No. 5, p 1556-1569, October, 1984. 6 Fig, 4 Tab, 69 Ref.

Descriptors: *Invertebrates, *Streams, *Clear-cutting, *Appalachian Mountains, Forest management, Logging, Moss, Stability, Land use, Management.

The response of aquatic invertebrates to a major watershed disturbance, clear-cutting, was examined in a second-order stream in the southern Appalachian Mountains. For 21 months after the start of logging, invertebrates were sampled in four substrate types: rock face, cobble riffles, pebble riffles, and sand. Clear-cutting of a watershed is a large-scale, low-frequency, anthropogenic disturbance that has no precise natural analog with respect to its effects on a stream ecosystem. The response of invertebrates to such disturbances is mediated by substrate, which suggests that substrate should be an important consideration in the design and interpretation of ecological studies of streams. In the stream that drained the clear-cut watershed more taxa increased in density in moss-covered rock face than in any other substrate. Cobble riffles were next, followed by pebble riffles and sand. Conversely, the number of taxa with significant reductions in density was highest for sand substrates, followed by pebble, cobble, and rock face. Predictive models of stream response to disturbance should take into consideration these substrate-associated factors. Logging practices that minimize sediment inputs and streamside canopy alteration could reduce the effects on the invertebrate communities. (Baker-IVI)
W85-02818

HEAVY METALS AND HIGH PUP MORTALITY IN THE SAIMAA RINGED SEAL POPULATION IN EASTERN FINLAND,
Joensuu Univ. (Finland). Dept. of Biology.
H. Hyvarinen, and T. Sipila.
Marine Pollution Bulletin, Vol. 15, No. 9, p 335-337, September, 1984. 2 Fig, 1 Tab, 12 Ref.

Descriptors: *Seals, *Heavy metals, *Finland, *Lake Saimaa, *Water pollution effects, Nickel, Mercury, Cadmium, Lead, Chromium, Hair.

Hair nickel, mercury, cadmium, lead and chromium concentrations were measured in still-born ringed seal pups and from other ringed seal groups from Lake Saimaa in Finland. Nickel concentration was significantly higher in the hair samples of still-born pups as compared to live-born pups and to adult seals. There was assumed to be some connection between the stillbirth of the pups and nickel concentration of the hair. Mercury concentration of the natal hair of pups was significantly higher than the mercury concentration of the first adult hair, but no clear connection between still birth and mercury pollution was noted. No differences were noted in cadium, lead and chromium concentrations of the hair of still-born and other ringed seal groups. The source of nickel in the Lake Saimaa is still unclear, but there is a considerable amount of industry in the area. It is also noted that the high nickel concentration in the hair of still-born pups may also be a consequence of some metabolic disturbance, which could be the main factor in the background of still-births. (Baker-IVI)
W85-02839

IN VITRO STUDY OF THE EFFECTS OF ZINC ON OSMOREGULATORY PROCESSES,
Barcelona Univ. (Spain). Facultat de Biologia.
S. Crespo.
Marine Pollution Bulletin, Vol. 15, No. 9, p 341-342, 1984. 2 Fig, 1 Tab, 18 Ref.

Descriptors: *Fish, *Water pollution effects, *Osmoregulatory processes, *Zinc, Heavy metals, Killifish, Toxicity.

In an attempt to relate electrophysiological parameters, short-circuit current, potential difference and transmural resistance to morphological changes caused by zinc to the opercular epithelium of the killifish, the short-circuited opercular epithelium of seawater adapted killifish, Fundulus heteroclitus, was studied following addition of zinc to both serosal and mucosal sides of the preparation. Zn inhibited the short-circuit current which is a direct measure of the chloride transport across the epithelium. Light microscope observations showed that the mucosal side of the epithelium was completely desquamated after 1 hr exposure to Zn. It is suggested that desquamation of gill epithelia described by several authors following in vivo Zn contamination is a direct consequence of the breakdown of osmoregulatory processes. (Baker-IVI)
W85-02840

MORPHOMETRIC FEATURES OF THE ROACH, RUTILUS RUTILUS, OF IVAN'KOVSKOYE RESERVOIR IN THE ZONE AFFECTED BY WARM WASTE WATERS,
Vserossiiskii Nauchno-Issledovatel'skii Inst. Prudovogo Rybnogo Khozyaistva, Konakovo (USSR). Upper Volga Dept.
V. V. Filon.
Journal of Ichthyology, Vol. 20, No. 3, p 50-57, 1980. 4 Tab, 19 Ref. Translated from Voprossy Ikhtiologii, Vol. 20, No. 3, 1980.

Descriptors: *Fish, *Reservoirs, *Thermal poll tion, *Powerplants, Thermal water, Water poll tion effects.

A morphometric description is given of the ad roach, Rutilus rutilus, which inhabits areas of d ferent thermal regimes in the reservoir. These gimes include the zone influenced by the wa waste waters of the regional power station and t zone with normal reservoir conditions. Wa waters have a positive influence on the exter indices of the roach. The improvement in feedi conditions was conducive to an increase in bo depth and predorsal distance and to a decrease snout length. In the roach, meristic characte have not changed appreciably. Differences in t fin size of roach underyearlings from these se tions, accounted for by their existence under co ditions of different flow velocity, are retained adult fish. In Kremenchug Reservoir conditions existence of the roach are more favorable than Ivan'kovskoye Reservoir. A comparison of t Kremenchug roach with the roach from the zo of heated waters produced fewer differing chars ters than a comparison between the Kremenchu roach and the roach from the control section Ivan'koyskoye Reservoir. The number of elemen in the meristic characters of the roach from Iva kovskoye Reservoir is greater than in the mo southerly bodies of water; this corresponds to t general pattern of geographic variability in mer tic characters. (Baker-IVI)
W85-02846

TOXIC EFFECT OF MERCURY ON SALMO LARVAL, ONCORHYNCHUS KETA AND KISUTCH,
All-Union Research Inst. of Marine Fisheries a Oceanography, Moscow (USSR).
S. A. Petukhov, and N. G. Storozhuk.
Journal of Ichthyology, Vol. 20, No. 6, p 138-14 1980. 1 Fig, 3 Tab, 9 Ref. Voprossy Ikhtiolog Vol. 20, No. 6, 1980.

Descriptors: *Water pollution effects, *Salmo *Larvae, *Mercury, *Toxicity, Population dynam ics, Reproduction, Mortality, Heavy metals.

Chum salmon and coho salmon eggs were obtain at the stage of commencement of organogenes Following acclimation for 2 days, eggs we placed in batches of 500 on frames and incubat in 1 l of water at a constant 8 C. Coho eggs we incubated in mercuric chloride solutions for days. An experiment with larvae lasted 140 da Chum embryos were placed in the same mercur chloride solutions after hatching and were used the experiment for 90 days. Mortality of the chu occurred during the first 40 days of exposure; was 15% in the variant in which the concentrati of the toxicant was 1 micro g/l, 13% at 5 micro g and 30% at 25 micro g/l, 12% in the control. Ma mortality of coho larvae was noted from beginni to end of hatching and was 12% in the variants which the concentration of the toxicant was micro g/l, 11% at 5 and 25 micro g/l, and 3% the control. Consequently, the coho was mo tolerant of mercury. An appreciable percenta mortality of larvae of this species was noted mercury concentrations of 25 micro g/l. It is su gested that when fish develop from the stage embryogenesis under conditions of an increase content of toxicants of the heavy metal group t most resistant individuals survive. A reduction the concentration of biologically active metals w noted in salmon larvae reared in an environme with an increased concentration of mercur (Baker-IVI)
W85-02848

INFLUENCE OF MERCURY ACCUMULATIO ON FISH,
Kaspiiskii Nauchno-Issledovatel'skii Inst. Rybnog Kozyaistava, Makhachkala (USSR).
V. K. Dokholyan, A. M. Akhmedov, T. P. Akhmedova, and G. S. Shleyfer.
Journal of Ichthyology, Vol. 21, No. 3, p 103-11 1981. 6 Fig, 4 Tab, 17 Ref. Translated from Vo prossy Ikhtiologii, Vol. 21, No. 3, 1981.

Descriptors: *Water pollution effects, *Fish, *Mercury, *Accumulation, Population dynamics, Fish populations.

Questions of the accumulation and distribution of mercury in the organs and tissues of different species of fish were examined in relation to the influence of mercury on survival, physiological and biochemical indices of the blood and brain. In the sturgeon and the roach, mercury accumulates primarily in the kidneys, liver, spleen and gills. The uneven distribution is evidently due to differentiation and differences in the degree of intensity of the metabolic processes of the cells in the organs and tissues, and the physico-chemical mechanism of the interaction of mercury with the biological structure is also important. There are substantial changes in the composition of the blood as a result of intoxication. In the sturgeon and roach a drop is noted in erythrocytes, hemoglobin and leukocytes and qualitative changes in the red blood cells also occur. Deviations were also noted in the correlation of individual forms of leukocytes. These changes are evidently provoked both by the direct presence of mercury in the blood stream and by its disruption of the functions of the hematopoetic organs. Mecury poisoning leads to disruption of the nitrogen metabolism of the brain of the fish. With the accumulation of mercury in fish to a certain critical level, the metabolic processes are inhibited or altered and the defense functions of the blood are weakened. (Baker-IVI)
W85-02849

EFFECT OF MERCURY ON THE RESPIRATION RATE OF LARVAL PINK SALMON, ONCORHYNCHUS GORBUSCHA,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
N. G. Storozhuk, and B. P. Smirnov.
Journal of Ichthyology, Vol. 22, No. 5, p 168-171, 1982. 2 Fig, 9 Ref. Translated from Voprossy Ikhtiologii, Vol. 22, No. 5, 1982.

Descriptors: *Salmon, *Mercury, *Respiration, *Toxicity, Water pollution effects, Metabolism, Larvae, Fish eggs, Heavy metals.

The eggs of pink salmon were obtained at the beginning of organogenesis. After 2 day acclimatization, 500 eggs were placed in incubation frames in one liter water at 8 C. Eggs were incubated in mercury solution for 300 days and larvae were used experimentally for 150 days. The experiments on the eggs and larvae were carried out with two replications using 300 eggs or larvae for each treatment. The toxicant concentration in the experimental aquaria were 1.0 and 25.0 g Hg/liter. Oxygen consumption by pink salmon larvae in mercury concentrations of 25 micro g/liter was sharply decreased even on the 4th day after hatching, and the oxygen consumption by the experimental fishes was half at the time of changeover to active feeding in comparison to the control. Mercury content in the body of the experimental fishes reached 4.0 micro g/g of fresh weight. Overall findings showed an inhibition of the metabolic processes in young pink salmon when kept in a medium with high mercury content. This can be a result of replacement of copper, iron, and zinc by mercury in the metal containing enzymes. The minimum mercury concentration in pink salmon larvae causing a harmful metabolic effect is 1 micro g/g of live weight which is achieved by maintaining the larvae for 60 days in the medium with the toxicant concentration of 1 micro g/liter. This concentration should be considered harmful for the species. (Baker-IVI)
W85-02853

EFFECT OF PESTICIDES ON RUSSIAN STURGEON, ACIPENSER GUELDENSTAEDTI (ACIPENSERIDAE), IN THE EMBRYONIC-LARVAL PERIOD,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
L. S. Tikhonova, and I. A. Shekhanova.
Journal of Ichthyology, Vol. 22, No. 5, p 172-175, 1982. 1 Fig, 2 Tab, 3 Ref. Translated from Voprosy Ikhtiologii, Vol. 22, No. 5, p 172-175, 1982.

Descriptors: *Water pollution effects, *Sturgeon, *Carbamate pesticides, *Ordram, *Embryonic growth stage, *Larval growth stage, Growth stages, Toxicity, Bioassays, Gastrulation.

Embryos and larvae of Russian sturgeon, Acipenser gueldenstaedti, were used in an assay of the toxicity of the carbamate pesticide, Ordram. Ordram is used widely in rice fields for weed control. The observations on the dynamics of mortality of the sturgeon embryos throughout the period of their development pointed to gastrulation as the most sensitive stage to carbamates, since most of the embryos died in this period. At the age of 130 h, the control embryos reached the developmental stage XXXIV, in which the embryo extracted from the shell was completely straight and slowly moving. The embryos kept in a 5.0 mg/l Ordram solution were at developmental stage XXXII; embryos extracted from the shells were still not fully straight, and the head section was much smaller. Apparently, the process of morphogenesis stops under the action of Ordram ultimately leading to an increase in the duration of incubation of the eggs or the hatching of undeveloped and deformed embryos. The resistance of the sturgeon embryos and larvae against carbamates decreases in the process of development. Considering the low resistance of sturgeon in the embryonic-larval period, it is particularly important to protect the spawning grounds from pollution. The threshold concentration of Ordram during the embryonic-larval period is 0.005 mg/liter, and the minumum lethal concentration is 0.5 mg/liter. (Collier-IVI)
W85-02854

ACID PRECIPITATION IN THE COLORADO FRONT RANGE: AN OVERVIEW WITH TIME PREDICTIONS FOR SIGNIFICANT EFFECTS,
Colorado Univ. at Boulder. Dept. of Environmental, Population, and Organismic Biology.
For primary bibliographic entry see Field 2K.
W85-02856

INFLUENCE OF WATER TABLE AND ATMOSPHERIC CO2 CONCENTRATION ON THE CARBON BALANCE OF ARCTIC TUNDRA,
Clemson Univ., SC. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2G.
W85-02857

BIOCONCENTRATION POTENTIAL OF POLYDIMETHYLSILOXANE (PDMS) FLUIDS BY FISH,
Gifu Prefecture Research Inst. for Environmental Pollution, Yabuta (Japan).
N. Watanabe, T. Nakamura, and E. Watanabe.
Science of the Total Environment, Vol. 38, p 167-172, 1984. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Biological magnification, *Organic compounds, *Fish, *Polydimethylsiloxane, Water pollution effects, Fish populations, Toxicity.

The water solubilities (S), octanol/water partition coefficients (Kow) and bioconcentration factors (BCF) of four commercial grade polydimethylsiloxane (PDMS) fluids covering a wide range of molecular weights were measured. Silver carp were housed in an aquarium whose water was circulated through a PDMS fluid-coated glass bead column for one week prior to the introduction of the fish. Four fish samples were taken for PDMS analysis at hours 0 and 72. Circulation flow rate was maintained at 3.5 ml/min for 72 hr of accumulation study. The results indicate that a previously described correlation between S and Kow for organic chemicals may be invalid for PDMS fluids; an alternative correlation is proposed. Some PDMS fluids tend to have a bioconcentration potential in silver carp. (Baker-IVI)
W85-02865

SOVIET-AMERICAN COOPERATION IN THE FIELD OF PROTECTING WATER FROM POLLUTION,
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 6E.
W85-02882

XENOBIOTIC PERTURBATION OF MICROBIAL GROWTH AS MEASURED BY CO2 UPTAKE, IN AQUATIC HETEROTROPHIC BACTERIA,
Columbia National Fisheries Research Lab., MO.
For primary bibliographic entry see Field 5A.
W85-02885

CANCER IN WILD FRESHWATER FISH POPULATIONS WITH EMPHASIS ON THE GREAT LAKES,
Columbia National Fisheries Research Lab., MO.
For primary bibliographic entry see Field 5A.
W85-02886

BRAIN ACETYLCHOLINESTERASE AND BACKBONE COLLAGEN IN FISH INTOXICATED WITH ORGANOPHOSPHATE PESTICIDES,
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
V. I. Kozlovskaya, and F. L. Mayer, Jr.
Journal of Great Lakes Research, Vol. 10, No. 3, p 261-266, 1984. 4 Fig, 3 Tab, 32 Ref.

Descriptors: *Fish, *Water pollution effects, *Pesticide toxicity, *Organophosphates, Phosphates, Toxicity, Acetylcholinesterase, Collagen, Toxicity.

Diminished levels of brain cholinesterase have been observed at all exposures of fish to organophosphate pesticides including acute, sublethal, and intermittent sublethal exposures. Recovery to preexposure levels appears to be slow, although external symptoms of intoxication disappear relatively more quickly. Excluding acute nonspecific stress situations, brain acetylcholinesterase activity can be expected to decrease by 75 to 90% prior to mass mortality of exposed populations. Organophosphate compounds possess accumulative effect. Periodic intermittent exposure to sublethal concentrations over time may produce results similar to acute exposures. In this situation, the death of fish is observed at a total dose which is significantly less than the minimum lethal concentration. Chronic exposure to organophosphate pesticides may alter fish growth without causing mortality. (Baker-IVI)
W85-02888

AVOIDANCE OF SUBLETHAL DOSES OF COPPER AND ZINC BY TUBIFICID OLIGOCHAETES,
Toronto Univ. (Ontario). Dept. of Zoology.
M. J. McMurtry.
Journal of Great Lakes Research, Vol. 10, No. 3, p 267-272, 1984. 2 Tab, 27 Ref.

Descriptors: *Benthos, *Heavy metals, *Sediments, *Tubificids, *Oligochaetes, *Toronto Harbor, *Lake Ontario, Water pollution effects, Zinc, Copper, Toxicity, Behavior.

Worms and sediment were collected in February and March of 1981 from Keating Channel in Toronto Harbor, Lake Ontario. Sublethal doses of copper sulfate and zinc sulfate were added singly and together to cores of the sediment populated by Tubifex tubifex and Limnodrilus hoffmeisteri. The result of the experiment demonstrates an avoidance response to sediment containing sublethal concentrations of copper or zinc. There is no evidence that the effects of copper and zinc are additive. The mean number of worms colonizing islands from epicenters treated with copper and zinc is higher than for either copper or zinc treatments, but the difference is not significant. Extrapolation of the result to natural communities is limited by a lack of information on the dispersive capabilities of tubificids. While they can avoid unsuitable conditions in a very small area, the scale of their dispersive capability may not be equal to or greater than the scale of polluted patches in the field. Tubificids can tolerate far higher concentrations of metals in sediment than metals in water. This experiment

offers one way in which avoidance testing can be adapted for sediment dwelling invertebrates. (Baker-IVI)
W85-02889

EVALUATION OF THE TOXICITY OF SODIUM PENTACHLOROPHENATE, PENTACHLOROPHENOL AND PHENOL TO THE SNAIL VIVIPARUS BENGALENSIS (L.),
Roorkee Univ. (India). Dept. of Zoology.
P. K. Gupta, and V. S. Durve.
Archiv fur Hydrobiologie, Vol. 101, No. 3, p 469-475, September, 1984. 3 Tab, 24 Ref.

Descriptors: *Phenols, *Snails, *Toxicity, *Sodium pentachlorophenate, *Pentachlorophenol, *Bioassay, Lethal concentration, Water pollution effects, Invertebrates, Mollusks.

The freshwater pondsnail Viviparus bengalensis L. were exposed to various concentrations of sodium pentachlorophenate, pentachlorophenol and phenol to evaluate their toxic effects by static bioassay tests. The 96 hr median lethal concentrations (Lc50s) and their 95% confidence limits worked out on the basis of snail mortality percentage were in mg/l 0.720 (0.590-0.878) of NaPCP, 0.840 (0.712-0.991) of PCP and 69.0 (51.11-93.15) of phenol. Their relative potencies suggested that NaPCP was the most toxic and the phenol the least toxic among the three chemicals. (Author's abstract)
W85-02898

REACTIONS OF CHLORINE DIOXIDE WITH AQUATIC ORGANIC MATERIALS AND THEIR HEALTH EFFECTS,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
C. Rav-Acha.
Water Research, Vol. 18, No. 11, p 1329-1341, 1984. 10 Fig, 1 Tab, 92 Ref.

Descriptors: *Disinfectants, *Cholorine dioxide, *Chlorination, *Toxicity *Chemical reactions, Water pollution effects, Trihalomethanes, Humic acids, Fulvic acids, Aldehydes, Carboxylic acids, Quinones.

One of the most promising of alternatives to water chlorination is treatment with chlorine dioxide which does not lead to the formation of trihalomethanes (THM). Chlorine dioxide reacts primarily as a one-electron acceptor, in contrast to chlorine which acts via a variety of electrophilic, oxidative, and radical pathways. Consequently, the reactions of ClO2 are much more selective and specific than those of chlorine. Chlorine seems to be more efficient for the general removal of aquatic organics (TOC); if the primary consideration is to avoid the formation of harmful by-products, then ClO2 may be the disinfectant of choice. One of the major weaknesses of ClO2 is that upon reaction with aquatic organics, abour 50% of it is converted to chlorite. The more desirable water treatment should include physical processes to reduce the organic content prior to disinfection. The principle organic by-products formed by ClO2 in drinking water would probably be quinones and hydroquinones produced by the reaction of ClO2 with aquatic humic and fulvic acids. This is in addition to low molecular weight aldehydes and carboxylic acids. Although most of the aldehydes (with the exception of formaldehyde and alpha-keto-aldehydes) and carboxylic acids are generally considered to be non-toxic, some quinones and hydroquinones have recently been found to possess negative biological activities (Trevors, J.T. and J. Bursuraba, 1980. Bull. Environ. Contam. Toxic., Vol. 25, p 672-675). (Collier-IVI)
W85-02904

EVALUATION OF THE POTENTIAL TOXICITY OF TREATED BLEACHED KRAFT MILL EFFLUENT TO STRIPED BASS (MORONE SAXATILIS WALBAUM) LARVAE EXPOSED THROUGH METAMORPHOSIS TO THE JUVENILE STAGE,
Johns Hopkins Univ., Shady Side, MD. Aquatic Ecology Section.
D. T. Burton, R. J. Klauda, L. W. Hall Jr., and, M. A. Jepson.
Water Research, Vol. 18, No. 11, p 1365-1376, 1984. 5 Fig, 8 Tab, 43 Ref.

Descriptors: *Kraft Mills, *Effluents, *Bass, *Life cycles, *Toxicity, Pulp and paper industry, Bioassay, Biological oxygen demand, Suspended solids, Color, Water pollution effects.

Twenty-day-old striped bass (Morone saxatilis) larvae were exposed to a range of treated bleached kraft mill effluent (BKME) concentrations from 0 to 20% effluent by volume (v/v) under continuous flow test conditions. The experimental test concentrations in the 2-20% BKME test aquaria had a BOD5 which ranged from < 1 to 5 mg/l, TSS 12-17 mg/l and true color 35-416 mg/l. Bleached kraft mill effluent did not kill larvae exposed to it for 20 days through metamorphosis to the juvenile stage. The BKME did not alter growth in length, weight or condition factor in larvae over the 20-day exposure period as determined by multiple regression analysis. A linear regression analysis on the dry weight data at Day 20 only, however, indicated a trend of decreasing weight with increasing BKME concentration. Effluent-exposed larvae also developed normally during the 20-day study. All individuals examined completed the transformation from postlarvae to juveniles by the age of 40 days. (Author's abstract)
W85-02908

DYNAMICS OF MERCURY AND CADMIUM UPTAKE INTO DIFFERENT ORGANS OF ANODONTA CYGNEA L.,
Balatoni Limnologiai Kutato Intezete, Tihany (Hungary).
K. V.-Balogh, and J. Salanki.
Water Research, Vol. 18, No. 11, p 1381-1387, 1984. 6 Fig, 1 Tab, 28 Ref.

Descriptors: *Mercury, *Cadmium, *Mussels, *Bioaccumulation, Trace metals, Gills, Kidney, Adductor muscles, Animal physiology, Water pollution effects.

The bioaccumulation of Hg and Cd into various organs of the freshwater mussel Anodonta cygnea was investigated during an 840 h experimental period. Parallel with the metal concentrations the periodicity of activity and the body weight of the animals were also checked. The accumulation of Hg in all of the investigated organs, and that of the Cd into the kidney have two phases: up to 24 h it was non linear; between 24 and 72 h it became linear in most organs up to 840 h, and could be characterized by a regression line. For Hg accumulation the gills were exceptions and for Cd accumulation the kidney and viscera were exceptions; saturation was observed after 504 and 672 h, respectively. The speed of Hg and Cd uptake was different in various organs of Anodonta cygnea. Accumulation into the kidney of Hg was six times faster than of Cd. As compared to the adductor muscles the Hg and Cd uptake of the kidney was 20 and 10 times faster, respectively. The factor of concentration in all organs except adductor muscles was over 1000; in case of the kidney, the rate of bioconcentration for Hg reached nearly 100,000. The dry weight of organs dropped the metal uptake by 20-60%, but no mortality was observed up to 840 h. In the presence of Hg and Cd the filtering activity of the mussels became reduced as a result of increase of inactive rest periods. Nevertheless, the decrease of activity did not prevent the linear uptake of metals into animal. (Author's abstract)
W85-02910

BACTERIOPLANKTON IN AN URBAN RIVER: THE EFFECTS OF A METAL-BEARING TRIBUTARY,
Hull Univ. (England). Dept. of Plant Biology.
C. R. Milner, and R. Goulder.
Water Research, Vol. 18, No. 11, p 1395-1399, 1984. 3 Tab, 29 Ref.

Descriptors: *Bacteria, *Trace metals, *Water pollution effects, *River Aire, *West Yorkshire, *England, Copper, Zinc, Lead, Cadmium, Riv
Path of pollutants.

Concentrations of total Cu, Zn, Pb and Cd in
River Aire, West Yorkshire, were elevated clos
the confluence of a metal-bearing tributary
rapidly decreased over 500 m downstream. He
otrophic activity of bacterioplankton appeared
be inhibited adjacent to the confluence, but c
centrations of total bacteria, colony-forming u
and chromogenic colony-forming units were
depressed. Bacterial variables were not (negati
ly) correlated with metals (except heterotrop
activity with Cu) but correlations were found
tween bacteria and other environmental variab
Hence bacterioplankton was probably control
by environmental variables other than metals or
nating from the tributary. (Author's abstract)
W85-02912

MORPHOLOGICAL CHANGES IN THE GI OF CARP (CYPRINUS CARPIO L.) EXPOS TO ACUTELY TOXIC CONCENTRATIONS METHYL BROMIDE,
Agricultural Univ., Wageningen (Netherland
Dept. of Toxicology.
J. H. L. Segers, J. H. M. Temmink, J. H. L. Van Den Berg, and R. C. C. Wegman.
Water Research, Vol. 18, No. 11, p 1437-144
1984. 10 Fig, 1 Tab, 13 Ref.

Descriptors: *Carp, *Water pollution effec
*Methyl bromide, *Toxicity, *Gills, Fish physiol
gy, Bromides, Halogenated pesticides, Pesticid

The acute toxicity of methyl bromide (CH3Br)
carp (Cyprinus carpio L.) was determined in e
periments with a 4 h exposure period. The 4
LC50 was calculated at approximately 17 mg/l, i
the order of magnitude of actually encounter
peak concentrations in surface water. The conce
tration-effect curve was found to be very steep a
the response was somewhat delayed. Morpholog
cal damage to the gill epithelium, indicative
alkylation of cell membranes, was the most pr
nounced effect of CH3Br. It consisted of initi
swelling of the lymphatic space and vacuolizatio
of the epithelial cells, followed by disintegration
the epithelium and invasion of leukocytes. Dea
of the fish was probably caused by suffocatio
(Author's abstract)
W85-02916

ACUTE TOXICITY OF CHROME ELECTRO PLATING WASTES TO MICROORGANISMS ADSORPTION OF CHROMATE AND CHRO MIUM (VI) ON A MIXTURE OF CLAY AN SAND,
Aligarh Muslim Univ. (India). Environmental R
search Lab.
M. Ajmal, A. A. Nomani, and A. Ahmad.
Water, Air and Soil Pollution, Vol. 23, No. 2, 119-127, August, 1984. 1 Fig, 5 Tab, 15 Ref.

Descriptors: *Chromate, *Chromium, *Adsorp
tion, *Toxicity, *Clay, *Bacteria, *India, Electro
plating, Heavy metals, Water pollution effects
Wastewater treatment, Industrial wastewater, Su
fates, Chlorides, Silica, Nitrogen, Phosphorus, A
kalinity, Biochemical oxygen demand, Chemica
oxygen demand, Hydrogen ion concentration
Conductivity, Calcium carbonate, Osmotic pres
sure.

The toxicity of chrome electroplating wastes t
microorganisms was investigated and an inexpen
sive method for removal of chromate and chrom
(VI) from the effluents was developed. Chrom
electroplating wastes were collected from two in
dustrial plants in India. The wastes were found t
be rich in sulfate, chloride, silica, N, P, chromate
and Cr(VI). The wastes were alkaline in nature an
had low levels of dissolved oxygen and low BOD
and COD. In cultures using sucrose substrate as
carbon source (in 300 mL BOD bottles) 0.5 mL o
the wastes showed weak toxic effects in repressing
the BOD of the system. Pronounced repression o
the activity of saprophytic bacteria started with 2
mL of waste and increased with an increasing
volume of waste. All microbial activity was retard-

d with 12 mL of waste. Inhibition of nitrifying acteria activity was only observed when 15 mL f the waste had been added. Nitrifying bacteria an mildly tolerate effects of wastes as compared the saprophytic bacteria. Clay-sand mixtures ere used as adsorbents for chromate and chromi-n (VI); mixtures high in clay content were suita-e for the removal of Cr from the wastes. The ay was characterized by pH 7.9 to 8.0, electrical onductivity 0.000350 to 0.00040 mhos/cm, osmot- pressure 0.79 to 0.82, calcium carbonate 8.14 to 0.7% and organic matter 0.84 to 0.86%. Its high ation exchange capacity and strong binding force ake the clay a good adsorbent for chromate and r(VI). The column filled with pure clay adsorbed early 95.6 to 96% chromate and 99 to 99.2% r(VI). (Collier-IVI)
'85-02921

OXICITY AND BINDING OF COPPER, ZINC, ND CADMIUM BY THE BLUE-GREEN LGA, CHROOCOCCUS PARIS,
lassachusetts Univ., Amherst. Dept. of Environ-ental Sciences.
. Les, and R. W. Walker.
'ater, Air, and Soil Pollution, Vol. 23, No. 2, p 9-139, August, 1984. 9 Fig, 35 Ref.

escriptors: *Toxicity, *Binding, *Bioaccumula-on, *Copper, *Zinc, *Cadmium, *Cyanophyta, Chroococcus, *Algae, Trace metals, Adsorption, ydrogen ion concentration, Water pollution ef-cts.

he toxic effects and accumulation of the heavy etals, Cd, Cu, and Zn by the sheath forming blue-reen alga Chroococcus paris were investigated. ll three of the metals were bound rapidly. Ap-roximately 90% of the total amount of the added etal was bound within 1 min. Further significant nding occurred at a slower rate. The maximum etal binding capacity, as determined by filtration udies, was determined to be 53, 120, and 65 mg/g y algal weight for Cd, Cu, and Zn, respectively. nding curves for the metals followed the Lang-uir adsorption isotherm model. The amount of etal bound increased with increasing pH. Metal nding increased significantly when pH was in-eased from 4 to 7. Nearly all of the metal was und to be rapidly EDTA extractable. Metals ere found to be increasingly toxic to growing ltures in the order, Zn, Cd, and Cu. All of the etals studied exhibited toxic effects at concentra-ons greater than 1.0 mg/L. The lowest concen-ations used which showed detectable toxicity ere 0.1 mg/L for Cu and > 0.4 mg/L for Cd and n. (Authors' abstract)
'85-02922

IOACCUMULATION AND TISSUE DISTRI-UTION OF MERCURY - HGCL2 AND H3HGCL - IN SALMO GAIRDNERI AFTER IRECT CONTAMINATION (BIOACCUMULA-ION ET REPARTITION TISSULAIRE DU IERCURE - HGCL2 ET CH3HGCL - CHEZ ALMO GAIRDNERI APRES CONTAMINA-ION PAR VOIE DIRECTE),
ordeaux-1 Univ., Talence (France). Lab. d'Ecolo-e Fondamentale et d'Ecotoxicologie.
. Ribeyre, and A. Boudou.
'ater, Air, and Soil Pollution, Vol. 23, No. 2, p 9-186, August, 1984. 9 Fig, 4 Tab, 7 Ref.

escriptors: *Bioaccumulation, *Tissue distribu-on, *Mercury, *Trout, *Direct contamination, ish, Heavy metals, Water pollution effects, Tissue nalysis.

almo gairdneri specimens were directly contami-ated with mercury compounds (HgCl2 and H3HgCl) for 30 days. The kinetics of mercury ccumulation in the whole fish following direct ntamination was characterized by a sigmoid rve; both the mercury concentrations and mer-ry contents showed this tendancy. During the perimental period the weight of the fish did not hange significantly. Mercury accumulation in the sh was much greater when methylmercury was ed (6 times greater after 30 days exposure). After xposure to HgCl2, the muscle and the gills con-ined no less than 55% of total mercury in the fish. After exposure to methylmercury these organs contained 60% of total mercury. The blood, the liver, and the kidneys also showed a high mercury accumulation. The phenomena observed during the experimental period were influenced by two processes: the first called 'cumulative' characterized by an increase in the rate of mercury accumulation and the second one 'limitative', characterized by a progressive slowing of mercury accumulation. The comparative analysis of results obtained during direct contamination and the following decontamination period in Salmo gairdneri should permit a better understanding of bioaccumulation processes. Those organs showing a fast ratio of decontamination (donor organs) had a sigmoid profile during contamination phase. Those organs whose mercury content is increased during the decontamination period (receiver organs) showed an exponential type accumulation curve during contamination. Results obtained during trophic contamination are very different from those obtained during direct exposure, especially in the case of HgCl2 which crosses the intestinal epithelium with difficulty. (Collier-IVI)
W85-02925

WATER FLEA (DAPHNIA MAGNA) AS A SENSITIVE INDICATOR FOR THE ASSESSMENT OF TOXICITY OF SYNTHETIC DETERGENTS,
Industrial Toxicology Research Centre, Lucknow (India).
H. Lai, V. Misra, P. N. Viswanathan, and C. R. K. Murti.
Ecotoxicology and Environmental Safety, Vol. 8, No. 5, p 447-450, October, 1984. 1 Fig, 1 Tab, 22 Ref.

Descriptors: *Daphnia, *Toxicity, *Bioassay, *Detergents, Crustaceans, Bioindicators, Animal behavior, Behavior, Water pollution effects.

Daphnia may serve as a suitable toxic indicator for determining potential hazards to aquatic biota. Daphnia magna was used as a sensitive indicator for assessing the toxicity of synthetic detergents. Acute and chronic toxicity of detergents to the water flea was studied under laboratory conditions by following the median tolerance limit (TLM) at 48 hr and the rate of survival. The rate of reproduction decreased significantly; as compared to controls, the numbers of ecdyses were 35%, the hatches were 78%, and the neonates produced were 92%. The TLM at 48 hr was 0.013 ppm. The rate of survival decreases when increasing the concentration with time in a dose-dependent response. During the acute toxicity studies, behavioral changes were also noticed. The filter feeding behavior of daphnia may be affected on chronic exposure to detergents; the retardation in the rate of filter feeding behavior may one of the reasons for the sensitivity as well as for the decrease in the rate of reproduction of daphnia. (Collier-IVI)
W85-02943

FATE AND BIOLOGICAL EFFECTS OF METHYL PARATHION IN OUTDOOR PONDS AND LABORATORY AQUARIA; I. FATE,
Shell Research Ltd., Sittingbourne (England). Sittingbourne Research Centre.
For primary bibliographic entry see Field 5B.
W85-02945

FATE AND BIOLOGICAL EFFECTS OF METHYL PARATHION IN OUTDOOR PONDS AND LABORATORY AQUARIA; II. EFFECTS,
Shell Research Ltd., Sittingbourne (England). Sittingbourne Research Centre.
N. O. Crossland.
Ecotoxicology and Environmental Safety, Vol. 8, No. 5, p 482-495, October, 1984. 5 Fig, 5 Tab, 14 Ref.

Descriptors: *Parathion, *Water pollution effects, *Fate of pollutants, *Toxicity, Trout, Algae, Mayflies, Daphnia, Copepods, Bioassays.

Methyl parathion (MEP) applied to three outdoor ponds at a nominal concentration of 100 micro g/liter was toxic to some species of aquatic insects and crustaceans but not to fish. The spectrum of toxicity was similar to predictions based on a literature survey of data obtained from laboratory tests. Various secondary effects occurred that could not be predicted from laboratory toxicity tests. An increase in populations of Diaptomus in treated ponds was probably caused by mortality of predators and competitors. A bloom of filamentous algae which then collapsed, leading to severe depletion of dissolved oxygen and fish deaths, may have been triggered by mortality of herbivorous mayflies and daphnids. The growth of juvenile rainbow trout in treated ponds was significantly less than in untreated ponds. On the other hand their growth in laboratory aquaria was not affected when rainbow trout were exposed to higher concentrations of MEP than occurred in the outdoor ponds. It was concluded that growth of rainbow trout in the ponds was probably affected by mortality among aquatic insects and crustaceans on which they feed. (Author's abstract)
W85-02946

CRUSTACEAN PLANKTON IN NORTHEASTERN ONTARIO LAKES SUBJECTED TO ACIDIC DEPOSITION,
Ontario Ministry of the Environment, Sudbury.
For primary bibliographic entry see Field 2H.
W85-02954

EFFECTS OF EFFLUENTS FROM A SEWAGE TREATMENT PLANT ON THE AQUATIC ORGANISMS,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Biological Sciences.
A. A. Oladimeji, and J. W. Wade.
Water, Air and Soil Pollution, Vol. 23, No. 3, p 309-316, October, 1984. 1 Fig, 3 Tab, 15 Ref.

Descriptors: *Ecological effects, *Wastewater treatment, *Zaria, *Nigeria, *Kubanni River, Water pollution effects, Conductivity, Hydrogen ion concentration, Chemical oxygen demand, Heavy metals, Bioindicators, Algae, Aquatic insects, Crustaceans, Rotifers, Fish.

The effects of sewage pollution on the distribution and abundance of some organisms over a period of 4 mo at the Ahmadu Bello University Main Campus sewage treatment plant and Kubanni river were studied. Physical-chemical parameters such as dissolved oxygen; temperature; hydrogen ion concentration (pH); electrical conductivity and chemical oxygen demand influenced by pollution were measured with respect to the population of aquatic organisms. The organisms were used as biological indices to monitor the ecological imbalance caused by the effluent. The variations in concentrations of some heavy metals were also measured. The studies revealed that at the source of pollution there were no organisms except for some insect larva such as Eristalis, Psychoda, and some microscopic algae like Oscillatoria, Anaebaena, and Polysystis. A location (site 5) on Kubanni river just before the confluence of the sewage effluent and the river was taken as the control. There was a wide variety of organisms (crustaceans, rotifers, and fish) at the control point. (Author's abstract)
W85-02955

EFFECT OF SIMULATED ACID PRECIPITATION ON NITROGEN MINERALIZATION AND NITRIFICATION IN FOREST SOILS,
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
N. J. Novick, T. M. Klein, and M. Alexander.
Water, Air and Soil Pollution, Vol. 23, No. 3, p 317-330, October, 1984. 6 Fig, 2 Tab, 20 Ref.

Descriptors: *Acid rain, *Nitrogen, *Mineralization, *Nitrification, *Soil chemistry, Hydrogen ion concentration, Isotope studies, Ammonium, Adirondacks, New York.

After exposure of samples of three forest soils (pH 3.4 to 3.9) from the Adirondacks region of New York to 60, 230, or 400 cm of simulated rain of pH 3.5 or 5.6 in 4, 14, or 24 weeks, respectively, the soil samples were separated into the 0 to 2 and 2 to

5 cm organic layers and further incubated. The rates of N mineralization in Woods soils exposed to the simulated precipitation were less for rain at pH 3.5 than at pH 5.6, but the inhibition decreased with increasing exposure of the 0 to 2 cm layer. In Panther soil, the rates of mineralization were usually not affectd by the acidity of the simulated rain. In the upper layer of Sagamore soil, mineralization was not influenced by the pH of the simulated rain, but the transformation was faster in the bottom layer of soil after prolonged exposure to simulated rain at pH 3.5 than at pH 5.6. The rate of nitrate formation in Panther and Woods soils amended with ammonium was inhibited by the more acid rain. Studies with labeled NH4 indicated that ammonium was oxidized to nitrate even though ammonium levels did not decline or declined only slightly after prolonged exposure of Panther or Woods soil to rain at pH 3.5. The growth of orchardgrass in Panther and Woods soil was inhibited by the more acid simulated rain. (Author's abstract)
W85-02956

EFFECTS OF FIVE INSECTICIDES ON ZYGOSPORE GERMINATION AND GROWTH OF THE GREEN ALGA CHLAMYDOMONAS MOEWUSII,
Illinois State Univ., Normal. Dept. of Biological Sciences.
J. R. Cain, and R. K. Cain.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 5, p 571-574, November, 1984. 2 Tab, 7 Ref.

Descriptors: *Water pollution effects, *Insecticides, *Algal growth, Toxicity, Aldicarb, Carbaryl, Dichlorvos, Propoxur, Trichlorfon, Organic compounds, Germination, Spores.

The effects of exposure to aldicarb, carbaryl, dichlorvos, propoxur, and trichlorfon were investigated using Chlamydomonas moewusii. Carbaryl and trichlorfon produced significant growth inhibition over the concentration range tested. No such inhibition was demonstrated by the other insecticides. Carbaryl significantly inhibited zygospore germination. No statistically significant effects on germination were produced by the other 4 insecticides. This is the first study to demonstrate that an insecticide can produce toxic effects on an algal spore, and illustrates the need for further toxicity studies involving reproductive stages of algal life histories. (Baker-IVI)
W85-02966

LOW CONCENTRATION EFFECTS OF ENDOSULFAN INSECTICIDE ON REPRODUCTIVE BEHAVIOUR IN THE TROPICAL CICHLID FISH SAROTHERODON MOSSAMBICUS,
Tropical Development and Research Inst., London (England).
P. Matthiessen, and J. W. M. Logan.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 5, p 575-583, November, 1984. 1 Fig, 5 Tab, 18 Ref.

Descriptors: *Water pollution effects, *Endosulfan, *Cichlids, *Pesticide toxicity, *Fish behavior, *Reproduction, Fish populations, Organic compounds.

The interruption of the cichlid reproductive behavior by endosulfan was investigated. Endosulfan at 0.5 microg/l had no apparent effect on breeding behavior in young adults. However, many of the newly-hatched fry died through exposure to their 24 hr LC50. Four weeks exposure to 0.5 micro g/l endosulfan produced no pathological signs in ovary or testis tissue. In a second experiment juvenile fish were exposed to 0.6 micro g/l levels of endosulfan. Originally the juveniles showed no signs of reproduction. After about 12 days those in the control tank began to demonstrate sexual behavior while those in the treated tank did not. Dosed males fed poorly, floated with heads higher than tails, and were abnormally sensitive to sudden audial or visual stimuli. Control females started laying eggs after 18 days, while dosed females did not start laying until day 30, but the differences in numbers of eggs was not significant. The concentration of 11-ketoestrosterone in male fish was elevated after exposure to endosulfan at 0.6 micro g/l, but not significantly so. No deleterious effects in either sex were observed at 0.2 micro g/l. (Baker-IVI)
W85-02967

TERATOGENIC AND LETHAL EFFECTS OF PARAQUAT ON DEVELOPING FROG EMBRYOS (RANA PIPIENS),
Indiana State Univ., Terre Haute. Dept. of Life Sciences.
N. A. Dial, and C. A. Bauer.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 5, p 592-597, November, 1984. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Water pollution effects, *Herbicides, *Paraquat, *Frogs, Amphibians, Organic compounds, Teratogenesis.

Lethal and gross teratogenic effects of a range of concentrations of paraquat on Rana pipiens embryos were investigated, including concentrations at the recommended aquatic field application rates. Eggs were exposed at early gastrula to 0, 0.1, 0.5, 2.0, and 10.0 ppm paraquat. Eggs were very resistant as development proceeded normally to hatch. At 3 days post hatch a significant increase was noted in mortality of all treatment groups, except the 0.1 ppm exposed group. No tadpoles subjected to 2 and 10 ppm paraquat survived beyond 11 days after treatment. Survivability was very poor at 0.5 ppm exposure levels with only 5.5% living to day 12. Growth rate was slowed in all treated groups, but only slightly so in embryos exposed to 0.1 ppm. A trend was also observed in maximum size attained by embryos exposed to the various dose levels of paraquat. A significant number of tadpoles exposed to levels of 0.5 ppm and above were observed to have abnormal tail development by day 5. Exposure of embryos to concentrations over 0.1 ppm produced profound effects on motor ability. After hatch, aquatic application levels of paraquat caused death, retardation of growth, significant levels of multiple tail malformations, poor head development, and produced profound effects on motor ability. Paraquat disappears from treated water quite rapidly and therefore the timing of paraquat application to aquatic ecosystems could be of utmost importance to R. pipiens. (Baker-IVI)
W85-02968

ACUTE TOXICITY OF HYDRAZINE HYDRATE TO THE FATHEAD MINNOW (PIMEPHALES PROMELAS) AND DAPHNID (DAPHNIA PULEX),
Duke Power Co., Huntersville, NC. Environmental Services Section.
J. S. Velte.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 5, p 598-604, November, 1984. 2 Tab, 16 Ref.

Descriptors: *Water pollution effects, *Hydrazine, *Daphnia, *Minnows, Organic compounds, Industrial wastes, Antioxidants, Toxicity, Invertebrates, Fish.

Hydrazine is a strong antioxidant which is used to deoxygenate boiler water. Hydrazine may enter the aquatic environment as controlled industrial discharge or as a result of an accidental spill. Two 48-hr static renewal tests were used to expose D. pulex to hydrazine hydrate. The highest nominal hydrazine exposure concentrations were 5.00 and 4.00 mg/L in two daphnid tests. The daphnids were observed at 3, 6, 12, 24, 36, and 48 hr for immobilization. Fathead minnows were tested using a flow-through acute test procedure using exposure concentrations of 1.12, 2.25, 4.50, 9.00, and 18.00 mg hydrazine/L. Daphnids were far more sensitive to hydrazine than were fathead minnows during equivalent lengths of exposure. After 48 hr the LC50 value for fathead minnows (5.98 mg/L) was approximately 33 times greater than the comparable value for daphnids (0.18 mg/L). Dissolved oxygen concentrations in the exposure chambers were affected only slightly by the hydrazine concentrations tested. Hydrazine decays readily in the environment due to its reactivity. The rate of degradation is closely related to temperature, receiving water chemistry, and amount of suspended particulate material pre
(Baker-IVI)
W85-02969

**SELENIUM EFFECTS ON ANTENNAL INT
RITY AND CHRONIC COPPER TOXICITY
DAPHNIA PULEX (DEGEER),**
Miami Univ., Oxford, OH. Dept. of Zoology.
R. W. Winner.
Bulletin of Environmental Contamination
Toxicology, Vol. 33, No. 5, p 605-611, Novem
1984. 2 Fig, 20 Ref.

Descriptors: *Water pollution effects, *Cop
*Selenium, *Daphnia, Minerals, Toxicity, He
metals, Essential nutrients, Water quality st
ards.

The effect of sodium selenite on the incidenc
antennal damage in cohorts of D. pulex exposed
copper in a soft, reconstituted water was examin
Tests were run in water to which had been ad
(ppb): 0 Cu - 0 Se, 10 Cu - 0 Se, and 10 Cu - 5
The cohort reared in water containing 10 ppb
and no added Se began to exhibit antennal dam
on day 28 of the experiment and all animals ex
ited antennal damage by day 32. The cohort rea
in water containing 10 ppb Cu and 5 ppb
exhibited no antennal damage over the 42
exposure. In the absence of both Cu and Se, o
one animal developed antennal damage and
was late in the experiment. Se addition not o
eliminated antennal damage, it also significan
reduced the chronic toxicity of Cu as evidenced
an increase in survival. Se should thus be inclu
as one of the essential nutrients in lab culture
daphnids and this metal will have to be added
the increasing list of water quality parame
which must be considered when delivering wa
quality criteria and standards for metal toxic
(Baker-IVI)
W85-02970

**EFFECT OF PH ON PENTACHLOROPHEN
TOXICITY TO EMBRYOS AND LARVAE
ZEBRAFISH (BRACHYDANIO RERIO),**
Goeteborg Univ. (Sweden). Dept. of Zoophys
logy.
G. Dave.
Bulletin of Environmental Contamination a
Toxicology, Vol. 33, No. 5, p 621-630, Novemb
1984. 3 Fig, 2 Tab, 11 Ref.

Descriptors: *Acidity, *Pentachlorophenol, *To
icity, *Fish, *Water pollution effects, Acid ra
Organic compounds, Industrial wastes, Hydrog
ion concentration.

A simple laboratory procedure was sought for t
determination of the effect of pH on the toxicity
various chemicals added to or already present
various samples of ground and surface waters.
experiment 1, ten eggs were exposed to 50 mL p
adjusted and buffered water. In experiment 2, t
eight-day-old larvae were exposed to pH-adjust
and buffered water with pentachlorophenol (PC
added to nominal concentration between 0.3 a
640 micro g/L. Three series with nominal pHs
5, 7, and 9 and a control series, without buff
were tested simultaneously. In experiment 3 t
embryos were 30-32 hr old; PCP was added
nominal concentrations of 0, 10, 20, 40, 80, 16
320, and 640 micro g/L at pH 4, 5, 6, 7, 8, and
At high pH values there are long-term effects
PCP resulting in a slightly reduced period of su
vival in unfed larvae, presumably because of le
efficient use of energy through uncoupling of ox
dative phosphorylation. (Baker-IV)
W85-02971

**COAL ASH BASIN EFFECTS (PARTICULATE
METALS, ACIDIC PH) UPON AQUATI
BIOTA: AN EIGHT-YEAR EVALUATION,**
Virginia Polytechnic Inst. and State Univ., Black
burg. Center for Environmental Studies.
D. S. Cherry, R. K. Guthrie, E. M. Davis, and R.
S. Harvey.

Water Resources Bulletin, Vol. 20, No. 4, p 535-544, August, 1984. 5 Fig, 3 Tab, 65 Ref.

Descriptors: *Coal ash, *Particulates, *Metals, Acidity, *Aquatic life, Aquatic insects, Mosquitofish, Invertebrates, Effluents, Water pollution effects, Biological magnification, Arsenic, Cadmium, Chromium, Copper, Selenium, Zinc, Macrophytes.

Coal ash effluent effects including particulates, acidic pH excursions, elemental concentrations and bioconcentration in selected organisms have been studied as changes in water quality and densities of benthic macroinvertebrate and mosquitofish (Gambusia affinis) populations in a swamp drainage system over an eight-year period. Three changes in the ash basin settling system were made between mid-1973 and January 1982. Initial density of the aquatic biota was altered severely by heavy ash siltation, followed by acidic pH excursions, and perhaps overall by elemental concentrations and bioaccumulation. Heavy ash siltation, followed by acidic pH excursions (mean of 5.5, extreme of 3.5) after the addition of fly ash to the original settling basin system, had the most profound effect on biota. Dipterans (chironomids) and some odonates (Plathemis lydia and Libellula spp.) were resistant to heavy siltation, while mosquitofish, which showed no discernible responses to ash siltation, were absent at acidic pH, along with the few previously surviving invertebrate populations. Elemental concentrations of arsenic, cadmium, chromium, copper, selenium, and zinc did not appear to limit aquatic flora and fauna on a short-term, acute basis. Long, chronic elemental exposures may have been instrumental in retarding the recovery of all forms of aquatic life in the receiving system. Elemental concentrations (except for arsenic and selenium) in the receiving system were generally one to two orders of magnitude higher than the Water Quality Criteria set by the U.S. Environmental Protection Agency (1980) for protection of aquatic life for the minimum and 24-hour mean values. From collective elemental exposures in the receiving system, bioconcentration factors in macrophytes, invertebrates and fish were generally lower than those reported in the literature for laboratory, single elemental concentrations. By 1978, when the new settling basin systems were operating effectively, invertebrate populations were largely recovered, and mosquito-fish populations recovered within one year afterward. (Author's abstract)
W85-02980

OLIGOHALINE BENTHIC INVERTEBRATE COMMUNITIES AT TWO CHESAPEAKE BAY POWER PLANTS,
Hampton Inst., VA. Center for Marine and Coastal Environmental Studies.
R. A. Jordan, and C. E. Sutton.
Estuaries, Vol. 7, No. 3, p 192-212, September, 1984. 20 Fig, 9 Tab, 39, Ref.

Descriptors: *Nuclear powerplants, *Invertebrates, *James River, *Saltpeter Creek, *Maryland, *Thermal pollution, Water pollution effects, Estuarine environment, Cooling water, Benthic fauna, Tidal creeks, Oligohaline environment.

Benthic invertebrate populations at the Surry power plant on James River, Virginia and the C.P. Crane power plant on Saltpeter Creek, Maryland exhibited large spatial and temporal variations. At C.P. Crane, where the cooling water is pumped between two tidal creeks, populations in the receiving creek exhibited five response patterns: 1) mitigation of a winter dieoff (Rangia cuneata, a brackish water clam), 2) acceleration of growth or development (R. cuneata; Scolecolepides viridis, a polychaete; Leptocheirus plumulosus, an amphipod; Tubificidae; and Coelotanypus sp., a dipteran), 3) importation of larvae from the source water creek (S. viridis and Coelotanypus sp.), 4) extension of creek-dwelling species into the adjacent river (Coelotanypus sp. and other dipterans), and 5) increased severity of late summer population depression (S. viridis and L. plumulosus). At Surry, where the cooling water is taken from the downriver side of a peninsula and discharged on the upriver side, there was no confined creek system at the discharge, and effects were less pronounced. The community in the Surry discharge zone resembled the community at downriver stations more closely than at upriver reference stations. The L. plumulosus population near the Surry discharge was depressed, while the Mytilopsis leucophaeta population was enhanced. No major ecological damage was attributed to either power plant, due in part to the resilience of estuarine endemic populations, but the unique features exhibited by each of the two sites support the argument that oligohaline estuarine zones should not be designated a priori for unregulated industrial development. (Author's abstract)
W85-02994

INFLUENCE OF CHLORINE ON THE SUSCEPTIBILITY OF STRIPED BASS (MORONE SAXATILIS) TO VIBRIO ANGUILLARUM,
Maryland Univ., College Park. Dept. of Microbiology.
F. M. Hetrick, L. W. Hall, Jr., S. Wolski, W. C. Graves, and B. S. Roberson.
Canadian Journal of Fisheries and Aquatic Science, Vol. 41, No. 9, p 1375-1380, September, 1984. 5 Tab, 29 Ref. Maryland DNR grant P-84-81-04.

Descriptors: *Chlorine, *Toxicity, *Bass, *Vibrio, Water pollution effects, Pathogenic bacteria, Infection, Mortality, Immunity.

The subtle effects that low levels of pollutants have on fish populations are probably more important than the effects of large spills, since the effects are less likely to be obvious and the source more difficult to detect in time to save the environment. An experiment was carried out to determine if exposure of striped bass to sublethal concentrations of chlorine affected their susceptibility to bacterial infection. Exposure of striped bass for 96 h to sublethal concentrations of total residual chlorine (TRC) (0.05-0.23 mg/L) did not increase their susceptibility to infection with the bacterial pathogen Vibrio anguillarum. Variables examined were TRC concentrations, length of exposure to chlorine, and the order of exposure to chlorine and the pathogen. Mortalities in the groups exposed to both chlorine and pathogen were not significantly different from those seen in groups receiving the bacteria only. Smaller fish are more susceptible than larger fish, and the LD50 is markedly affected by the ambient temperature in that fewer bacteria are needed to kill fish at lower temperatures. One contributing factor to this increased resistance of fish at higher water temperatures appears to be related to their immune status. (Moore-IVI)
W85-03001

EFFECTS OF A SETTLED INDUSTRIAL DOMESTIC SEWAGE WORKS EFFLUENT FROM PERCOLATING FILTERS ON THE EMBRYO VIABILITY AND HATCHING SUCCESS OF RAINBOW TROUT, SALMO GAIRDNERI RICHARDSON,
Aston Univ., Birmingham (England). Dept. of Chemistry.
J. A. L. Fraser, and E. R. Clark.
Journal of Fish Biology, Vol. 25, No. 4, p 393-403, October, 1984. 5 Tab, 34 Ref.

Descriptors: *Trout, *Water pollution effects, *Effluents, *Microorganisms, *Embryonic growth stage, Hatching, Mortality, Sphaerotilus, Eleutheroembryos, Wastewater pollution.

Survival of juvenile stages and the growth and reproductive capacity of larger fish may be adversely affected in streams or rivers which receive effluents giving rise to prodigious growths of 'sewage fungus'. 'Sewage fungus' is a community of mostly heterotrophic organisms forming slime growth in organically polluted water. Embryo viability, hatching success and eleutheroembryo survival in tap water, 50% and 100 settled effluent were investigated in rainbow trout embryos when one group of embryos was washed twice daily and the other group was not washed. Differences in the hatching success between washed and unwashed embryos in the three treatments were compared to the effect of saprophytic microbial growths assessed. There was a significant difference in mortality between washed embryos to tap water (5%) and 50% effluent (12%) and 100% effluent (12%) when dissolved oxygen levels maintained near 100% air saturation value. Mortalities of unwashed embryos were 4%, 26%, and 26% respectively for the three treatments. After 10 days exposure unwashed embryos in the effluent treatments had become covered in microbial growths, among which Sphaerotilus spp. were identified. Hatching success of washed embryos was similar in the three treatments but unwashed embryos were significantly affected by the effluent treatments. The presence of Sphaerotilus spp. was the major cause of unsuccessful hatching in both effluent treatments. All eleutheroembryos that hatched and settled to the debris in the bottom of the fry tanks died within 3 days in 100% effluent and within 14 days in 50% effluent. All eleutheroembryos maintained in the water column through cage retention died within 18 days in 100% effluent, while 33% reached the swim-up phase in 50% effluent. (Moore-IVI)
W85-03002

INTERACTIONS OF TEMPERATURE AND SUBLETHAL ENVIRONMENTAL COPPER EXPOSURE ON THE ENERGY METABOLISM OF BLUEGILL, LEPOMIS MACROCHIRUS RAFINESQUE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
P. A. Felts, and A. G. Heath.
Journal of Fish Biology, Vol. 25, No. 4, p 445-453, October, 1984. 4 Fig, 27 Ref.

Descriptors: *Water temperature, *Copper, *Toxicity, *Bluegill, Oxygen consumption, Heavy metals, Metabolism, Temperature acclimation, Water pollution effects.

Copper (0.21 mg/l) caused a decreased in whole body oxygen consumption in bluegills exposed for 32 days, but no changes occurred during days 3, 4 or 9 of copper exposure. In vitro oxygen consumption of gill and brain, were not significantly altered, whereas liver QO2 was slightly elevated which suggests that copper is acting to decrease oxygen consumption of the whole animal at a higher level of integration than these individual tissues. In fish subjected to an increase in temperature as well as sublethal copper exposure, whole body oxygen consumption was higher than controls 5 days after the temperature was increased, indicating a delay in temperature acclimation in the copper exposed fish. This difference was reflected in higher in vitro oxygen consumption in the liver and gill of these fish suggesting the metal was delaying the process of temperature acclimation by at least in part acting directly on the tissues. (Author's abstract)
W85-03003

PREDICTED SURVIVAL OF THE BAY ANCHOVY (ANCHOA MITCHILLI) IN THE HEATED EFFLUENT OF A POWER PLANT ON GALVESTON BAY, TEXAS,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
K. S. Chung, and K. Strawn.
Environmental Biology of Fishes, Vol. 7, No. 1, p 57-62, January, 1982. 1 Fig, 2 Tab, 29 Ref.

Descriptors: *Thermal pollution, *Entrainment, *Powerplants, *Anchovy, *Galveston Bay, *Texas, Cooling water, Fish, Mortality, Cooling towers.

The P.H. Robinson Generating Station, Bacliff, Texas, uses the Galveston estuarine system as a cooling water resource. Five supplemental cooling towers operate during June through September. Cooling water from the towers is mixed with the hot discharge water and the temperature is lowered to 35 C or less in summer. Bay anchovy (Anchoa mitchilli) collected from the intake canal were tested for 180 min at various constant temperatures during June 1974 through September 1975 to determine if they could survive passage through the discharge canal system. Three-h survival temperatures were significantly lower, throughout the year, than the temperatures in the discharge canal both afferent and efferent to the

cooling towers. The bay anchovy entrained and entrapped from the intake canal and exposed to the heated effluent could not survive in the cooling water systems. The cooling towers should aid survival of the fish in the canal below the towers. (Moore-IVI)
W85-03022

ACUTE TOXICITY OF AMMONIA AND COPPER TO THE GASTROPOD POTAMOPYRGUS JENKINSI (SMITH),
Aston Univ., Birmingham (England).
For primary bibliographic entry see Field 5A.
W85-03042

TOXICITY OF LOWER THAN PERMISSIBLE LEVELS OF CHROMIUM (VI) TO THE FRESHWATER TELEOST NURIA DENRICUS,
Centre for Water Resources Development and Management, Calicut (India).
S. A. Abbasi, and R. Soni.
Environmental Pollution (Series A), Vol. 36, No. 1, p 75-82, 1984. 1 Fig, 3 Tab, 23 Ref.

Descriptors: *Chromium, *Fish, *Toxicity, *Water pollution effects, Metals, Bioassay, Hexavalent chromium.

The impact of chromium (VI) on the freshwater teleost Nuria denricus in concentrations ranging from 0 to 100 mg/liter was studied by computer-aided long-term static bioassays. Hexavalent chromium induced marked changes in swimming and balancing patterns. The stressed fishes exhibited erratic and rapid twisting movements, loss of balance, increased frequency of surfacing and vertical swimming compared with the smooth and predominantly horizontal swimming of fishes in the control aquaria. A marked effect on feeding was noted above 2.0 mg/liter. Fishes exposed to 0-2 mg/liter chromium consumed food completely, while in exposures of 5-100 mg/liter food consumption was lower than normal with a clear trend towards loss in food consumption with increase in chromium concentration. The stress gradually led to sluggishness and death. Chromium also caused erosion of fins and fin rays. (Baker-IVI)
W85-03043

TOXICITY OF AMMONIA TO EARLY LIFE STAGES OF THE GREEN SUNFISH LIPOMIS CYANELLUS,
Environmental Research Lab.-Duluth, MN.
J. H. McCormick, S. J. Broderius, and J. T. Fiandt.
Environmental Pollution (Series A), Vol. 36, No. 2, p 147-163, 1984. 1 Fig, 4 Tab, 25 Ref.

Descriptors: *Sunfish, *Toxicity, *Ammonia, Lake Superior, Water pollution effects, Fish, Growth stages, Hydrogen ion concentrations, Hatching.

Toxicity of ammonia to early life stages of green sunfish Lepomis cyanellus was studied. One chronic and four acute exposure studies were conducted. During the chronic study green sunfish were exposed to a series of ammonia concentrations from the blastula stage through 40 days post hatching. During the acute studies, juvenile green sunfish were exposed at four pH levels, 6.6., 7.2, 7.7, and 8.7, to derive 3-, 6-, 12-, 24-, 48-, 72-, and 96-hr LC50 and EC50 concentrations of un-ionized and total ammonia. Embryos of the green sunfish were relatively resistant to adverse effects of ammonia. Hatching success was not affected by concentrations as high as 0.91 mg/liter NH3. Growth was, however, significantly reduced from that of control fish at a concentration between 0.22 and 0.49 mg/liter NH3. Particularly sensitive was the critical period when the larvae first require exobenous food to survive. Growth was the most sensitive measure of chronic effect. Growth at the two lowest ammonia treatments was actually elevated above that of the control fish exposed to unaltered Lake Superior water. (Baker-IVI)
W85-03045

EFFECT OF TERRESTRIAL HERBICIDES ON THE COMMUNITY STRUCTURE OF STREAM PERIPHYTON,
Texas A and M Univ., College Station. Dept. of Biology.
R. J. Kosinski.
Environmental Pollution (Series A), Vol. 36, No. 2, p 165-189, 1984. 1 Fig, 8 Tab, 54 Ref.

Descriptors: *Herbicides, *Periphyton, *Toxicity, *Water pollution effects, Atrazine, Trifluralin, Paraquat, Algae, Standing crop, Species composition.

The influence of 0.1, 1 and 10 mg/kg of the herbicides atrazine, trifluralin, MSMA and paraquat on the species composition and standing crop of algal periphyton was assessed using artificial streams. For each herbicide, two experiments were performed; one using algae from a pristine spring and another using algae from a stream heavily influenced by agricultural runoff. Also, in each experiment 0.01 mg/kg of the test herbicide was maintained in the water of half the streams during a three-week period prior to the application of the 0.1/1/10 mg/kg treatments in an attempt to induce development of a resistant community. Calculated half lives were 3.2 days for atrazine, 51 min for trifluralin, and 13.1 hr for paraquat. MSMA's half life was 2.3 days in 1981 and 5.9 days in 1982. Both univariate and multivariate tests rarely disclosed a significant chronic x acute interaction term. Diversity was a poor indicator of herbicide effects. Atrazine caused the most extensive damage. The spring community seemed more resistant than the stream community to both atrazine and paraquat. The 0.01 mg/kg did not appear to induce resistance to any of the herbicides. (Baker-IVI)
W85-03046

BACTERIAL ACTIVITY IN SEDIMENTS OF LAKES RECEIVING ACID PRECIPITATION,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W85-03047

EFFECTS OF LEAD TAILINGS ON BENTHOS AND WATER QUALITY OF THREE OZARK STREAMS,
Missouri Dept. of Conservation, Columbia.
R. M. Duchrow.
Transactions of the Missouri Academy of Science, Vol. 17, No. 2, p 5-17, 1983. 8 Fig, 1 Tab, 30 Ref.

Descriptors: *Lead mines, *Mine wastes, *Water pollution effects, *Saline Creek, *Logan Creek, *Little St. Francis River, *Missouri, Sedimentation, Smothering, Abrasion, Benthic fauna, Invertebrates, Aquatic insects, Fish, Heavy metals.

Lead mine tailings were discharged into two Missouri Ozark streams (Saline and Logan creeks) on March 28-29, 1977 following heavy rainfall and runoff. Sedimentation caused severe damage to benthic invertebrate communities inhabiting the receiving streams. Adult fish populations seemed unaffected; no dead fish were found during each study. Degradation in a secondary receiving stream (Little St. Francis River) was limited to the reduction of pollution-sensitive mayfly and stonefly taxa. Benthic invertebrate communities began to recover in both study streams about 2 months after the tailings discharges, but still showed signs of adverse effects after 1 year. Dissolved heavy metal concentrations never reached acutely toxic levels in either stream. Their concentrations were also below safe limit guidelines for the protection of aquatic life in most samples. The cause of degradation in both streams was primarily the physical effects of the tailings (sedimentation, smothering, and abrasion). Heavy metals did not appear to contribute significantly to the degradation of the biota of either stream. Effects on early life stages of fish and benthos were not studied. (Author's abstract)
W85-03068

SOME EFFECTS OF EUTROPHICATION AND THE REMOVAL OF AQUATIC PLANTS BY GRASS CARP (CTENOPHARYNGODON IDELLA) ON RAINBOW TROUT (SALMO GAIRDNERII) IN LAKE PARKINSON, NEW ZEALAND,
Ministry of Agriculture and Fisheries, Rotor
(New Zealand). Fisheries Research Div.
D. K. Rowe.
New Zealand Journal of Marine and Freshwat
Research, Vol. 18, No. 2, p 115-127, July, 1984
Fig, 4 Tab, 40 Ref.

Descriptors: *Eutrophication, *Aquatic weed co
trol, *Trout, *Grass carp, *Lake Parkinson, *Ne
Zealand, Stratification, Dissolved oxygen, Sha
Predation, Cladocerans, Phytoplankton, Ammon
Fish populations.

Temporary removal of aquatic plants in Lake Pa
kinson, a small, eutrophic dune lake, resulted in
number of changes to the population of stock
rainbow trout (Salmo gairdnerii). During ea
summer the lake stratified and low oxygen lev
limited the distribution of trout to shallow (0-4
surface waters. In the first summer following we
removal the numbers of black shags (Phallacr
corax carbo) counted at the lake increased, a
their predation resulted in a decline in trout den
ty. However, the growth rate and condition of t
trout population then exceeded that of tro
present before weed removal. During the secon
summer after weed removal a cladoceran bloo
was followed by low phytoplankton levels a
high ammonia concentrations. A prolonged ca
compounded this situation with the result th
oxygen levels in bottom and surface wate
dropped below 2 ppm. These low oxygen lev
eliminated the trout population, but other fish sp
cies present survived. Elimination of aquatic plan
affected the population dynamics of other fish sp
cies in the lake with potential implications for t
trout. The experiment demonstrated the impo
tance of weed beds in maintaining a stable fi
community in lakes such as Lake Parkinson. (A
thor's abstract)
W85-03072

**EFFECTS OF SIMULATED ACID PRECIPIT
TION ON DECOMPOSITION AND LEACHIN
OF ORGANIC CARBON IN FOREST SOIL**
Bemidji State Univ., MN. Center for Environme
tal Studies.
F.-H. Chang, and M. Alexander.
Soil Science, Vol. 138, No. 3, p 226-234, Septe
ber, 1984. 3 Fig, 8 Tab, 12 Ref.

Descriptors: *Acid rain, *Forest soils, *Leachin
*Decomposition, *Organic carbon, *New Yo
Simulation, Organic matter, Mineralization, Wat
pollution effects.

Soil samples from three watersheds of New Yo
State were treated with simulated rain at pH 3
4.1, and 5.6 daily for 14 d, at 12 3-d intervals
three separate tests, or at 22 7-d intervals. Exce
for one system of treating the three forest soi
simulated acid rain reduced the amount of organ
matter leached from samples of soil from whi
more than 0.05% of the organic carbon w
leached during the exposure period. In the s
samples representing the exceptions, acid rain e
hanced the leaching of organic matter. Sampl
from the organic layer of the treated samples
acid soil were taken at two equal depths, and t
rates of organic matter decomposition in the tw
layers were studied. As compared with simulat
rain at pH 5.6, simulated acid rain reduced t
decomposition of organic matter in the three so
at both depths in three of the five tests and at bo
depths of two of the soils in the fourth test.
some instances, organic matter decomposition w
enhanced by the simulated acid rain. Except f
the sample of soil at the highest initial pH, carb
mineralization was inhibited in soils and treatmer
in which simulated acid rain reduced the amou
of organic carbon leached, and its was stimulat
in soils and treatments in which the quantity
organic carbon leached was increased by the sim
lated acid rain. (Author's abstract)
W85-03095

**CHANGING MACROINVERTEBRATE CO
MUNITY STRUCTURE AND DIVERSITY
AN ORGANICALLY LOADED RIVER DURIN
ITS SELFPURIFICATION,**

Bulgarian Academy of Sciences, Sofia. Inst. of Zoology.
S. G. Kovachev.
Hydrobiology (Bulgarian Academy of Science), Vol. 21, p 29-33, May 1984. 3 Fig, 1 Tab, 13 Ref.

Descriptors: *Mesta River, *Bulgaria, *Species diversity, *Organic loading, Species composition, Saprobity, Mesosaprobic rivers, Polysaprobic rivers, Self purification, Ecological effects, Water pollution effects, Fate of pollutants.

Information-theoretical community structure indices were calculated for macroinvertebrate samples obtained on the Mesta River, Bulgaria. Fifteen stations were distributed along a gradient of decreasing organic loading between just below Razlog and just downstream from Gotse Delchev. Community diversity tended to vary in parallel with number of species and individuals, whereas redundancy was high when a few species dominated. Water quality according to the saprobic system ranged from S sub R = 17.16 to S sub R = 53.07. The river environment was classified as polysaprobic at the most upstream station, and became alpha-mesosaprobic to beta-mesosaprobic at the most downstream two stations. Evenness in the macroinvertebrate community structure increased as saprobity decreased, while redundancy decreased over the same river reach. As self-purification of the stream improved the environment, community structure became more complex and increased in information content. (Rochester-IVI)
W85-03101

BIOLOGICAL STATE OF UNDERGROUND WATERS IN THE INDUSTRIAL ZONE OF THE EASTERN PART OF THE SOFIA PLAIN BIOLOGICHIO S'STOYANIE NA PODZEMNITE VODI V INDUSTRIALNATA ZONA NA IZTOCHNOTO ZOFIIZKO POLE),
For primary bibliographic entry see Field 5B.
W85-03103

OLIGOCHET WORMS COMPLEX OF THE BLAGOEVGRADSKA BISTRITSA RIVER AS AFFECTED BY SOME FACTORS OF THE ENVIRONMENT (DINAMIKA NA OLIGOKHETNIYA KOMPLEKS V REKA BLAGOEVGRADSKA BISTRITSA V ZAVISIMOST OT NYAKOI FAKTORI NA SREDATA),
. I. Uzunov, and N. D. Nachev.
Hydrobiology, Vol. 21, p 56-67, May, 1984. 5 Fig, ! Tab, 17 Ref.

Descriptors: *Blagoevgradska Bistritsa River, *Oligochaetes, *Water pollution effects, Eutrophication, Saprobity, Water temperature, River flow, Species composition, Water level, Abundance.

The effect of temperature, water flow and saprobity on the specific composition and abundance of oligochaetes in the Blagoevgradska Bistritsa river in 1970 through 1975 and 1978 through 1981 were studied. A total of 230 samples were collected from 13 localities annd 35 species of 19 genera and families of oligochaetes were established. The specific composition is highly dependent on the saprobic conditions. With the ongoing saprobization a primary saprobic succession develops with the specific composition reaching its highest variety under beta-mesosaprobic conditions. During the succession the specific composition and dominant species change continuously which actually are the oligochaetic saprobic sequences. The inflowing city sewage discontinue these processes and reduce considerably the oligochaetic specific composition and abundance. The number of individuals grows with the rise of temperature (r = +0.60) while at the same time the number of species stays constant, which is due to the nonsexual reproduction of the dominating Naididae worms. Because of the drift the high water level leads to reduced specific variety (r = -0.75). The saprobity was found to be the most important factor affecting the oligochaetic specific composition and abundance. Its relative value as computed was 26% of the total value of environmental factors affecting the specific composition and 49% of the value of factors affecting the abundance. The correlation between these parameters and the saprobic levels is of the parabolic pattern. The numercial correlation shows that in the lower course of the river, toxic pollutants are present, too. (Author's abstract)
W85-03104

STUDY ON THE HEAVY METALS HAVING EFFECT ON THE WATER BIOCENOSES IN THE BACKWATERS AT ALPAR AND LAKITELEK,
Lower-Tisza District Water Authority, Szeged (Hungary).
E. Fekete.
Tiscia (Szeged), Vol. 19, No. 2, p 3-15, 1984. 12 Fig, 13 Ref.

Descriptors: *Backwaters, *Alpar, *Lakitelek, *Tisza, *Hungary, *Heavy metals, *Water pollution effects, Copper, Cadmium, Zinc, Chromium, Mercury, Hydrogen ion concentration, Organic matter, Ammonium, Nitrates, Sodium, Potassium.

Heavy metals which have an effect on the water biocenosis were determined monthly during 1982 in the Tisza backwaters at Alpar and Lakitelek, Hungary. Copper, cadmium, zinc, chromium, and mercury contents of the water were determined. Organic matter, ammonium, nitrate, pH, sodium and potassium content were determined jointly with the studies of the heavy metals. On the basis of water quality indexes, the water qualty of Lakitelek backwater is more stable than that of the Alpar backwater. Correlations were observed between the zinc and copper content and aquatic life. The two backwaters have significant mercury content, which is due to agricultural runoff. It is striking that cadmium does not occur in significant concentrations in the backwaters. Samples originating from the bottom sediments should be included in the studies on heavy metals, to obtain complete information on equilibrium and transport process taking place in the backwaters. (Moore-IVI)
W85-03112

BIOLOGICAL WATER QUALITY OF THE TISZA BETWEEN TOKAJ AND TISZAFURED (ON THE BASIS OF STUDIES CARRIED OUT BETWEEN THE PERIOD 1971-1980),
Northern Hungarian Water Conservancy Directorate, Miskolc.
A. L. Vancsa.
Tiscia (Szeged), Vol. 19, No. 2, p 21-38, 1984. 15 Fig, 2 Tab, 4 Ref.

Descriptors: *Tisza, *Hungary, *Water quality, Flow discharge, Eutrophication, Water pollution effects, Fertilizers, Algae, Diatoms, Chlorophyll a, Nutrients, Phosphorus.

Water quality studies were carried out between 1971 and 1980 in the two characteristic segments of the Tisza (Tiszatardos and Tiszakeszi) in Hungary. The 10 year period can be divided into two 5-year periods, characterized by basically different flow values: with values mostly under 500 cu m/s, 1971 - 1975; and values above 500 cu m/s, 1976 - 1980 (on many occasions above 1,000 cu m/s). The water quality of the Tisza is fundamentally determined by the water output. During the period 1971 - 1980 there was a substantial increase in the utilization of chemical fertilizers. Significant degradation took place in both segments, but was greater in the Tiszakeszi segment. The cause of this may be the runoff originating from areas belonging to the channel section between the two segments. Of the biological water quality property-groups, the halobity and toxicity are favorable. The trophity shows extreme seasonal changes; it may become eutrophic at times. The C:N:P value is 2000:12:1 in the Tisza. The saprobity shows relatively balanced changes, but there is an indication of an unfavorable shift. The algae population maximums are characterized by the domination of diatoms (Bacillariophyceae). The changes in the chlorophyll-a content when the algae population maximums are subsiding are correlated with the changes in the total algal count within the longitudinal segment. Among the plant-nutrients, dissolved reactive phosphorus is regarded as a limiting factor. The water quality of the Tisza is acceptable in general; nevertheless, the results characteristic of unfavorable conditions cannot be ignored. (Moore-IVI)
W85-03113

RELATIONSHIP BETVEEN THE CHEMICAL OXYGEN DEMAND, SUSPENDED MATTER CONTENT AND ALGAL COUNT IN THE EASTERN MAIN CANAL (HUNGARY),
Magyar Tudomanyos Akademia, Budapest. Station for Danube Research.
K. T. Kiss.
Tiscia (Szeged), Vol. 19, No. 2, p 39-48, 1984. 4 Fig, 15 Ref.

Descriptors: *Eastern Main Canal, *Hungary, *Chemical oxygen demand, *Suspended solids, *Algae, Floods, Velocity, Canals, Organic matter.

The Eastern Main Canal is a 100 km long artificial stream conducted from the Tisza river at Tiszalok (535 river km) with the rate of flow 30-50 cu m/s. The investigations were carried out in the Eastern Main Canal at the section between Tiszalok and Balmazujvarous in 1968-1975. The amount of suspended matter changed from 5-700 mg/l, the values of chemical oxygen demand (COD) varied from 3-15 mg/l and that of the algal count from 30 thousand - 20 million individuals per liter. The changes of these values depended on the floods of the Tisza river and on the current velocity of the Eastern Main Canal. The present paper reports on the degree to which the COD values were altered by the suspended matter content, and modified by that algal count, respectively (that organic material of suspended matter and algae should be taken into account; which are oxidizable in acid with potassium permanganate, since the suspended matter also comprises the algae). With the help of path-analysis it was concluded that in case of high suspended matter content, when the algal count is low, the COD is determined by the amount of suspended matter in 40-70%, and by the algal count in 0.5-0.6%. Besides low suspended matter content, when the algal count is high, the values of the chemical oxygen demand are determined in 4-10% by the amount of suspended matter content, and in 15-20% by the algal count. (Author's abstract)
W85-03114

ALGOLOGICAL INVESTIGATIONS IN THE WATERS OF THE TISZA BASIN AT ALPAR,
Jozsef Attila Univ., Szeged (Hungary). Dept. of Botany.
I. Kiss.
Tiscia (Szeged), Vol. 19, No. 2, p 49-58, 1984. 1 Tab, 14 Ref.

Descriptors: *Eutrophication, *Tisza Basin, *Alpar, *Hungary, *Algae, Cyanophyta, Euglenophyta, Chrysophyta, Chlorophyta, Animal wastes, Water pollution effects.

The algological investigations of the waters at the Alpar basin were continued in 1982 since the area will be a part of the Tisza-III River Barrage waterbasin. The pH in the Alpar backwater was tested monthly, and found to usually be above 8.0. During the course of the year a total of 174 species or taxa were determined. Their taxonomic distribution is as follows: Cyanophyta, 30; Euglenophyta, 47; Chrysophyta, 45; Chlorophyta, 52. Four algal blooms occurred, and through these, the role of the factors influencing the algal associations could be studied. The one-sidedly antagonistic effect of the blue-green algae, Aphanizomenon flos-aquae and Microcystis aeruginosa, was particularly striking. The mass production of these occurred in every biotope. The algal blooms of Euglena sanguinea and E. polymorpha proved that the Euglenophyta species are able to produce enormous mass productions in the dung-polluted waters. E. sanguinea blooms colored the shallow water which is rich in organic matter and covered the surface of the reed marsh with a yellowish-green, 1-2 mm thick bioseston layer. In the green mass production of this organism, in the region of the cell center, 3-4 deep-red hematochrome clumps were detectable in 10-15% of the individuals. These disappeared within 2-3 hr upon illumination, and reappeared

upon exposure to dark. This organism has been observed in Hungary several times. (Moore-IVI)
W85-03115

RESULTS OF THE PRELIMINARY INVESTIGATIONS ON THE ALGACOMMUNITIES IN THE BACKWATER OF THE TISZA AT ALPAR,
Lower-Tisza District Water Authority, Szeged (Hungary).
E. Dobler, and K. Kovacs.
Tiscia (Szeged), Vol. 19, No. 2, p 59-68, 1984. 5 Fig, 25 Ref.

Descriptors: *Tisza River, *Alpar Backwater, *Hungary, *Algae, Eutrophication, Water quality, Nutrients, Phosphorus, Seasonal variation, Species diversity, Phytoplankton.

The results of the studies carried out in the backwater of the Tisza at Alpar between 1976 and 1980 are briefly reviewed to determine the biological water quality of the backwater. In 1976-1977 and in 1980 the backwater was alpha-oligohalobic; due to inrush of Tisza water in 1977 and 1979, the halobity changed to beta-oligohalobic. The backwater was eutrophic and somewhat polluted. The seasonal changes characteristic to the zone were studied on the basis of the composition of the algal communities. In the studied years the tendency of changes was similar; in some cases, however, the effect of the changes in weather resulted in slight shifts. In 1982 a more detailed study was started at the Alpar backwater, in which the phytoplankton composition was examined to species level. For the demonstration of the seasonal changes regarding the algal communities the Czekanowski similarity index was used. The phytoplankton diversity of the water area was investigated by applying the Shannon-index. The chlorophyll-a and pheophytin-a concentrations were determined from the monthly samples. The algal association of the water sample taken in February completely differs from associations in other months. At that time a Synura species was dominant, with 130 million individuals/l. (Moore-IVI)
W85-03116

STUDIES ON THE QUALITATIVE AND QANTITATIVE COMPOSITION AND THE SEASONAL CHANGES OF PHYTOPLANKTON AT THREE SAMPLING AREAS OF THE DEAD TISZA AT LAKITELEK,
Lower-Tisza District Water Authority, Szeged (Hungary).
K. Kovacs, and E. Dobler.
Tiscia (Szeged), Vol. 19, No. 2, p 69-78, 1984. 5 Fig, 4 Ref.

Descriptors: *Tisza, *Lakitelek, *Hungary, *Phytoplankton, Seasonal variation, Backwaters, Species composition, Biomass, Diversity.

The backwater at Lakitelek is a bend cut through during river control work in the last century. The Northern section of the dead channel is part of the Kiskunsag National Park. Studies on phytoplankton were carried out at three sampling points on the dead Tisza at Lakitelek, in the Northern region. Samples were taken monthly over a period of one year, to study qualitative and quantitative composition and the seasonal changes in the phytoplankton. The biomass and diversity of phytoplankton were measured on the basis of the total algal count. Cluster analysis was used to determine what similarities in time and space are manifested by the algal communities of the three sampling locations. In the autumn, winter and spring periods, the samples from the various areas do not show expressed differentiation; the time-point of sampling is determinant in the development of the groups. At all three sampling areas the highest values of diversity were experienced in the summer months. The diversity index values in the winter months at the time of the winter biomass maximums are due to the outstandingly high number of individuals of a few species. (Moore-IVI)
W85-03117

EFFECTS OF ACIDIFICATION AND PHOSPHORUS ADDITION ON PHYTOPLANKTON BIOMASS AND PRODUCTIVITY IN A CIRCUM-NEUTRAL MESOTROPHIC LAKE RECEIVING ACID PRECIPITATION,
West Virginia Univ., Morgantown.
K. E. Havens, III, and J. DeCosta.
Archiv fur Hydrobiologie, Suppl. 69, No. 4, p 443-476, October, 1984. 11 Fig, 19 Tab, 30 Ref.

Descriptors: *Water pollution effects, *Acid precipitation, *Lake O'Woods, *West Virginia, *Trophic level, Acidification, Phosphorus, Mesotrophic lakes, Phytoplankton, Biomass.

A one year study was performed in 1980 to determine the trophic status of Lake O'Woods, and assess the impact of acid precipitation on this shallow lake. In situ bag experiments were performed during 1980 and 1981 to examine the effects of acidification and phosphorus addition on algal biomass and productivity. Lake O'Woods is a small impoundment in northern West Virginia, mesotrophic based on chlorophyll a concentrations, annual primary production, and total phosphorus loading. While the lake receives large inputs of hydrogen ions via the precipitation, the lake maintains a circum-neutral pH because a large limestone formation in the watershed effectively buffers the incoming acid. This limestone formation is very large and therefore Lake O'Woods resistance to acidification should be a long term phenomenon. Phosphorus addition resulted in increased phytoplankton biomass and productivity, regardless of pH. Nitrogen became a secondarily limiting nutrient in bags where phosphorus addition resulted in rapid algal growth. With the exception of an initial period of pH shock immediately following acid addition, acidification did not cause reduced algal biomass, production, or production efficiency, despite the extreme nature of the acidification treatments used. The results lend further support for the idea that as a lake is acidified, levels of algal biomass and production will be determined by the phosphorus concentration in the lake. The increased acidity should not have any significant effect on algal biomass, production, or production efficiency, unless for some reason it results in a change in phosphorus availability. (Baker-IVI)
W85-03123

FAUNISTIC INVESTIGATIONS OF THE HYPORHEIC INTERSTITIAL OF THE RIVER MUR (STYRIA, AUSTRIA) (FAUNISTISCHE UNTERSUCHUNGEN IM HYPORHEISCHEN INTERSTITIAL DES FLUSSES MUR (STEIERMARK, OSTERREICH)),
Graz Univ. (Austria). Inst. fuer Zoologie.
M. Kirchengast.
International Revue de Gesamten Hydrobiologie, Vol. 69, No. 5, p 729-746, 1984. 6 Fig, 2 Tab, 42 Ref.

Descriptors: *River Mur, *Interstitial water, *Invertebrates, *Water pollution effects, *Austria, Population dynamics, Aquatic fauna.

Two distinct sections of the River Mur, Styria, Austria, one almost unpolluted and the other heavily polluted by domestic and industrial waste waters, were investigated for two years. Essential differences occur in the following ecological parameters. The maximal water temperature in summer is 11 C at Murau and 18 C at Granz. The oxygen concentration of the river water at Murau oscillates in the vicinity of 10.5 mg/l and never drops below 4.1 mg/l in the sediments. In the Graz area, however, the oxygen concentration of the running water fluctuates between 4.5 and 11.5 mg/l and decreases in the hyporheic interstitial zone to between 0.1 and 2.5 mg/l. The lack of sufficient oxygen is responsible for the absence of some species. Calcium lignosulfonic acids can be found only in the Graz area where they occur in large amounts. Sphaerotilus natans filaments cover the entire river bottom in the Graz region and reach a height of several centimeters. This sewage bacterium does not occur in the Murau area. The fauna of the clean section differs from that in the polluted region qualitatively, and even to a greater degree quantitatively. In the area upstream from Murau, chironomids were most numerous, followed in abundance by trichopterans, oligochaetes, nematodes and water mites. All other taxa together comprise barely 10% of the total invertebra fauna of the Murauregion. In the Graz regio oligochaetes clearly form the predominant grou followed in abundance by chironomids and nem todes. All other taxa together contribute less th 1% to the total number of species. Water mites a completely absent. (Baker-IVI)
W85-03126

TOXIC BLUE-GREEN ALGAL BLOOMS I EUROPE: A GROWING PROBLEM,
Norsk Inst. for Vannforskning, Oslo.
O. M. Skulberg, G. A. Codd, and W. W. Carmichael.
Ambio, Vol. 13, No. 4, p 244-247, 1984. 2 Fig, Tab, 37 Ref.

Descriptors: *Algal growth, *Toxicity, *Europ *Eutrophication, Saline water, Fresh water, Publ health, Water pollution effects, Toxins, Toxicit

Several species of blue-green algae in saline an freshwaters produce toxins which cause illness death to domestic animals, birds and fish. Toxici can vary in time and location within a given wat body. Blooms and toxic blooms are often associa ed with man-induced eutrophication. Situations i volving suspected toxic blue-green algae oft result in incomplete documentation of the circun stances for the toxic oubreak. Administrators an officials in Europe are generally not well informe about the possible health hazards from toxic blu green algae. The interest and awareness of som scientists as regards toxic blue green algae a increasing. Several recent cases of toxicity hav taken place in different parts of Northern Europ indicating that the problems of the toxic algae a more widespread than hitherto understood. Ne species of blue green algae with toxic properti have been discovered. Toxin producing popul tions of cyanophyceans have been detected in se eral geographical regions. Toxicity assays reveal complex pattern of pathology indicating that toxi ity can be chronic, acute or lethal. (Baker-IV
W85-03199

ACIDIFICATION OF LAKES: EFFECTS O WATERBIRDS IN SWEDEN,
Goeteborg Univ. (Sweden). Dept. of Zoology.
M. O. G. Eriksson.
Ambio, Vol. 13, No.4, p 260-262, 1984. 2 Fig, Ref.

Descriptors: *Water pollution effects, *Acidific tion, *Lakes, *Birds, *Sweden, Fish, Aquati plants, Ducks, Aluminum, Metals, Population dy namics, Turbidity, Aquatic insects, Acid rain.

The ecological changes in lakes damaged by acid fication affect waterbirds in many different way according to the feeding habits of each specie concerned. Ducks feeding on aquatic insects ar favored by the reduced competition with fish fo common prey. Goldeneye in particular exploit th increased populations of highly mobile insect which turn up in lakes with reduced densities o fish. Birds which eat fish are compensated for th decreasing numbers of fish by the increasing cla ity of the water which makes the remaining fis easier to see. In addition to exposure to ecologic changes resulting from acidification, birds are als increasingly exposed to metal pollutants, whic increase in acidifed waters. Among passerine bird impaired reproductive success has been related t breeding in territories close to the shore, wher they are exposed to aluminum by feeding o emerging insects. Waterbird fauna is in gener sparse along lakes susceptible to acidification, bu for some species a considerable proportion of th total European populations breed at such water and for them the situation is critical. (Baker-IVI
W85-03200

FRESHWATER ONCOLITES CREATED BY IN DUSTRIAL POLLUTION, ONONDAGA LAKE NEW YORK,
Geological Survey, Lakewood, CO. Water Re sources Div.
W. E. Dean, and J. R. Eggleston.

imentary Geology, Vol. 40, No. 4, p 217-232, gust, 1984. 10 Fig, 2 Tab, 10 Ref.

scriptors: *Onondaga Lake, *New York, *On-ites, *Water pollution effects, Calcium carbon-Sodium, Chlorides, Bicarbonates, Cyanophyta, rophytes, Lakes.

ondaga Lake is a culturally eutrophic marl lake hin the metropolitan area of Syracuse, New rk. The lake is moderately saline with waters n in calcium, sodium, chloride and bicarbonate. rge quantities of calcium carbonate that are pre-itated in the lake result from excess calcium plied as calcium chloride wastes produced by a-ash manufacturing to lake waters that are at near saturation with respect to calcium carbon-from solution of carbonate rocks in the drain-basin. Beaches along the leeward shore of the e are composed almost entirely of oncolites ging from a few millimeters to several centime-s in maximum dimension. Offshore, in 1-2 m of ter, the oncolites are biscuit-shaped concretions much as 15 cm in diameter. The oncolites con-mainly of low-magnesium calcite, but dissolu-n of the carbonate with dilute acid results in a ss of blue-green algal filaments of the same proximate size and shape as the original oncolite. st oncolites have an obvious nucleus; the most mmon nucleus is the hollow stem and cortica-n tubules of charophytes. Charophytes do not cur in Onondaga Lake today although they are mmon in other limestone-bedrock lakes in cen-l New York State. Charophytes probably were minated by the marked increases in salinity of lake that resulted from the introduction of la-ash manufacturing on the lake shores around 30 which means that growth of the oncolites gan at least 100 years ago. (Baker-IVI)
85-03217

D. Waste Treatment Processes

ESTRUCTION BY OZONE OF AMOEBA YSTS IN RECYCLED SWIMMING POOL ATER,
en Univ. (France). Unit of Pharmaceutical Sci-ces.
Perrine, D. Barbier, P. Georges, and B. nglais.
fluent and Water Treatment Journal, Vol. 24, o. 8, p 299-303, August, 1984. 3 Tab, 18 Ref.

escriptors: *Swimming pools, *Protozoa, Amoeba, *Ozonation, Pathogenic protozoa, Dis-fection, Water reuse, Naegleria, Acanthamoeba, rtmannella, Public health, Water treatment.

spensions of cysts from cultures of eleven strains free-living amoeba of the Naegleria, Acantha-oeba and Hartmannella genera likely to be en-untered in swimming-pool water, some of which ay be pathogenic to man, were subjected to onization in bactericidal and virucidal condi-ons. For Naegleria, the method was not apprecia-y more effective than halogen treatment. There as, however, a considerable improvement for canthamoeba and cysts of A. culberstoni, a path-genic strain, which were resistant to chlorine, ere quickly destroyed by ozonization. Similarly, ysts of A. polyphaga, which resisted 40 mg OCl/liter for 60 minutes were largely destroyed y ozonization. The results show significant resist-nce of these cysts, but the original level of 9,200 ysts per liter was considerable, and much higher an that to be expected in a swimming pool, and e figure of 500 cysts per liter after ozonization is ell below the 20000 per liter considered as the rmissible maximum. Cysts of Hartmannella hich are also among those commonly resistant to alogen treatment, were destroyed fairly easily by zonization. (Baker-IVI)
W85-02725

VALUATION OF SINGLE- AND SEPARAT-D-PHASE ANAEROBIC INDUSTRIAL VASTEWATER TREATMENT IN FLUIDIZED ED REACTORS,
mperial Coll. of Science and Technology, London England). Public Health Engineering Lab.
M. A. Bull, R. M. Sterritt, and J. N. Lester.
Biotechnology and Bioengineering, Vol. 26, No. 9, p 1054-1065, September, 1984. 9 Fig, 8 Tab, 35 Ref.

Descriptors: *Fluidized beds, *Wastewater treatment, *Anaerobic digestion, Chemical oxygen demand, Industrial wastes, Acidification reactor.

Four fluidized bed reactors were used to evaluate single- and separate-phase anaerobic treatments of a high strength wastewater. Two reactors were fed with a synthetic wastewater, containing glucose as the primary carbon source, with a COD of 12000 mg/liter while the remaining pair were fed with a wastewater with a COD of 6000 mg/liter. At each influent strength, one fluidized bed reactor was operated as a single-phase system while the other was operated as a methanogenic reactor which was preceeded by an acidification reactor in a separated-phase system. The reactors were operated under steady-state and variable process conditions. Anaerobic fluidized bed reactors treating a glucose based substrate achieved good COD removal up to a COD loading of 15 kg/cu m/day. Above this loading, volatile acid accumulation indicated failure of the reactors. The addition of a stirred tank reactor to achieve a separated phase system with an acidification reactor followed by a methanogenic fluidized bed reactor improved effluent quality compared to a single-phase fluidized bed reactor. The separated-phase system produced an effluent with a considerably lower suspended solids concentration, and this was attributed to the superior settling properties of the acidification reactor sludge and the formation of ethanol and lactate in the acidification reactor which has been shown to reduce acid sludge production. Under shock load conditions, the separated-phase system was inherently more stable. In calculation of the kinetic parameters of acetate and propionate degradation, acetate degradation was 4.3 times greater and propionate degradation 9.9 times greater than values reported for a conventional anaerobic sludge digester. Specific degradation rates for acetate and propionate were 2.08 and 1.96 times higher, respectively, in a separated-phase system compared to the single-phase system. (Baker-IVI)
W85-02735

MICROBIOLOGICAL EXAMINATION OF A TWO-STAGE WASTEWATER TREATMENT PLANT, 1. COMMUNICATION: QUALITATIVE AND QUANTITATIVE EXAMINATION OF AEROBIC AND FACULTATIVELY ANAEROBIC CHEMOHETEROTROPHIC BACTERIAL POPULATIONS (MIKROBIOLOGISCHE UNTERSUCHUNGEN EINER ZWEISTUFIGEN ADSORPTIONS-BELEBUNGSANLAGE, 1. MITTEILUNG: QUALITATIVE UND QUANTITATIVE ERFASSUNG DER AEROBEN UND FAKULTATIV ANAEROBEN CHEMOHETEROTROPHEN BAKTERIENPOPULATIONEN),
Bonn Univ. (Germany, F.R.).
A. Wetzel, and W. Dott.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17, No. 4, p 121-126, August, 1984. 6 Fig, 3 Tab, 29 Ref.

Descriptors: *Activated sludge process, *Aeration, *Bacteria, Microorganisms, Sludge, Wastewater treatment facility.

Activated sludge samples, taken from both aeration tanks of a two-stage wastewater treament plant, were microbiologically examined. The number of viable bacteria was generally about an order of magnitude higher in stage A than in stage B. No significant differences were found between the two stages, however, when an analysis of the aerobic/facultatively anaerobic chemoheterotrophic bacteria flora was performed. Common bacterial groups included inert gram-negative rods, Enterobacteriaceae and pseudomonads. The sludges differ regarding the presence of protozoans, as higher organisms were found only in stage B. (Author's abstract)
W85-02737

ANTIBACTERIAL EFFECTS ON PREDOMINANT TAXA IN THE ACTIVATED SLUDGE SYSTEM OF A CHEMICAL COMBINE (DIE HEMMSTOFFRESISTENZ DOMINIERENDER BAKTERIENGRUPPEN IN DER BELEBTSCHLAMMANLAGE EINES CHEMIEWERKS),
Technische Univ. Muenchen, Weihenstephan (Germany, F.R.). Sueddeutsche Versuchs- und Forschungsanstalt fuer Milchwirtschaft.
H. Seiler, H. Blaim, and M. Busse.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17. No. 4, p 127-133, August, 1984. 1 Fig, 3 Tab, 22 Ref.

Descriptors: *Wastewater treatment, *Bacteria, *Purification, *Activated sludge process, Solvents, Sludge, Industrial wastes.

The sensitivity on selective media and the break point concentrations of bioinhibitory agents were tested for the prevalent bacterial groups of a wastewater treatment plant of the chemical industry. After a remarkable reduction in purification efficiency the strains of the dominant taxa comprised the most resistant bacteria. This confirms the assumption that the fall in process efficiency noted was caused by an intoxication of the activated sludge flora. The sensitivity of Cornyforms and other Gram-positive microorganisms enabled them to serve as indicator organisms for a low sludge load with poisonous effluents. Concepts to reduce the risk for sludge intoxication are discussed including the reduction of risk of sludge intoxication by operational control of the water treatment systems based on biological data. (Author's abstract)
W85-02738

INVESTIGATION AND DEVELOPMENT OF SWIMMING POOL WATER TREATMENT, III. LONG CONTACT TIME OZONATION FOR POOL WATER TREATMENT (ERFORSCHUNG UND ENTWICKLUNG DER SCHWIMMBADWASSERAUFBEREITUNG. III. MITT: BADEWASSERAUFBEREITUNG MIT OZON IM LANGZEITKONTAKT),
Technische Univ. Muenchen (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
D. Eichelsdorfer, and J. Jandik.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17, No. 4, p 148-153, August, 1984. 9 Fig, 1 Tab, 12 Ref.

Descriptors: *Swimming pools, *Ozonation, *Water treatment, Ozone, Disinfection, Filtration, Flocculation, Chlorination, Reaction rate.

In the ozone pool water treatment process, contaminants are normally removed in a stepwise process. Sieving, flocculation and filtration steps are followed by ozonation. The toxic ozone is removed from the water by filtration through an activated carbon layer before the water is brought back into a swimming pool. This treatment is followed by chlorination for disinfection. In the ozone process described the time available for the reaction of the ozone is very short - usually 1.5 to 3 minutes. However, some of the reaction rates are rather slow and longer reaction times need to be provided. The efficiency of the ozonation process with longer reaction times followed by slower filtration has been proven in a research project. (Baker-IVI)
W85-02740

EXPERIENCE WITH THE CO-DISPOSAL OF HAZARDOUS WASTE WITH DOMESTIC WASTE,
London Brick Landfill Ltd., Stwartby (England).
For primary bibliographic entry see Field 5E.
W85-02752

STRIPPING OF ORGANIC CHEMICALS IN BIOLOGICAL TREATMENT PROCESSES,
IT Corp., Knoxville, TN.
K. N. Truong, and J. W. Blackburn.
Environmental Progress, Vol. 3, No. 3, p 143-152, August, 1984. 8 Fig, 8 Tab, 14 Ref. EPA contracts 68-03-3027 and 68-03-3074.

Descriptors: *Biological wastewater treatment, *Stripping, *Organic compounds, Volatilization,

Volatility, Industrial wastewater, Activated sludge process.

Wastewater treatment plants often receive volatile compounds in their influent from industrial discharges or from other sources. Stripping is distinguished from volatilization by the mode of gas-liquid contact. Stripping is the process of gas/liquid mass transfer in systems with dispersed gas or liquid phases. Volatilization occurs at the major surface between gas and liquid phases. Stripping processes normally have a much greater interfacial area and may often be more turbulent than volatilization processes. A method is presented which offers a simpler approach for estimating stripping rates in pure water and wastewater than other approaches based on the two film theory of mass transfer. The presence of surfactants, salts, oils, and nonviable biomass was found to vary the stripping rate, but in no case was the effect more than 50% when compared with pure water. The values of the stripping rate constant predicted from the model in the study seem to agree reasonably well with previously reported values. The stripping predictive fate method was tested in continuous large scale activated sludge units. (Baker-IVI)
W85-02767

PREDICTIVE ASSESSMENT OF PRIORITY POLLUTANT BIO-OXIDATION KINETICS IN ACTIVATED SLUDGE,
Tennessee Univ., Knoxville. Dept. of Microbiology.
G. S. Sayler, A. Breen, J. W. Blackburn, and O. Yagi.
Environmental Progress, Vol. 3, No. 3, p 153-163, August, 1984. 11 Fig, 9 Tab, 14 Ref.

Descriptors: *Activated sludge process, *Kinetics, *Biooxidation, Chemical reactions, Bacteria, Organic compounds, Biological wastewater treatment, Phenols, Mineralization, Toluene.

Bacterial population densities and enzyme activities were measured in activated sludge to serve as predictive tools for assessing biooxidation of organic pollutants. Batch sludge cultivation using fill-and-draw reactors was performed to establish acclimated sludge used in developing the biooxidation assay and to determine the biooxidative response of the sludge during acclimation to test pollutant substrates. An overall summary of the rate constants for the substrates is given. There was less than a two fold difference in the maximum attained first order rate constant for phenol mineralization in either batch or continuous sludge cultures. This relationship also holds true for toluene mineralization in the same comparison. A like relationship is observed for the mean first order rate constants for the two substrates in the different sludge cultures. These results indicate the quantitative role of developing bacterial populations during acclimation and can be reflected in second order mineralization rate constants. On a comparative basis, phenol removal rates are an order of magnitude faster than mineralization of the substrate to carbon dioxide. The results of this study indicate that potential may exist for predicting biooxidation mineralization kinetics based on observed population and enzyme population. (Baker-IVI)
W85-02768

IN-SITU AND ON-SITE BIODEGRADATION OF INDUSTRIAL LANDFILL LEACHATE,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering.
D. S. Kosson, and R. C. Ahlert.
Environmental Progress, Vol. 3, No. 3, p 176-183, August, 1984. 7 Fig, 4 Tab, 10 Ref.

Descriptors: *Leachates, *Landfills, *Industrial wastes, Wastewater treatment, Biodegradation, Hazardous wastes.

Industrial landfill leachates are similar to very high strength, complex industrial wastewaters. An on site field, pilot scale experiment was performed which demonstrated promising results for the treatment of aqueous hazardous wastes. Pretreatment was needed to remove bulk and dispersed organic phases. Seeding and acclimation of a mixed microbial population was sufficient to achieve an active in-situ microbial community. A sandy loam and a clay loam with different permeabilities and sorptive characteristics have been investigated. TOC reductions in excess of 90% were readily achieved and reductions in excess of 95% have been observed. (Baker-IVI)
W85-02769

COMPETITIVE ADSORPTION OF PHENOLS ON ACTIVATED CARBON,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
C. Yen, and P. C. Singer.
Journal of Environmental Engineering, Vol. 110, No. 5, p 976-989, October, 1984. 4 Fig, 5 Tab, 18 Ref. EPA grant R804917.

Descriptors: *Phenols, *Adsorption, *Activated carbon, *Langmuir model, *Ideal Adsorbed Solution theory, Model studies, Adsorbents, Water treatment, Wastewater treatment, Organic compounds.

The adsorption of phenol and substituted phenols on activated carbon was examined. An improved calculation procedure for the Ideal Adsorbed Solution (IAS) model was developed to describe adsorption in multi-component systems. This method is more accurate and more effective than the original published method and, most importantly, makes the IAS model predictive in nature. Using this modified calculation method, the IAS model was proved to be superior to the Langmuir competitive model in predicting multi-component adsorptive behavior in several phenolic mixtures. These included binary and ternary systems, systems containing similar and dissimilar components, and mixtures containing different initial concentrations of the solutes. The IAS model was found to be especially better than the Langmuir competitive model in predicting the concentration of minor components in systems containing species with different initial concentrations. The modified three-parameter Freundlich model was shown to effectively describe single-solute adsorption, and was proven to be useful in predicting multi-component adsorptive behavior because of its computational efficiency in the IAS model. (Baker-IVI)
W85-02820

SEASONAL VARIATIONS OF PHOSPHATE SPECIES IN WASTEWATER,
Sherbrooke Univ. (Quebec). Dept. of Civil Engineering.
K. S. Narasiah, and C. Morasse.
Journal of Environmental Engineering, Vol. 11, No. 5, p 1005-1008, October, 1984. 1 Fig, 1 Tab, 4 Ref.

Descriptors: *Phosphates, *Wastewater analysis, *Seasonal variation, Pollutant identification, Orthophosphates, Effluents, Wastewater treatment.

On-site and lab experiments were conducted on an existing biological wastewater treatment plant during winter and summer. Correlations between the phosphate fraction showed that orthophosphate in effluent constituted a greater proportion of total phosphorus during summer months than winter months. This difference may be due to more extensive hydrolysis of polyphosphates in the wastewater during summer than winter. The defined relationships between total orthophosphate (TOP) and total phosphate (TP) could be useful in the day-to-day operation of a wastewater treatment plant as they point out the change of these relationships from summer to winter months. Plant operators who utilize a TOP measurement to characterize effluent TP would be well advised to determine the values of phosphorus species due to seasonal changes. By measuring orthophosphates in the effluent, which is fairly direct and uncomplicated, one can calculate the total P in the effluent. (Baker-IVI)
W85-02823

ESTIMATING CROP GROWTH RATE WITH LAND TREATMENT,
Florida Univ., Gainesville. Dept. of Agricultu
Engineering.
A. R. Overman.
Journal of Environmental Engineering, Vol. 1
No. 5, p 1009-1012, October, 1984. 3 Fig, 6 R

Descriptors: *Plant growth, *Crop yield, *La
disposal, Wastewater irrigation, Bermudagra
Water reuse, Grasses.

Data from the literature has been used to estim
growth rate of coastal bermudagrass as affected
harvest frequency and wastewater irrigatio
Growth data was shown to follow the Gauss
probability function with a correlation coeffici
of 0.9924. Irrigation and harvest frequency we
shown to influence total yield, but not the shape
the growth curve. Assuming an average nutrie
concentration of the grass, it is possible to calcula
weekly uptake of nutrients. (Baker-IVI)
W85-02824

WASTE WATER TREATING PROCESS,
Chevron Research Co., Richmond, CA.
J. P. Leonard, N. J. Haritatos, and D. V. Law.
Chemical Engineering Progress, Vol. 80, No. 10,
57-60, October, 1984. 3 Fig, 3 Tab, 1 Ref.

Descriptors: *Waste water treatment, *Econom
aspects, *Oil refineries, *Hydrogen sulfide, *Am
monia, Water reuse, Industrial wastes, Oil industr

The Chevron Waste Water Treating Proce
(WWT) is an economical method of treating so
water which produces high quality hydrogen su
fide suitable for feeding a sulfur recovery un
anhydrous ammonia suitable for sale and strippe
water suitable for reuse or discharge. The WW
process considered consists of four main proces
ing steps: degassing and feed storage, acid g
stripping, ammonia stripping, ammonia purificatio
and liquefaction. The WWT process is flexible an
versatile. The two major reasons for building
WWT instead of a SWS followed by an ammoni
burning SRU are the economics of ammonia re
covery and improved SRU operation. The ec
nomics of the WWT process strongly depend o
the amount of ammonia present in the feed. Th
more ammonia in the sour water, the more incen
tive there is to recover it as a valuable by-produc
Separation of ammonia from the hydrogen sulfid
in the WWT has the following advantages for th
SRU: elimination of ammonia-related problems i
SRU's such as lower operating factor, plugging i
condensers and seals caused by ammonia salts, an
catalyst deactivation; increased overall sulfur re
coveries; and reduction in the size of SRU's an
tail gas units because ammonia and the air neede
to burn it act as diluents. As an example, consider
ation is given to a refinery SRU that gets 70% o
its acid gas feed from an amine plant with the res
coming from a sour water stripper. The gas from
the sour water stripper contains 24 metric ton/d o
ammonia. Removing the ammonia from the SRU
reduces the SRU feed and combustion air flow
rates by about 45%, thus reducing the size and cos
of the SRU. The tail gas flow rate from the SRU i
reduced by about 55%. Removing the ammoni
diluent from the SRU can also increase the sulfu
recovery by as much as 2%. (Baker-IVI)
W85-02863

ACTIVATED CHARCOAL AND MICROFLORA IN WATER TREATMENT,
Katholieke Univ. Leuven (Belgium). School o
Public Health.
P. J. Van Dijck, and H. van de Voorde.
Water Research, Vol. 18, No. 11, p 1361-1364,
1984. 4 Tab, 11 Ref.

Descriptors: *Activated carbon, *Bacteria, *Water
treatment, Disinfection, Wastewater treatment,
Adsorption, Adsorbents, Microorganisms, Can-
dida, Vahlkampfia, Leptospira, Trichomonas.

Significant sanitation was achieved by using 0.5%
activated charcoal in influent and effluent of a
wastewater treatment plant. The drastic reduction
in the microorganisms was confirmed for twelve
tester strains, including gram-positives, gram-nega-

tives, Candida albicans, Vahlkampfia avara, Leptospira biflexa and Trichomonas foetus. The removal of microflora correlates positively with the quality of the activated charcoal used. Once adsorbed, the bacteria could not be eluted by salt, alkalinization or citric acid. Diatomaceous earth also eliminated some of the microflora, but white clay (Bolus alba) and zinc dust are inefficient. The activated carbon may be reused several times after regeneration by heat (2 h at 160 C), but eventually a slight decrease in adsorbing capacity occurs. (Author's abstract)
W85-02907

EQUALIZATION/NEUTRALIZATION MODELING AN APPLICATION TO FLUORIDE REMOVAL,
Texas Univ. at Austin. Dept. of Civil Engineering.
D. F. Lawler, and D. H. Williams.
Water Research, Vol. 18, No. 11, p 1411-1419, 1984. 13 Fig, 2 Tab, 10 Ref.

Descriptors: *Fluoride, *Aluminum refining, *Wastewater treatment, *Model studies, *Equalization, *Normalization, Hydrogen fluoride, Hydrogen ion concentration, Lime, Carbonates, Chemical precipitation, Scrubbers.

Hydrogen fluoride gas (HF(g)) is produced in the reduction of aluminum ore through the use of cryolite, Na3AlF6. The HF(g) is often removed from the waste gas stream by wet scrubbing, thereby transferring the fluoride into water as hydrofluoric acid. The scrubber wastewater is then treated with lime, Ca(OH)2, resulting in the precipitation of CaF2. For the capture of the fluoride in the scrubbers and removal via precipitation and sedimentation, plant operators attempt to maintain the pH in the water going to the scrubbers in the narrow range of $8.0 < pH < 8.3$. Carbonate, when present in the system studied, was found to interfere with the precipitation in the pH range 7-11 but little carbonate was in the system studied because of the low pH and high gas/liquid exchange in the scrubber. A general approach to modeling equalization/neutralization problems was developed using mass balances on conservative substances and a charge balance to determine pH. The precipitation of CaF2 in the pH range 6-11 is strongly dependent on pH only when carbonate is present. Due to the capture of the HF, the pH of the effluent of the scrubber is inevitably low; the low pH leads to the virtual absence of carbonate in the water, which in turn leads to the difficulty of controlling the pH in the range 6-10. (Collier-IVI)
W85-02914

KINETICS OF MICROBIAL INACTIVATION BY CHLORINE - I; REVIEW OF RESULTS IN DEMAND-FREE SYSTEMS,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
C. N. Haas, and S. B. Karra.
Water Research, Vol. 18, No. 11, p 1443-1449, 1984. 4 Tab, 29 Ref.

Descriptors: *Kinetics, *Chlorine, *Microbiological studies, *Disinfectants, Water treatment, Chloramine, Model studies, Chlorination.

Available data on microbial inactivation by free and combined chlorine were analyzed under demand-free conditions using several different kinetic models. The Chick-Watson model produced an adequate fit and, in general, no substantial improvement in the fit to experimental data is obtained by using the alternative models. The relative kinetics of inactivation by free vs combined chlorine have been compared to the available information on the equilibrium between free and combined chlorine species, and this comparison suggests that the combined chlorine species themselves, rather than merely the equilibrium free chlorine present, may possess some biocidal activity. The propagated measurement errors have been estimated, and based on this, in most cases, the residuals from the Chick-Watson estimation equation are greater than the measurement error, and therefore potential for improvement in the understanding of disinfection kinetics exists. (Baker-IVI)
W85-02917

KINETICS OF MICROBIAL INACTIVATION BY CHLORINE - II; KINETICS IN THE PRESENCE OF CHLORINE DEMAND,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
C. N. Haas, and S. B. Karra.
Water Research, Vol. 18, No. 11, p 1451-1454, 1984. 5 Tab, 11 Ref.

Descriptors: *Kinetics, *Coliforms, *Wastewater, *Disinfection, *Model studies, *Chlorine, Water treatment, Chlorination, Bacteria, Hydraulic properties.

Use of the empirical Selleck model for description and analysis of kinetics of coliform decay in wastewater and other systems containing chlorine demand, has been shown to be justifiable as an approximation to rational kinetic behavior. More importantly, it suggests that the dominant features of wastewater chlorine disinfection may be predicted from and are consistent with the results obtained in demand-free systems. The sensitivity analyses conducted indicate that the Selleck parameters depend most strongly upon the inactivation rates of microorganisms which could be determined in demand-free systems. By additional knowledge of the immediate chlorine demand, and of the rate of conversion of free to combined chlorine it is possible to provide a good estimate of specific parameters which may then be used for design purposes. The efficiency of disinfection in real wastewater chlorine contact chambers is influenced by the hydraulic performance of the contact chambers. By application of the reaction rates estimated by use of the rational model is should be possible to estimate quantitatively the degree of influence on such hydraulic factors. This would provide a rigorous test of the validity of the kinetic model discussed. (Baker-II)
W85-02918

ACUTE TOXICITY OF CHROME ELECTROPLATING WASTES TO MICROORGANISMS: ADSORPTION OF CHROMATE AND CHROMIUM (VI) ON A MIXTURE OF CLAY AND SAND,
Aligarh Muslim Univ. (India). Environmental Research Lab.
For primary bibliographic entry see Field 5C.
W85-02921

DYNAMICS OF POLLUTION-INDICATOR AND HETEROTROPHIC BACTERIA IN SEWAGE TREATMENT LAGOONS,
Montreal Univ. (Quebec). Dept. of Biological Sciences.
P. Legendre, B. Baleux, and M. Troussellier.
Applied and Environmental Microbiology, Vol. 48, No. 3, p 586-593, September, 1984. 5 Fig, 1 Tab, 25 Ref. Natural Sciences and Engineering Research Council Canada grant A7738.

Descriptors: *Bioindicators, *Heterotrophic bacteria, *Wastewater treatment, *Lagoons, Phytoplankton, Zooplankton, Bacterial analysis.

The spatio-temporal dynamics of pollution-indicator bacteria and aerobic heterotrophic bacteria were studied in the sewage treatment lagoons of an urban wastewater center after 26 months of biweekly sampling at eight stations in these lagoons. Robust statistical methods of time-series analysis were used to study successional steps (through chronological clustering) and rhythmic behavior through time (through contingency periodogram). The aerobic heterotrophic bacterial community showed two types of temporal evolution: in the first four stations, it seems mainly controlled by the nutrient support capacity of the sewage input, whereas in the remaining part of the lagoon, it seems likely that the pollution-indicator bacteria are gradually replaced by other bacterial types that are better adapted to this environment. On the other hand, the pollution-indicator bacteria showed an annual cycle which increased in amplitude at distances further from the wastewater source. The main events in this cycle were produced simultaneously at all stations, indicating control of these bacterial populations by climatic factors, which act through physical and chemical factors, and also through other biological components of this ecosystem (phytoplankton and zooplankton). Results from this study suggest a modified design for a future study program. (Author's abstract)
W85-02935

SUPPORT BIOLOGIES IN WASTE WATER TECHNOLOGY (TRAGERBIOLOGIEN IN DER ABWASSERTECHNIK),
Krupp (Fried.) G.m.b.H., Essen (Germany, F.R.).
C. Oehme.
Chemie Ingenieur Technik, Vol. 56, No. 8, p 599-609, August, 1984. 14 Fig, 5 Tab, 104 Ref.

Descriptors: *Wastewater treatment, *Biological wastewater treatment, Activated carbon, Biodegradation, Biomass, Contact beds.

The numerous possibilities of immobilizing biomass and using it fixed on a wide range of carriers in the available types of reactors is matched by a great variety of practical applications in waste water purification technology for partial, complete, subsequent, and ultrapurification. All support biologies share the following advantages to a greater or lesser extent: smaller reactor volumes and shorter reaction times thanks to higher biomass concentrations; volume reduction or elimination of subsequent purification pools owing to the more favorable sludge index and fixation in the reactor or the filter; long sludge lifetimes are possible (favorable for slowly multiplying nitrifiers and specialist strains); no floating sludge formation on carbohydrate degradation or nitrification; and increase in process stability and degradation activity towards refractory compounds which are difficult to degrade biologically if suitable supports showing synergistic activity are used, such as highly porous activated charcoal. (Author's abstract)
W85-02958

HIGH-BOD LOADING TREATMENT USING LARGE-SCALE DEEP AERATION TANKS,
Hitachi Research Lab. (Japan).
N. Shimizu, T. Sumitani, Y. Masaki, Y. Odawara, and S. Hisatomi.
Journal of Fermentation Technology, Vol. 62, No. 3, p 277-284, 1984. 11 Fig, 2 Tab, 9 Ref.

Descriptors: *Food-processing wastes, *Deep aeration tanks, *Activated sludge process, Wastewater treatment, Aeration, Biochemical oxygen demand, Oxygen transfer.

The rising cost of land and the smaller areas available for construction of wastewater treatment plants have stimulated increased interest in deep aeration tanks for activated sludge process wastewater treatment. A large-scale aeration process was investigated with one deep aeration tank 5 m in diameter and three deep aeration tanks 8.7 m in diameter, all of which were capable of treating wastewater at high levels of BOD loading. Beanpaste wastewater treatment was carried out in the 5 m diameter aeration tank with a a liquid height of 9 m. The BOD removal rate ranged from 92 to 99%. The sludge volume index (SVI) values ranged from 180 to 320 mg/l. The oxygen transfer rate is directly proportional to BOD loading. The size of deep aeration tanks used in the activated sludge process can be increased if the oxygen transfer rate is used as a parameter. Beet sugar wastewater with a feed rate of 6,000 cu m/day was treated in three 8.7 m diameter tanks, each of which had a liquid height of 9 m. The BOD removal rate ranged from 98 to 99% the SVI values of the activated sludge ranged from 127 to 148 ml/g. The power required was only 0.56 kWh/hg-BOD removed. Very high-BOD wastewater can be efficiently treated with deep aeration tanks. (Moore-IVI)
W85-02972

WATER AUTHORITY VIEW OF TRADE EFFLUENT CONTROL,
M. D. Colley.

Journal of the Institution of Water Engineers and Scientists, Vol. 38, No. 4, p 297-304, October, 1984. 1 Tab, 8 Ref.

Descriptors: *Industrial wastewater, *Northumbrian Water Authority, *England, Water pollution control, Spills, Sewer systems, Wastewater facilities, Sampling.

Within a national framework, agreed between the Confederation of British Industry (CBI) and the water industry, a generally uniform system of industrial (trade) effluent control and charging has developed, though some differences of approach remain between water authorities. The Northumbrian Water Authority (NWA) is one of the smaller authorities, serving a population of about 2.6 million. The trade effluent and river quality functions were combined in 1980 into a Pollution Prevention Department. Only a small proportion of industrial effluent discharges to sewers cause problems of a continuous nature. Short-term unsatisfactory discharges are more common and prove more troublesome because of their unexpected nature, and the disruptive effect they have on sewerage and sewage disposal operations. Close liason between water authorities and developers at the early planning stage can help to avoid many of the causes of sewerage and sewage disposal incidents, especially those caused by leaks and spillages. Efforts are being made to reduce costs by reducing sampling programs, while retaining adequate control of discharges and securing sufficient data to levy fair charges. (Moore-IVI)
W85-03017

TRADE EFFLUENT CONTROL - AN INDUSTRIAL VIEWPOINT,
Imperial Chemical Industries Ltd., Brixham (England). Brixham Lab.
L. R. Reynolds, and B. R. H. Williams.
Journal of Institution of Water Engineers and Scientists, Vol. 38, No. 4, p 305-315, August, 1984. 5 Tab, 20 Ref.

Descriptors: *Industrial wastewater, *Legislation, *United Kingdom, European Economic Community, Water quality, Water pollution control, Cost analysis.

During the past few decades there has been a progressive extension in legislative control over sewage and trade effluent discharges. While inevitably leading to increased public and industrial expenditure, in the United Kingdom (UK) it has also resulted in a steady and noticeable improvement in the quality of natural receiving waters. Overall this implementation of extended legislation can be said to have been cost-effective. New legislative controls proposed in EEC (European Economic Community) Directives and in UK law appear to be more extensive than hitherto, and if implemented without due consideration of the balance between scientific assessment, cost effectiveness and ultimate aims, will result in significant cost increases to industry, water authorities and public alike, without a genuine and worthwhile environmental benefit. (Moore-IVI)
W85-03018

BEHAVIOUR OF PERSISTENT ORGANOCHLORINE MICROPOLLUTANTS DURING PRIMARY SEDIMENTATION OF WASTE WATER,
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
A. G. Gutierrez, A. E. McIntyre, R. Perry, and J. N. Lester.
Science of the Total Environment, Vol. 39, No. 1/2, p 27-47, October, 1984. 2 Fig, 10 Tab, 27 Ref.

Descriptors: *Wastewater treatment, *Sedimentation, *Organic pesticides, Insecticides, Aldrin, Endrin, Dieldrin, gamma-HCH, Polychlorinated biphenyls, Pilot plants, Water reuse, Water quality.

The behavior of polychlorinated biphenyls (PCB) and organochlorine insecticides (OCL), gamma-HCH, aldrin, dieldrin, and endrin during primary sedimentation of raw sewage containing varying concentrations of suspended solids, surfactants, and grease was investigated using jar test experiments. The effect of varying hydraulic and influent raw sewage suspended solids loadings on the removal of PCB and OCL during primary sedimentation were investigated using a pilot scale sedimentation tank. Significant removals of micropollutants into the primary sludge were noted. During the course of primary sedimentation, acceptable removals of suspended solids from the raw sewage influent were achieved and it was apparent that the sedimentation tanks were performing satisfactorily. The removals of PCB ad OCL during primary sedimentation were variable, although broadly within the range of those reported from previous studies. Where sewage effluents are discharged to rivers which are abstraction sources factors such as hydraulic dilution and natural adsorption and degradation processes in the water course may attenuate concentrations of organic contaminants such that conventional treatment at a subsequent abstraction point will produce potable water of an acceptable quality. If potable water of sufficient quality was not consistently produced, it may be debateable whether to upgrade water or waste water treatment processes. (Baker-IVI)
W85-03031

ENHANCED ACTIVATED SLUDGE WASTE TREATMENT BY THE ADDITION OF ADSORBENTS,
Kuwait Univ., Safat. Dept. of Civil Engineering.
M. F. Hamoda, and M. A. Fahim.
Environmental Pollution (Series A), Vol. 36, No. 3, p 283-294, 1984. 7 Fig, 1 Tab, 9 Ref.

Descriptors: *Activated sludge process, *Wastewater treatment, *Adsorbents, *Charcoal, *Kaolin, Sludge, Organic compounds.

Laboratory batch and continuous-flow experiments were conducted at 20 degrees C on primary treated wastewater using charcoal and kaolin in concentrations between 0 and 5000 mg/liter added to activated sludge bioreactors. Organic removal in the activated sludge system was enhanced by the addition of charcoal or kaolin, but the latter was relatively less effective. Removal efficiency increased with sorbent concentration to an optimum dosage of about 2000 mg/liter. Kinetic relationships obtained can be approximated by a first order reaction in which an apparent rate constant describes the overall substrate removal. Addition of sorbent generally improves sludge settleability and increases solids retention in the activated sludge system. Sorbent enhancement of organic removal could be attributed to concurrent adsorption and stimulation of biological activity. (Baker-IVI)
W85-03049

EXPERIMENTAL STUDY OF OZONATION FOLLOWED BY SLOW SAND FILTRATION FOR THE REMOVAL OF HUMIC COLOUR FROM WATER,
Queen's Univ., Belfast (Northern Ireland).
M. H. Gould, D. A. Cameron, and T. F. Zabel.
Ozone: Science and Engineering, Vol. 6, No. 1, p 3-15, 1984. 4 Fig, 3 Tab, 7 Ref.

Descriptors: *Ozonation, *Water treatment, *Color removal, *Northern Ireland, Humic substances, Filtration, Sand filters, Turbidity, Iron.

A pilot plant operation undertaken in Northern Ireland to investigate the use of ozonation followed by slow sand filtration for the removal of humic color from an upland water is described. Eleven separate test runs were undertaken using a number of process combinations and a range of ozone dosages. An ozone dose of 5 mg/l was required to reduce the color from 40 Hazen to less than 20 Hazen. At least for this source water, pre-ozonation generally reduced the filter run length of the slow sand filter. Pre-ozonation had little influence on the turbidity and iron concentration in the final water. Turbidities in excess of 1 NTU and iron concentration above 0.1 mg/l were frequently found in the effluent. Very good treated water quality was achieved with pre-ozonation followed by rapid gravity filtration and also sand filtration. Turbidities and iron concentrations were consistently reduced to below 0.3 NTU and 0.02 mg/l respectively and the filter run length was extended to more than 80 days. (Baker-IVI)
W85-03050

TRADEOFFS IN WATER QUALITY MANAGEMENT,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
J. W. Male, and H. Ogawa.
Journal of Water Resources Planning and Management, Vol. 110, No. 4, p 434-444, October, 1984. 6 Fig, 8 Ref. OWRT project A-115-MASS.

Descriptors: *Water quality management, *Decision making, *Ware River, *Massachusetts, Economic aspects, Low flow, Wastewater treatment, Biochemical oxygen demand, Dissolved oxygen.

A diagram was developed which can be used to assess easily some of the trade-offs involved in water quality management decisions. The diagram incorporates wastewater treatment costs, effluent quality, receiving stream water quality and different critical streamflows. The procedure was developed using biochemical oxygen demand as the discharge to be regulated and dissolved oxygen as the water quality parameter of interest. The use of the procedure is demonstrated for the Ware River in Massachusetts, where a primary treatment plant is being upgraded to meet water quality standards. The diagram is used to address the economic effect of specifying a critical low flow, other than the seven-day ten-year low flow. For the case study chosen, significant cost savings could result without substantially reducing the water quality of the receiving stream. (Moore-IVI)
W85-03063

EFFLUENT IRRIGATION OF PARA GRASS: WATER, NITROGEN, AND BIOMASS BUDGETS,
Florida International Univ., Miami. Drinking Water Quality Research Center.
For primary bibliographic entry see Field 3C.
W85-03132

5E. Ultimate Disposal Of Wastes

ENVIRONMENTAL ENGINEERING AND PUBLIC HEALTH ASPECTS OF ALTERNATE DAIRY WASTE MANAGEMENT TECHNIQUES DESIGNED TO PROTECT GROUND WATER QUALITY,
California State Coll., San Bernardino. Dept. of Health Science and Human Ecology.
A. El-Ahraf, W. Van Willis, F. Moses, and L. Mowafy.
Journal of Environmental Health, Vol. 47, No. 1, p 15-19, July-August, 1984. 2 Fig, 4 Tab, 20 Ref.

Descriptors: *Public health, *Metals, *Waste management, *Animal wastes, *Soil amendments, Feeds, Refeeding, Heavy metals, Water pollution control, Iron, Manganese, Lead, Zinc, Copper, Nickel, Cadmium, Environmental effects.

Environmental engineering and public health aspects of refeeding as an alternate diary waste management technique for the protection of ground water quality are described. A technique has been developed to process dairy manure into three fractions: CI or sillage; CII, a protein rich fraction; and CIII, a soil amendment. CI and CII are being fed to cattle and poultry on an experimental basis. The mean concentrations for Cd, Cr, Cu, Fe, Mn, Ni, Pb, and Zn are reported as obtained from the analysis of the CI and CII fractions intended for use as animal feed. Levels of lead and cadmium in both CI and CII samples were lower than California's standards. There are no California standards for the other metals. Results indicate that protein products derived from the process do not contain sufficient concentrations of detected metals to warrant prohibiting their use as feed ingredients for poultry or cattle at this time. Based on metal levels obtained and the volume of manure produced, removal of the dairy waste from the Chino Basin would result in reduction of both soil contamination and the potential of water pollution by metals

at the following annual rates: 10,000 lbs of iron, 287 lbs of manganese, 232 lbs of zinc, 55 lbs of copper, 14 lbs of nickel, 4 lbs of lead, and 1.5 lbs of cadmium. Because of its higher fiber content, CI is also being considered as an energy source for dairy manure processing plants. (Baker-IVI)
W85-02724

EFFECTS OF PH ON THE RELEASE TO SOLUTION OF ZINC, COPPER AND NICKEL FROM METAL-LOADED SEWAGE SLUDGES,
Rothamsted Experiment Station, Harpenden (England). Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 5B.
W85-02742

EXPERIENCE WITH THE CO-DISPOSAL OF HAZARDOUS WASTE WITH DOMESTIC WASTE,
London Brick Landfill Ltd., Stwartby (England).
A. C. Cheyney.
Chemistry and Industry, No. 17, p 609-615, September 3, 1984. 3 Fig, 4 Tab, 8 Ref.

Descriptors: *Waste disposal, *Hazardous materials, *Domestic wastes, *Co-disposal, Landfills, Leachates.

The co-disposal of hazardous and non-hazardous wastes is carried out in L Field, Stewartby, England. L Field is a pit created during the excavation of clay for brickmaking. The first refuse was deposited in L Field in November 1976. The great preponderance of solid wastes entering the site is domestic in origin. Surface water is pumped away, while the leachate which collects at the toe of the refuse is pumped back into trenches dug into the refuse. Liquid waste is disposed of in other trenches. The landfill mass is used as a giant anaerobic digestor. The liquid removed when the landfill is loaded hydraulically is treated by the use of a clay incline plane. Landfill gas is collected for use. (Baker-IVI)
W85-02752

MANAGING ORGANICS IN SLUDGE REUSE PROGRAMS,
Madison Metropolitan Sewerage District, WI.
D. Taylor.
BioCycle, Vol. 25, No. 6, p 20-22, September, 1984. 2 Tab, 12 Ref.

Descriptors: *Sludge disposal, *Land disposal, *Organic compounds, *Regulations, Decision making, Planning, Management, Water pollution control.

As regulatory attention shifts to the organics in land application programs, it becomes essential that the proper approach is taken. Concentration specific regulations do not adequately protect human/animal health or environmental quality. In addition, they could preclude an opportunity to reuse sludges and use the treatment capability of the soil to degrade certain undesirable organics. The use of loading limits or maximum soil concentrations represents the most environmentally sound method of regulating organics in the land application program. The total mass loading to the environment for each site is then controlled, thereby minimizing the potential for groundwater contamination, plant accumulation, volatilization loss, and most importantly, introduction of organics to the food chain. (Baker-IVI)
W85-02796

SALINITY AND ALFALFA YIELD UNDER EFFLUENT IRRIGATION IN SOUTHWESTERN SASKATCHEWAN,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
For primary bibliographic entry see Field 3C.
W85-02802

COMPARING SOIL TESTS FOR A FORESTED ACID SANDY SOIL TOPDRESSED WITH SEWAGE EFFUENT,
Florida Univ., Gainesville.
J. G. A. Fiskell, R. Rebertus, N. B. Comerford, and W. L. Pritchett.
Soil Science Society of America Journal, Vol. 48, No. 5, p 1170-1174, September/October 1984. 5 Tab, 19 Ref.

Descriptors: *Forest soils, *Wastewater disposal, *Land disposal, *Acidic soils, *Soil tests, Forests, Chemical analysis, Heavy metals, Nutrients, Fennel, Nitrogen, Phosphorus.

Mobility of nutrients and heavy metals from mineralization of sewage sludge in acid soils is an environmental concern. Chemical properties of a forested acid sandy soil on flat terrain were examined at 6 and 30 months after ceasing multiple spray applications of sewage effluent. Total dry sludge applied was 5 and 26 Mg/ha on the treated 3- by 15-m portion of 9- by 15 m plots. Less than 1.1 mg/L of either NO3(-)-N or PO4(3-)-P was found at the 24- to 90- cm depth in soil solution extracted from the untreated bed adjacent to the planting area during 144 days. Treated areas were sharply defined by the growth of indigenous dog fennel (Eupatorium sp.) which was the dominant species. Mean soil pH was below 4.7 to 6 months and 5.1 at 30 months. Treated interbed Cd, Cu, and NH4(+)-N were higher with depth at 30 months than 6 months while the reverse held for PO4(3-)-P. Untreated bed or interbed soils had lower soil test values than corresponding treated soils. Much higher metal values were found at the 7-cm depth than deeper. Differences in metal extracted from treated and untreated soils were readily distinguished by DA (Mehlich I), DTPA-TEA, and EDTA-AA soil test methods. All three methods extracted from 25 to 75% of the metals applied in the sludge. Lack of more downward movement of N, P, and metals was attributed to slow mineralization of the sewage sludge. (Author's abstract)
W85-02878

EFFECT OF THERMAL PRETREATMENT ON THE ANAEROBIC BIODEGRADABILITY AND TOXICITY OF WASTE ACTIVATED SLUDGE,
Imperial Coll. of Science and Technology, London (England). Dept. of Chemical Engineering and Chemical Technology.
D. C. Stuckey, and P. L. McCarty.
Water Research, Vol. 18, No. 11, p 1343-1353, 1984. 8 Tab, 22 Ref.

Descriptors: *Activated sludge, *Biodegradation, *Toxicity, *Thermal pretreatment, *Anaerobic digestion, Digestion, Pretreatment, Organic compounds, Sludge, Wastewater treatment, Biological wastewater treatment.

The management of sludges generated by biological treatment of wastewaters has become an increasingly severe problem in recent years. The objective of this study was to examine the effect of thermochemical pretreatment on the anaerobic biodegradability and toxicity of waste activated sludge (WAS). In order to accomplish this, the degradability and toxicity of pure nitrogenous organic compounds present in WAS, and mixtures of these compounds were also evaluated. The anaerobic bioconvertibility and toxicity of the various organics were determined using batch bioassay techniques. It was found that WAS bioconvertibility increased with increasing pretreatment temperature up to a maxium at 175 degreees, and this resulted in an increase in methane production of 27% over the control. With the compounds and cultures used, mesophilic bioconvertibility and toxicity were found to be significantly higher than the corresponding values under thermophilic conditions. Finally, it was found that most of the pure individual nitrogen compounds and simple mixtures tested were quite biodegradable, although at the concentrations evaluated (20 g/l) most were toxic. It was also noted that small changes in structure could have a significant effect on both toxicity and bioconvertibility. In most cases thermochemical pretreatment of these individual compounds resulted in decreased bioconvertibility and increased toxicity. In conclusion it can be stated that thermochemical pretreatment enhances WAS bioconvertibility, while under identical treatment conditions, resulted in a considerable reduction in bioconvertibility of individual nitrogen compounds and mixtures. This effect appears to be due to the conversion of biodegradable organics to refractory ones. Further, the toxicity of WAS after thermochemical pretreatment appears to be due to its solubilization, and conversion of these soluble products to toxic compounds under more extreme treatment conditions. (Author's abstract)
W85-02905

SLUDGE DEWATERING AND COMPOST ECONOMICS,
E. Epstein, and J. E. Alpert.
Biocycle, Vol. 25, No. 7, p 32-33, October, 1984. 2 Fig, 4 Tab, 3 Ref.

Descriptors: *Sludge drying, *Composting, *Economic aspects, Costs, Sludge disposal, Bulking agents.

The dewatering of sewage sludge can greatly affect the cost of composting. Proper dewatering resulting in high sludge solids will reduce capital costs and operation and management costs. The higher the sludge solids content, the less bulking agent is needed and the volume of sludge and bulking agent to be handled is reduced. For proper composting to occur, the initial moisture content of the sludge bulking agent mixture should not exceed 60%. For efficient processing the final moisture should be about 45%. The sludge characteristics of key importance to process thermodynamics are solids content and degradable organic. The quantity of heat produced in composting is directly proportional to the amount of degradable solids contained in the sludge. Thus the composting process needs less space, fewer pieces of equipment, less labor, less fuel and smaller facilities. (Baker-IVI)
W85-02991

EVALUATING DEWATERING ALTERNATIVES,
Metcalf and Eddy of New York, NY.
J. Anderson, M. Ponte, S. Biuso, D. Brailey, and J. Kantorek.
Biocycle, Vol. 25, No. 7, p 34-35, October, 1985. 2 Fig, 6 Tab.

Descriptors: *Composting, *Sludge drying, *Municipal wastewater, *Clinton County, *New York, Wastewater treatment, Economic aspects, Belt filters, Centrifuges, Cost analysis.

Clinton County, New York is in the process of constructing a 34 dry ton per day enclosed composting system. The project includes upgrading the dewatering facilities at the Plattsburgh Water Pollution Control Plant which is currently able to produce a dewatered sludge at a maximum of 13% solids which is considerably less than the 20% level required. Use of continuous belt filter presses for dewatering municipal wastewater sludge in the US has increased in popularity in the past five years. Belt filters are sized based on two criteria: hydraulic loading gallons per minute per meter of belt width and solids loading pounds of solids per meter of belt width per hour. Design criteria for using the belt filter press are presented. Centrifuges have been used to dewater wastewater treatment sludge since the 1930's. Dewatering centrifuges are available from many manufactureres in a wide range of capacities and configurations. A summary of design criteria used for the cost-effectiveness analysis is presented. The results of a cost comparison for belt filter presses and centrigues are presented. After sufficient testing the belt filter presses displayed a slight economic advantage. Advantages for the belt filter presses were found not only in capital cost and operating cost but also in power requirements. The centrifuge shows an advantage only in the category of odor control as it is in an enclosed system. (Baker-IVI)
W85-02992

DEWATERING BY THE CAMBRIDGE SDS SYSTEM,

Cambridge Public Works Dept., MD. Pollution Control Div.
G. W. Spohr.
Biocycle, Vol. 25, No. 7, p 36-37, October, 1984. 7 Fig, 3 Ref.

Descriptors: *Composting, *Sludge drying, *Wastewater treatment, Leaching, Percolation, Sludge thickening.

Gravity sludge thickening is the most rational approach for all kinds of sludges, producing higher total solids concentrations and resulting in increased efficiency. A labor saving drying bed sludge technology is described, the SDS System. In the SDS System the detention time is set for 10 days. The process consists of collecting primary activated sludge mixtures in a wet well with a holding capacity of approximately 6,000 gallons. The sludge is then mixed with hydrated lime yielding a pH value of 11. At this stage, total solids content is about 3.5%. The material is conveyed via a plunger pump to a specially prepared holding bed which is built on a 6 inch layer of macadam and lightly sloped for better runoff and front end loader operation. The holding bed is concrete-walled on three sides with the front wall constructed out of a sandwiched berm of unscreened compost and woodchips. Any plant with a firm ground, and ability to convey and treat the leachate, could be considered a good candidate for this mode of sludge treatment. (Baker-IVI)
W85-02993

CADMIUM SORPTION AND MOBILITY IN SLUDGE-AMENDED SOIL,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
G. R. Cline, and G. A. O'Connor.
Soil Science, Vol. 138, No. 3, p 248-254, September, 1984. 1 Fig, 5 Tab, 24 Ref.

Descriptors: *Cadmium, *Sorption, *Mobility, *Sludge disposal, *Soil amendments, Trace metals, Leaching, Calcareous soils.

Soil amendments may increase the mobility of trace metals, and Cd may be the most mobile trace metal in sludge amended soils. Cadmium sorption was studied in three soils that were unamended, freshly amended, or preconditioned with gamma-irradiated sewage sludge. Metal sorption was studied in the same soils treated with a CaCl2-extract of the sludge. Cadmium sorption was greatest in the unamended soils, less in soils preconditioned with sludge, and least in the freshly amended soils and sludge-extract-treated soils. Reduced free metal ion activity did not explain the treatment effects. Despite the reduction in metal retention effected by various treatments, cadmium mobility was very limited. Short-term and long-term leaching studies showed cadmium movement to be limited to 1 or 2 cm below the zone of sludge incorporation. With time, sludge degrades and Cd retention increases to that in unamended soils. Cadmium availability also is reduced. Cadmium mobility is expected to be very limited in calcareous soils, regardless of sludge treatments. (Moore-IVI)
W85-03097

5F. Water Treatment and Quality Alteration

TOXICOLOGICAL INVESTIGATION AND EVALUATION OF DRINKING-WATER POLLUTION CAUSED BY CHEMICAL WASTES,
Orszagos Kozegeszegugyi Intezet, Budapest (Hungary).
I. Desi, and G. Somosi.
Ecotoxicology and Environmental Safety, Vol. 8, No. 4, p 315-327, August, 1984. 8 Fig, 1 Tab, 14 Ref.

Descriptors: *Drinking water, *Toxicity, *Water pollution effects, *Vac, *Hungary, Pharmaceutical industry, Industrial wastes, Groundwater pollution, Mutagens, Taste, Danube river.

In February 1981 drinking water from a waterworks in Vac (Hungary) proved to have a taste of chemicals and pharmaceuticals. Acute, subacute, in vitro, and animal experiments were performed in the spring and fall of 1981 on samples from bank-filtered drinking-water wells of Vac; from three neighboring observation wells; from water transported from the opposite side of the Danube; from a drinking-water well of a town farther northward; and from Danube water. The most severe toxicity was found in water from two observation wells. Drinking-water samples from the wells in Vac proved to be contaminated, and toxic effects of different degrees were also induced by water from other wells in Vac. Danube water caused changes only in some tests; the control drinking-water well, the samples of one observation well, and of the well on the opposite side of the Danube examined in the fall did not cause any alterations. The toxicity was confirmed by the elevated hemolysis, by the genotoxic effects on human erythrocytes and leukocytes, by the functional changes observed in the nervous system of rats, by alterations detected in the electric activity of the rats' brains, in the learning ability and the behavior of the rats, by the increase in the cytochrome P-450 enzyme level of the liver, and by the chromosome aberrations emerging in mice. The water proved to be inappropriate for human consumption. The contamination is believed to have originated at a pharmaceutical factory waste storage site. (Moore-IVI)
W85-02696

ASBESTOS IN WATER SUPPLIES OF THE UNITED STATES,
Health Effects Research Lab., Cincinnati, OH.
J. R. Millette, P. J. Clark, J. Stober, and M. Rosenthal.
Environmental Health Perspectives, Vol. 53, p 45-48, November, 1983. 5 Tab, 20 Ref.

Descriptors: *Asbestos, *Drinking water, Minerals, Fibers, Water pollution, Population exposure.

The review of available data on the concentrations of asbestos in U.S. water supplies suggests that the majority of water consumers are not exposed to asbestos concentrations over 1 million fibers/Liter. A few populations, however, may be exposed to concentrations over 1 billion fibers/L. Of the 538 water supplies for which waterborne asbestos data are available, 8% have concentrations of fibers over 10 million fibers/L. The vast majority of asbestos fibers found in U.S. water supplies are under 5 micro m in length. (Author's abstract)
W85-02703

ENGINEERING AND OPERATING APPROACHES FOR CONTROLLING ASBESTOS FIBERS IN DRINKING WATER,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
G. S. Logsdon.
Environmental Health Perspectives, Vol. 53, p 169-176, November, 1983. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Asbestos, *Pipes, *Asbestos cement, *Drinking water, Filtration, Water distribution, Linings, Coatings, Agressive water, Drilling, Tapping, Flushing.

Research efforts related to water filtration and the protection or rehabilitation of asbestos-cement (AC) pipe that transmits aggressive water are described. When asbestos fibers are present in the source water, filtration plants can be designed and operated to remove most of the fibers using diatomaceous earth filters and granular media filters. When AC pipe is used to transmit aggressive water, formation of a coating on the pipe wall can decrease the extent of deterioration of the pipe and the erosion of fibers from the pipe wall into the water. Water distribution system research revealed that utility operating practices can influence asbestos fiber concentration in drinking water. Drilling and tapping can introduce asbestos-containing debris into the distribution system unless pipe fragments are flushed out under pressure during the tapping process. After asbestos-containing debris has accumulated in the low-flow or dead-end areas of distribution systems, flushing such water mains can cause unusually high fiber counts. (Baker-IVI)
W85-02714

SELECTING AN ECONOMICAL WATER MAIN REHAB,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
T. M. Walski.
Civil Engineering/ASCE, Vol. 54, No. 9, p 68-70, September, 1984. 4 Fig, 4 Ref.

Descriptors: *Water mains, *Economic aspects, *Rehabilitation, Calcium carbonate, Scaling, Pipes, Linings, Hydrogen ion concentration, Planning.

Alternative pipe restoring methods are presented to aid the engineer in stretching every dollar to eliminate deposits that form on the inside walls of pipes. The nature of the deposits to be removed or prevented depends on the water's chemical makeup. At low pH, the water is aggressive and tends to pull or dissolve material out of the pipe wall. At high pH, dissolved material, especially calcium carbonate, precipitates in the pipe to form scale on the pipe wall. Chemical addition can minimize future problems, but in most cases it cannot restore lost carrying capacity economically. One possible remedial method is to install additional water mains. If lost carrying capacity causes problems only during peak flow conditions, additional elevated storage can be provided to dampen out peak flows and reduce the distance water must travel from storage. Cleaning or pigging may be most economical. Several passes with the pigs or scrapers are usually required to remove the deposits. Lining the pipe with an inert material usually prevents further loss of carrying capacity. When a pipe is to be cleaned and lined, it must be taken out of service, usually for several days. Temporary bypass lines are usually required to provide water to customers along the pipeline. (Baker-IVI)
W85-02729

HOW TO BUY A WATER TREATMENT PLANT,
R. Hill.
Chemical Engineer, No. 405, p 17-21, July, 1984. 1 Fig, 3 Tab.

Descriptors: *Water treatment facilities, *Design criteria, *Planning, Water resources development, Water quality, Water management.

Water treatment engineers tend to categorize natural waters into five broad groups according to their characteristics: upland, groundwater, lowland surface, brackish, and seawater. If no water analysis is available, information on the source of the water allows the designer of the water treatment system to make an intelligent guess at the quality. The design analysis will take into account the seasonal variations and possible blends of waters and allow for the worst case situations. Many water treatment plants are oversized because the treated water quantity has been specified incorrectly. This is particularly true for the batch processing industries where a large flowrate of treated water is needed for a short time to fill a batch reactor. Quite a lot of help can be provided by the water treatment plant supplier if he is consulted early in the design part of the project. There is never only one process route from a given raw water quality to a given treated water quality. The supplier should have a complete range of unit operations at his disposal and be able to discuss their relative merits in terms of capital cost, running costs and ease of operation. In addition, he can discuss the various options on materials for construction. (Baker-IVI)
W85-02765

MEETING THE CHALLENGE OF POWER PLANT WATER TREATMENT,
R. C. Rittenhouse.
Power Engineering, Vol. 88, No. 9, p 24-32, September, 1984. 3 Fig, 3 Tab.

Descriptors: *Powerplants, *Water treatment, *Decision making, Planning, Quality control, Design criteria, Dechlorination, Corrosion control, Chlorination, Biofouling.

Biofouling and corrosion control, special situations n cycling units, and water treatment system retro-itting and plant life extension are among the many requirements and problem areas being dealt with by powerplant managers. Specific problems and solutions are offered for the following areas of concern: dechlorination, alternatives to chlorine use, zero discharge requirements, corrosion control, brine concentrators, demineralization, plant life extension, problems with copper, condensate/steam quality, dissolved oxygen, and logic controllers. (Baker-IVI)
W85-02766

ELECTROCOAGULATION OF POTABLE WATER,
Norsk Inst. for Vannforskning, Oslo.
E. A. Vik, D. A. Carlson, A. S. Eikum, and E. T. Gjessing.
Water Research, Vol. 18, No. 11, p 1355-1360, 1984. 7 Ref, 2 Tab, 9 Ref.

Descriptors: *Drinking water, *Pretreatment of water, *Electrocoagulation, *Coagulation, Electrochemistry, Humus, Alum, Aluminum, Hydrogen ion concentration, Water treatment.

Coagulation caused by electrolytically produced ions (electrocoagulation) followed by filtration has been studied as a possible alternative to the conventional coagulation process. Electrochemical processes have been used in water and wastewater treatment since 1887. Electrocoagulation is looked upon as an interesting process in use at small water treatment plants. There are several important design aspects of this process which deserve further study. This study presents results showing the correlation between the current density and the aluminium dosing and provides results showing the necessary overpotential. The process has proved efficient with regard to removal of aquatic humus. A comparison of this method with conventional coagulation shows that the aquatic humus is removed equally well with both methods. Conventionally coagulated water (using alum) contains higher concentrations of sulfate and thus has a higher specific conductivity than the electrochemically treated water. The electrochemically treated water contains higher residual aluminium concentrations than the conventionally treated water due to the higher pH values. (Author's abstract)
W85-02906

REMOVAL OF BACTERIA FROM WATER BY ADSORPTION TO MAGNETITE,
Queensland Univ., Brisbane (Australia). Dept. of Microbiology.
I. C. MacRae, and S. K. Evans.
Water Research, Vol. 18, No. 11, p 1377-1380, 1984. 5 Tab, 4 Ref.

Descriptors: *Bacteria, *Water treatment, *Adsorption, *Magnetite, Water quality control, Magnesium, Calcium, Disinfection.

The effectiveness of the Sirofloc process magnetite preparation was evaluated for the removal of bacteria from water during three adsorption stages. The usefulness of acid washing of the magnetite in the desorption of adsorbed bacteria and the effect of multiple alkali-acid regeneration cycles on the ability of a magnetite sample to remove bacteria from water were also investigated. Using three adsorption stages reduced the numbers of bacteria in a suspension by five log cycles. Removal of calcium and magnesium from the magnetite surface by acid washing resulted in improved desorption of the bacterial cells. (Baker-IVI)
W85-02909

KINETICS OF MICROBIAL INACTIVATION BY CHLORINE - I; REVIEW OF RESULTS IN DEMAND-FREE SYSTEMS,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5D.
W85-02917

KINETICS OF MICROBIAL INACTIVATION BY CHLORINE - II; KINETICS IN THE PRESENCE OF CHLORINE DEMAND,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5D.
W85-02918

EFFECT OF FILTER PORE SIZE ON THE EVALUATION OF ALUMINUM COAGULANTS TO REMOVE FULVIC ACID FROM WATER,
McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
E. Diamadopoulos, and D. R. Woods.
Water Research, Vol. 18, No. 11, p 1455-1459, 1984. 10 Fig, 11 Ref.

Descriptors: *Coagulants, *Water treatment, *Aluminum, *Filtration, Membrane processes, Fulvic acid, Membranes, Filter media.

The evaluation of aluminum coagulants to remove fulvic acid from water depends on the process of separating the precipitate from the liquid phase. The interactions between fulvic acid and membrane filters during the routine work of filtration, in the presence and absence of aluminum, were determined and the effect of the membrane pore size on the apparent efficiency of aluminum to remove fulvic acid from water was examined. When pure fulvic acid solutions were filtered through membrane filters, some organics were initially adsorbed on the filter, but the filtrate concentration rapidly rose to the original fulvic acid levels for both types of the filters tested. When aluminum-treated fulvic acid solutions were filtered through membrane filters, the filtrate concentration depended on the filter pore size. In general, filters with a 0.10 micro m pore size were able to remove more particles from water than were the 0.45 micro m filters. Differences of up to 80% of the original fulvic acid concentration were observed. The 0.45 micro m filers showed a deep-filter like behavior for small particles. When little material was deposited on the filter and the filter pores were relatively clean, small particles at times accounting for up to 80% of the original fulvic acid concentration passed into the filtrate. After clogging of the pore occurred, the 0.45 micro m filters were able to remove smaller particles. (Baker-IVI)
W85-02919

EFFECT OF PH, APPLICATION TECHNIQUE, AND CHLORINE-TO-NITROGEN RATIO ON DISINFECTANT ACTIVITY OF INORGANIC CHLORAMINES WITH PURE CULTURE BACTERIA,
California Univ., Irvine. Program in Social Ecology.
N. R. Ward, R. L. Wolfe, and B. H. Olson.
Applied and Environmental Microbiology, Vol. 48, No. 3, p 508-514, September, 1984. 1 Fig, 4 Tab, 34 Ref.

Descriptors: *Disinfection, *Hydrogen ion concentration, *Chlorination, *Nitrogen, *Chloramines, Bactericides, Escherichia coli, Salmonella, Pseudomonas, Klebsiella, Enterobacter, Ammonia.

The influence of pH, application technique, and chlorine-to-nitrogen weight ratio on the bactericidal activity of inorganic chloramine compounds was determined with stock and environmental strains of Escherichia coli, Salmonella spp., Pseudomonas aeruginosa, Klebsiella pneumoniae, and Enterobacter cloacae. The rate of inactivation increased from 1.5 to 2 times as the chlorine-to-nitrogen weight ratio was adjusted from 2:1 to 5:1, 5 to 6 times as the pH was decreased from 8 to 6, and 5 to 6 times as the concentrations was increased from 1 to 5 mg/liter. Separate additions of free chlorine and ammonia (concurrent addition and preammoniation) into seeded water at or below pH 7.5 resulted in killing comparable to that observed with free chlorine (99% inactivation in less than 20 s). At pH 8, inactivation by separate additions was considerably slower and was comparable to that by preracted chloramine compounds (99% inactivation in 25 to 26 min). Determination of the effectivness of inorganic chloramine compounds as primary disinfectants for drinking water must consider the method of application, of pH, and concentrations of chlorine and ammonia. (Author's abstract)
W85-02933

INACTIVATION OF GIARDIA LAMBLIA CYSTS WITH OZONE,
Ohio State Univ., Columbus. Water Resources Center.
G. B. Wickramanayake, A. J. Rubin, and O. J. Sproul.
Applied and Environmental Microbiology, Vol. 48, No. 3, p 671-672, September, 1984. 2 Fig, 1 Tab, 7 Ref. EPA grant R808150-02-0.

Descriptors: *Giardia, *Ozonation, *Disinfection, Water treatment, Chlorination, Protozoa.

The effectiveness of ozone was investigated as an alternative disinfectant for the inactivation of Giardia lamblia cysts. The cysts were inactivated at three different ozone concentrations at 5 and 25 degrees C and pH 7. The concentration-time products for 99% inactivation were 0.53 and 0.17 mg-min/liter at 5 and 25 C, respectively. These products were significantly lower than those reported for chlorine. G. lamblia cysts were only about twice as resistant to ozone inactivation as poliovirus 1 at a neutral pH and 5 and 25 C. G. lamblia cysts were more resistant to inactivation by ozone and chlorine than Escherichia coli by about 1 and 3 orders of magnitude, respectively, at low temperatures. There are fewer differences in resistance among these three organisms to ozone inactivation than to chlorine inactivation. (Collier-IVI)
W85-02937

COMPARISON OF METHODS OF ENUMERATING COLIFORMS AFTER UV DISINFECTION,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5A.
W85-02938

REOVIRUS REMOVAL AND INACTIVATION BY SLOW-RATE SAND FILTRATION,
Utah Water Research Lab., Logan.
L. K. McConnell, R. C. Sims, and B. B. Barnett.
Applied and Environmental Microbiology, Vol. 48, No. 4, p 818-825, October, 1984. 7 Fig, 4 Tab, 38 Ref.

Descriptors: *Reoviruses, *Sand filtration, *Filtration, Water treatment, Viruses, Adsorption, Filters, Disinfection.

Laboratory column studies were conducted at the Utah Water Research Laboratory, Logan, Utah, to evaluate reovirus removal from drinking water supplies by slow-rate sand filtration (SSF). Columns, constructed to simulate a full-scale SSF field operation, were inoculated with reovirus at ca. 1,000-times-greater concentrations than those typically found in domestic sewage. Reovirus removal and inactivation were investigated as functions of filter maturity and other filter sand characteristics. Reovirus removal studies demonstrated that the SSF process is capable of reducing reovirus in influent water by a minimum of 4 log concentration units under certain conditions of water quality, flow rate, and sand bed construction. Infectious reovirus was not detected in effluent samples from any of the sand beds studied, after inoculation of the SSF columns; therefore, removal efficiencies were not affected significantly by characteristics, including age, of the two filter sands evaluated. Studies conducted with radioactively labeled reovirus demonstrated that reovirus removed from influent water was distributed throughout the entire length of the filter beds. Concentrations of reovirus in the filter sands decreased with increasing bed depth. The greatest removal occurred in the top few centimeters of all sand beds. No infectious reovirus could be detected in clean or mature sand bed media, indicating the reoviruses were inactivated in the filter. (Author's abstract)
W85-02940

IMPACT OF CHLORINE, CHLORINE DIOXIDE AND OZONE ON THE OXIDATION OF NTA DURING DRINKING WATER TREATMENT,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands).
J. Hrubec, M. J. 't Hart, P. Marsman, and J. A. Luijten.
Bulletin of Environmental Contamination and Toxicology, Vol. 33, No. 5, p 548-555, November, 1984. 3 Fig, 2 Tab, 24 Ref.

Descriptors: *Water treatment, *Disinfection, *Chlorine, *Nitrilotriacetic acid, Oxidation, Ozone, Chlorine dioxide, Chemical reactions, Drinking water, Mutagens, Netherlands.

The removal of nitrilotriacetic acid (NTA) upon chlorine, chlorine dioxide and ozone treatment of drinking water was investigated. The possible formation of mutagenic substances from the reaction of NTA with these oxidants was considered along with the formation of halogenated reaction products of NTA with chlorine and chlorine dioxide, as far as analyses of the group parameter adsorbable organic halogens, extractable organic halogens and volatile organic halogens allow. Under typical conditions of the drinking water practice in the Netherlands, characterized by application of low doses of both chlorine and chlorine dioxide, no, or only a slight, degradation of NTA can be expected. Formation of halogenated organics, by reaction of NTA with chlorine and chlorine dioxide during water treatment, which can be detected with the analytical methods used, can be regarded as highly improbable. No increase in mutagenic activity was found in water with NTA addition treated with ozone and chlorine. (Baker-IVI)
W85-02965

FLOCCULATION AND TURBULENCE FROM BUBBLE-INDUCED MIXING,
Edinburgh Univ. (Scotland). Dept. of Civil Engineering.
G. L. McConnachie.
Journal of the Institution of Water Engineers and Scientist, Vol. 38, No. 4, p 337-347, August, 1984. 8 Fig, 2 Tab, 46 Ref.

Descriptors: *Flocculation, *Turbulence, *Bubble-induced mixing, Mixing, Water treatment, Suspended solids.

Mixing by air bubbles to promote the flocculation of suspended particles in water treatment was studied using different bubble sizes and air flows as well as results from turbulence measurements using laser-Doppler anemometry. Tapered agitation intensity gave significant improvement in efficiency over fixed agitation. Minimum residual turbidity occurs at relatively low air-flows. With the expected improvement from compartmentalized tanks and subsequent filtration, bubble agitation may be more economical than paddle mixers in conventional systems. Buble size has an influence on the efficiency of flocculation; 0.5-1.5 mm gave the lowest residual turbidity. The flocculation efficiency is related to the degree of turbulence induced and appears to be influenced by the distribution of turbulence within the reactor. An even distribution of many bubble streams in a tank would be beneficial in promoting flocculation. (Moore-IVI)
W85-03021

ARSENIC IN NOVA SCOTIAN GROUNDWATER,
Health and Welfare Canada, Ottawa (Ontario). Environmental Health Centre.
For primary bibliographic entry see Field 5A.
W85-03032

BIOFOULING CONTROL THROUGH TARGETED CHLORINATION,
W. Chow, J. S. Maulbetsch, and Y. G. Mussalli.
Power Engineering, Vol. 84, No. 10, p 38-41, October, 1984. 5 Fig, 2 Tab.

Descriptors: *Chlorination, *Powerplants, *Cooling water, *Biofouling, Condensers, Economic aspects, Water treatment.

Targeted chlorination is a new technique for reducing microbiological fouling of condensers and minimizing chlorine discharges in powerplant cooling water. The advantages of the method are best described in contrast to conventional chlorination, where chlorine is injected into and mixed with the cooling water well upstream of the pilot condenser system. Targeted chlorination seeks to direct a chlorinated flow to one small section of the condenser at a time. This flow can be at higher than normal chlorine concentrations because it is mixed in the condenser exit water box with a larger unchlorinated flow. Each section is chlorinated for a much shorter time permitting sequential treatment of the entire condenser within the prescribed time limit. Tests at a utility plant test site having complete operating records with its concurrent chlorination system will provide a baseline against which results can be compared and evaluated. (Baker-IVI)
W85-03051

5G. Water Quality Control

ENVIRONMENTAL ENGINEERING AND PUBLIC HEALTH ASPECTS OF ALTERNATE DAIRY WASTE MANAGEMENT TECHNIQUES DESIGNED TO PROTECT GROUND WATER QUALITY,
California State Coll., San Bernardino. Dept. of Health Science and Human Ecology.
For primary bibliographic entry see Field 5E.
W85-02724

SIGNIFICANCE OF THE 129 SUBSTANCE EEC-LIST FOR WATER QUALITY PROTECTION (DIE BEDEUTUNG DER 129 STOFFE DER EG-LISTE FUR DEN GEWASSERSCHUTZ),
BASF A.G., Ludwigshafen am Rhein (Germany, F.R.).
K.-G. Malle.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17, No. 3, p 75-81, June, 1984. 9 Tab, 50 Ref.

Descriptors: *Rhine River, *Germany, *Toxicity, *Pollutants, Water pollution prevention, Mercury, Cadmium, Regulations, Water quality standards.

With respect to the implementation of the EEC-directive 76/464/EWG for the protection of surface waters against pollution by discharge of certain dangerous substances the EEC-commission has named 129 individual substances for priority investigation. Directives for the discharge of mercury and cadmium have already been released. The investigation of the rest of the substances is well under way. This paper lists the acute toxicity data of the substances and is allotting them to the analytical results of Rhine water. It becomes evident that for a number of substances analytical data and even microanalytical procedures are missing. From a critical check of all the data the following questions arise for future work: which risk is involved with substances not detectable in surface waters; which difference is necessary between toxicity data and concentration in waters; which substances should be reduced according to list I-procedure or list II-procedure, respectively. (Author's abstract)
W85-02754

WATER QUALITY CONTROL AND ITS EFFECT ON THE CONCENTRATION OF HEAVY METALS IN PORT KEMBLA HARBOUR, N.S.W.,
Biological Lab., Cold Spring Harbor, NY.
P. J. Moran.
Marine Pollution Bulletin, Vol. 15, No. 8, p 294-297, August, 1984. 1 Fig, 2 Tab, 12 Ref.

Descriptors: *New South Wales, *Australia, *Port Kempla Harbour, *Heavy metals, *Water pollution control, Allans Creek, Iron, Lead, Zinc, Copper, Cadmium, Harbors.

Water quality control programs have been implemented by the industries surrounding Port Kempla Harbour, New South Wales, Australia, in an attempt to reduce the impact of pollution. The concentrations of five heavy metals (iron, lead, zinc, copper and cadmium) were measured at two sites in the harbor over a period of 9 months. In comparing the results of this study with those recorded previously at these sites during 1974 and 1978, it is shown that the concentrations of all five metals have decreased substantially over the last decade. The decrease has been a continual one with most heavy metal levels declining between 1974 and 1978 and again between 1978 and 1980/81. Over the entire period, from 1978 to 1980/81, the percentage decrease in these levels ranged from 67% (cadmium) to 97% (iron) in the middle of the harbor and from 72% (cadmium) to 99% (lead and zinc) at the entrance to Allans Creek. The substantial decrease in heavy metal concentration since 1974 has been due to the water quality control programs implemented by many of the surrounding industries. (Collier-IVI)
W85-02761

BIOLOGICAL PRODUCTIVITY OF LAKE QARUN (ARAB REPUBLIC OF EGYPT),
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
For primary bibliographic entry see Field 2H.
W85-02851

PROTECTION OF GROUNDWATER FROM OIL POLLUTION IN THE VICINITY OF AIRPORTS,
J. Svoma, and V. Houzim.
Environmental Geology and Water Sciences, Vol. 6, No. 1, p 21-30, 1984. 7 Fig, 3 Tab, 12 Ref.

Descriptors: *Groundwater pollution, *Airports, *Water pollution control, Hydrocarbons, Groundwater, Oil pollution, Monitoring, Water pollution sources.

The potential danger to the quality of groundwater close to airports is due to a combination of several ecologically unfavorable factors. Airports are usually situated in the proximity of a groundwater divide, or in wide valleys. Causes of pollution include the sheer volume of fluid being handled constantly, the physicochemical properties of hydrocarbons, and technical errors in the transport and storage of fuels. Oil hydrocarbons in concentrations of tenths to units of milligrams per liter have been found in snow in the vicinity of runways. Carcinogenic benzopyrenes are accumulated in soil. Oil hydrocarbons spread in rock formations as a separate layer as well as in solution. In porous permeable formations, pollution by a free product affects areas on the order of tens of meters, while hydrocarbons in solution penetrate to distances of hundreds of meters or even kilometers. Fissured rocks are cause for even more complex conditions for the spreading of oil based substances. Preventive protection of groundwater and mineral waters using monitoring devices is being carried out at some major airports. Observation wells situated in the tectonic zone can also be used for reparative pumping. (Baker-IVI)
W85-02859

ELECTRICAL RESISTIVITY INVESTIGATION OF POTENTIAL CAVITIES UNDERLYING A PROPOSED ASH DISPOSAL AREA,
Environmental Science and Engineering, Inc., Gainesville, FL.
B. J. Denahan, and D. L. Smith.
Environmental Geology and Water Sciences, Vol. 6, No. 1, p 45-49, 1984. 5 Fig, 1 Tab, 9 Ref.

Descriptors: *Crystal River, *Florida, *Electrical resistivity, *Waste disposal sites, *Electrical studies, Geophysics, Facility siting, Electrodes, Solution cavities, Facility siting, Limestone, Geophysics.

Measurements of electrical resistivity anomalies using a Wenner electrode array in a profiling mode were conducted over a 105-acre area near Crystal River, Florida. Analyzed results of collected data were used to determine the likelihood of subsurface solution cavities beneath a proposed ash dis-

posal area. 'Sounding' measurements with electrode spacing values extending up to 100 feet and Lee electrode measurements were used to identify and locate specific anomaly maxima. Identified anomalies on the order of 200 ohms-feet contrasted with expected values of 300 to 400 ohms-feet and were attributed to lower resistivities inherent in water-filled solution cavities below a shallow water table. Prominent cavity complexes at 5 to 15 feet depth were predicted in areas of low resistivity anomalies in the otherwise geoelectrically uniform, Eocene Ocala limestone. Shallow test borings confirmed the presence of a significant concentration of shallow cavities in the predicted areas. This study demonstrated the feasibility of electrical resistivity measurements as a reconnaissance tool to economically determine subsurface cavities and to aid in developmental and environmental planning. (Author's abstract)
W85-02861

OVERVIEW OF THE US-USSR JOINT AGREEMENT ON ENVIRONMENTAL PROTECTION RELATED TO PREVENTION OF WATER POLLUTION,
Amsterdam Univ. (Netherlands). Vakgroep Aquatische Oecologie.
For primary bibliographic entry see Field 6E.
W85-02881

PHOSPHORUS MANAGEMENT LP MODEL CASE STUDY,
New Jersey Dept. of Environmental Protection, Trenton.
T.-R. Jenq, M. L. Granstrom, S.-F. Hsueh, and C. G. Uchrin.
Water Resources Bulletin, Vol. 20, No. 4, p 511-520, August, 1984. 5 Fig, 9 Tab, 21 Ref.

Descriptors: *Cost analysis, *Phosphorus, *Water quality management, *Linear programming, *Carnegie Lake, *New Jersey, Nutrients, Eutrophic lakes, Water pollution control, Nonpoint pollution sources.

The Carnegie Lake basin in New Jersey has a drainage area of approximately 150 sq mi. The present population of the study area is approximately 70,000 people. due to develoment potential, the forecasted year 2000 population is 200,000. Carnegie Lake is not a true lake, but an impounded river. It suffers from excessive nutrient problems. A linear programming model to assess the cost-effectiveness of appropriate point and nonpoint phosphorus control measures was constructed for Carnegie Lake, and the model was tested for present and future conditions. Feasible solutions were obtained only after significant relaxation of receiving water quality standards. The high levels of point source treatment required to meet the in-stream water quality standards and the mesotrophic loading conditions suggest that a source control solution may not be feasible. Due to the nutrient cycles in natural water systems, the eutrophication problems of Carnegie Lake may not be immediately mitigated even if the target loadings are achieved. (Moore-IVI)
W85-02977

WATER SUPPLY AND FORESTRY - A CONFLICT OF INTERESTS: CRAY RESERVOIR, A CASE STUDY,
For primary bibliographic entry see Field 6G.
W85-03020

WATER AND HEALTH IN AFRICA,
Ottawa Univ. (Ontario). Dept. of Civil Engineering.
E. J. Schiller.
Water International, Vol. 9, No. 2, p 51-57, 1984. 1 Fig, 2 Tab, 44 Ref.

Descritors: *Public health, *Water quality control, *Africa, Waste disposal, Sanitation, Planning, Decision making, Wastewater treatment, Education, Public participation, Developing countries.

The health situation throughout Africa is surveyed as it relates to water usage and sanitary waste disposal practices. Exact quantitative interpretations of the entire water related health system are difficult to obtain because of the complexity of the many factors impinging upon health and the inherent difficulty in gathering data in the scattered villages where the greater majority of the population is still to be found. In addition to quality of water, the quantity of water available is also an important factor for the prevention of water related diseases. Because the causative factors of disease are multiple, the solution will not involve just a single action, even if that is providing clean water. A number of health workers have stressed that contemporary health care in Africa must adopt a holistic view. Many African countries are now placing greater stress on health education of the community. Health workers and engineers have been learning how to work together in dealing with water related health problems. A variety of sewerage systems is now available and through careful decision making, those schemes which are economically suited to the region can be made operable. (Baker-IVI)
W85-03026

ACID RAIN PERSPECTIVES: A TALE OF TWO COUNTRIES,
B. Hileman.
Environmental Science and Technology, Vol. 1, No. 1, p 341A-344A, November, 1984. 2 Fig.

Descriptors: *Acid rain, *Water pollution control, *Canada, *United States, Regulations, Emissions control, Sulfur dioxide, Economic aspects, Air pollution.

To understand the differences in approach to the acid rain problem it is important to know certain differences between the two countries, Canada and the United States concerning this problem. Control plans for emission reductions in Canada need to be less complex than those in the United States. The major sources of sulfur dioxide in Canada are few. The opposite is true in the United States. A second important difference is that the major sources of SO2 in the US appear to be widely separated from the most sensitive regions at immediate risk from acid rain, whereas in Canada the major sources lie within or close to sensitive regions. Total SO2 emissions from the eastern US are more than five times greater than those from eastern Canada. Canada does not have a single scrubber on a smelter or powerplant in contrast to the US which has a number of utilities with scrubbers. Cost of emission reductions is each country is considered. (Baker-IVI)
W85-03055

TRADEOFFS IN WATER QUALITY MANAGEMENT,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W85-03063

TWO-STAGE URBAN RUNOFF FORECAST MODEL,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 2E.
W85-03065

HYDROGEOCHEMICAL INTERACTION BETWEEN A MUNICIPAL WASTE STABILIZATION LAGOON AND A SHALLOW AQUIFER,
North Dakota Univ., Grand Forks. Dept. of Geology.
A. E. Kehew, F. J. Schwindt, and D. J. Brown.
Groundwater, Vol. 22, No. 6, p 746-754, November-December, 1984. 9 Fig, 1 Tab, 17 Ref.

Descriptors: *Stabilization lagoons, *Groundwater pollution, *North Dakota, Water pollution sources, Unconfined aquifers.

Unlined municipal waste stabilization lagoons are potential sources of groundwater contamination. Fourteen monitoring wells were installed around the McVille, North Dakota lagoon, a site at which the impoundment is excavated into permeable sediments of an unconfined glaciofluvial aquifer with a shallow water table. The infiltrating waste water dissolves iron oxides, thereby releasing dissolved iron to the groundwater flow system. Ammonium concentrations in the downgradient ground water are higher than the total nitrogen content of the waste water. A possible explanation for these ammonium concentrations is the conversion of nitrate in the upgradient ground water to ammonium as it passes beneath the pond. Downgradient ammonium concentrations may also be higher as a result of rapid infiltration of waste water from the cell used for periodic overflow discharges from another cell, which avoids possible attenuation by adsorption because of the lack of a sludge layer in this receiving cell. As ground water moves further downgradient, cation exchange processes reduce ammonium concentration to very low levels. The contaminant distribution at the McVille lagoon is not typical of other sites because the contaminant plume at McVille is larger and contains higher concentrations of most constituents than the other lagoons. Despite the extent of the plume at McVille, attenuation of the more harmful contaminants of those parameters measured in the study occurs within a relatively short distance of the lagoon. Impoundments with natural sludge layers may, in some cases, function as well as lined lagoons, with respect to minimizing ground water contamination. The practice of discharging waste water into impoundments where rapid infiltration occurs, however, appears to increase degradation of groundwater quality. (Baker-IVI)
W85-03154

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

CIRCULAR VS. LINEAR WATER SYSTEMS, GOING BACK TO NATURE'S WAY,
Sheaffer and Roland, Inc., Chicago, IL.
K. J. R. Sheaffer.
Environment, Vol. 26, No. 8, p 10-15 and 42-44, October, 1984. 3 Fig, 2 Ref.

Descriptors: *Water management, *Planning, Water supply development, Water treatment, Wastewater treatment, Management.

Proponents of a linear system of water management visualize water flowing in a straight line from source to users to receiving streams and on to the sea. They claim there is adequate water to serve indefinitely as both a source of supply and to dilute and carry away municipal sewage discharged into streams and other natural bodies of water. Those who favor a circular system argue the merits of nature's inviolable law of return. By sending the used water back to the natural cleansing systems of soil, plants, air and sunshine, it could be reclaimed for repeated reuse. The linear approach was adopted and for years appeared to be working. As cities continue to grow they must reach further and further away for continued supplies of useable water because nearby supplies have become polluted. The linear approach has been labeled a technological failure with design goals being unmet. The circular approach, which uses wastes as raw materials, must replace the linear approach, which seeks to get rid of wastes by discharge into some receiving body of water. In the circular approach, capital expenditures are directed to the development of facilities that will use wastes as raw materials to generate food, fiber, and energy resources. Barriers that block the way for changing the emphasis in the nation's water management from linear to circular are discussed. (Baker-IVI)
W85-03039

METHODS OF FITTING A STRAIGHT LINE TO DATA: EXAMPLES IN WATER RESOURCES,
Geological Survey, Reston, VA.
R. M. Hirsch, and E. J. Gilroy.

Group 6A—Techniques Of Planning

Water Resources Bulletin, Vol. 20, No. 5, p 705-711, October, 1984. 5 Fig, 1 Tab, 23 Ref.

Descriptors: *Statistical analysis, *Water resources development, *Regression analysis, Mathematical equations.

Three methods of fitting straight lines to data are described and their purposes are discussed and contrasted in terms of their applicability in various water resource contexts. The three methods are ordinary least squares (OLS), least normal squares (LNS), and the line of organic correlation (OC). The methods are evaluated for use in estimating individual values of one variable from observation on a related variable, calibration of an instrument, the estimating of multiple values of one variable from multiple observations of another variable, the description of a relationship betweeen two variables, and the description of a geographic trajectory. (Baker-IVI)
W85-03136

6B. Evaluation Process

YANGTZE ENGINEERS AIM HIGH.
Engineering News-Record, Vol. 213, No. 4, p 26-29, July 26, 1984. 6 Fig.

Descriptors: *Dam construction, *Water resources development, *Yangtze River, *China, *Three Gorge Dam, Management, Planning, Construction, Design criteria.

Planning for the Three Gorge Dam on the Yangtze River started in 1951. The Three Gorge flood-control, power, irrigation and navigation scheme will be one of the world's largest civil-engineering works comprising an 11 million cubic m gravity dam, two powerplants to house 26 500-Mw turbine generators, two 80 m high vertical shiplifts, a double lane lock on the left bank capable of transporting 50 million long tons of cargo a year up 87 m in three equal steps, spillways, low-level outlets and powerplant discharges capable of passing a maximum probable flood of 120,000 cu m per sec. A new construction agency will be established specifically for Three Gorge and a system of bonuses and penalties will be incorporated. (Baker-IVI)
W85-02753

CENTRAL ARIZONA WATER CONTROL STUDY: A COMPARISON OF ALTERNATE PLANS USING CONCORDANCE ANALYSIS AND MULTI-DIMENSION SCALING,
York Univ., Downsview (Ontario). Dept. of Geography.
B. H. Massam.
Water Resources Bulletin, Vol. 20, No. 4, p 483-491, August, 1984. 3 Fig, 6 Tab, 12 Ref.

Descriptors: *Evaluation, *Alternative planning, *Water management, *Concordance analysis, *Multi-dimensional scaling, *Arizona, Economic aspects, Social aspects, Environmental effects, Management planning.

The Central Arizona Water Control Study (CAWCS) was initiated by the Bureau of Reclamation in 1978. The study attempted to identify and evalute alternate water management schemes for Central Arizona. By 1981 a set of seven plans had been developed and for each a assessment on a number of economic, environmental, and social factors had been undertaken. This paper offers a formal procedure, using concordance analysis and multi-dimension scaling, to compare alternate plans using multiple factors in order to produce a classification of the attractiveness of the alternatives. Empirical data for the CAWCS are used to clarify the procedure. The results of the formal analysis are compared to those produced by the CAWCS. A critique of the formal procedure is offered, and it is suggested that it may have utility to assist in the collection of data as well as in the search for a best plan. The procedure allows a number of different types of sensitivity tests to be conducted. (Author's abstract)
W85-02974

PHOSPHORUS MANAGEMENT LP MODEL CASE STUDY,
New Jersey Dept. of Environmental Protection, Trenton.
For primary bibliographic entry see Field 5G.
W85-02977

REUSE OF AGRICULTURAL DRAINAGE WATERS: AN ECONOMIC ANALYSIS,
California Univ., Riverside.
For primary bibliographic entry see Field 3C.
W85-02978

DETERMINATION OF CROP PRODUCTION LOSS DUE TO INADEQUATE DRAINAGE IN A LARGE WATERSHED,
Iowa State Univ., Ames. Dept. of Agricultural Economics.
R. S. Kanwar, H. P. Johnson, and T. E. Fenton.
Water Resources Bulletin, Vol. 20, No. 4, p 589-597, August, 1984. 3 Fig, 10 Tab, 9 Ref.

Descriptors: *Evaluation, *Crop yield, *Drainage, *Iowa, Tile drains, Drainage coefficient, Drainage districts, Des Moines River basin.

Results are presented for a crop production evaluation method designed to assess the magnitude of crop damage due to inadequate drainage in a large watershed of Iowa, the Des Moines River basin. A method was developed for determining crop yields at various levels of inadequate and adequate drainage, and the frequencies of occurrence of inadequately drained areas at various levels of natural drainage in this watershed. Information on the current status of drainage of the watershed was collected through personal interviews with 256 farmers from 60 legal drainage districts. About 95% of the area in upper Des Moines River basin has inadequate district mains or main outlet drains currently having a design capacity of $< \text{or} = 0.64$ cm/day drainage coefficient; 81% of the area in the watershed has the potential for further improvement of drainage to a high level of drainage by simply increasing the capacity of district mains to 1.27 cm/day drainage coefficient. There were only 29 fields at no drainage level and 85 fields at intermediate level of drainage within naturally very poorly drained soils in a sample of 298 fields. Most of the areas affected by inadequate tile drainage at the field level are very small in size. These small areas contribute significantly to the overall crop production losses in the watershed. Inadequate drainage in the watershed is currently responsible for crop yield reduction equal to about one-third of the maximum yield potential for average weather conditions. (Moore-IVI)
W85-02987

ECONOMICS OF CHANGES IN IRRIGATION MANAGEMENT IN PAKISTAN: AN INTEGRATIVE MODELING APPROACH,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W85-03029

WATER SUPPLY AND HEALTH IN DEVELOPING COUNTRIES: SELECTIVE PRIMARY HEALTH CARE REVISITED,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. Briscoe.
American Journal of Public Health, Vol. 74, No. 9, p 1009-1013, September, 1984. 1 Fig, 2 Tab, 36 Ref.

Descriptors: *Sanitation, *Water quality control, *Developing countries, Water supply development, Planning, Public health, Cost analysis.

The inclusion of water supply and sanitation programs as a component of primary health care (PHC) has been questioned on the basis of calculations of the costs of these programs per infant death averted. The procedures used in these cost effectiveness calculations are examined. It is determined that the calculations are misleading since gross rather than net costs have been used and the health impact of these programs underestimated. The methodology used is biased against water supply and sanitation and other programs with multiple outputs. The time constraints facing mothers in implementing PHC programs, as well as the contribution of improved water supplies in alleviating these constraints are outlined. Data show that if poor women in developing countries were to choose the mix of activities included in PHC programs, improved water supplies would frequently constitute part of that mix. (Baker-IVI)
W85-03040

SALT GRADIENT PONDS: INVESTMENT TIMING MODEL,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 3C.
W85-03061

WATER RESOURCES MANAGEMENT: INTERNATIONAL CHALLENGE AND OPPORTUNITIES,
Johns Hopkins Univ., Baltimore, MD. Dept. of Sanitary Engineering and Water Resources.
A. Wolman.
Water Resources Bulletin, Vol. 20, No. 5, p 647-650, October, 1984.

Descriptors: *Planning, *Evaluation, *Water resources development, *Water supply development, Developing countries, Sanitation, Public health.

Water supply for potable and hygienic purposes is presented as symbolic of the global issues confronting 4.8 billion people. Targets for meeting the needs of those without adequate water supplies were exemplified by the international agencies in the International Water and Sanitation Decade of 1980-1990. The pace of accomplishment has been slow. Constraints are reviewed in detail. Challenges for reducing these constraints and increasing the pace of installations are presented. The potential for a global public works program unprecedented in history is reviewed. (Baker-IVI)
W85-03129

INSTITUTIONS AND TECHNOLOGY: KEYS TO BETTER WATER MANAGEMENT,
W. B. Lord.
Water Resources Bulletin, Vol. 20, No. 5, p 651-656, October, 1984. 4 Ref.

Descriptors: *Water management, *Technology, Planning, Decision making, Evaluation, Social values.

Water management technology consists of those behaviors and artifacts which are used to manipulate the hydrologic variables within the environment, such as reservoir storage, groundwater pumping, irrigation methods, water treatment, primary, secondary, and tertiary wastewater treatment, desalination, and weather modification. Seven considerations are offered on how water management can be improved. These include separating fact from value, separating social value from interest, achieving efficient water use and allocating the surplus, windfalls and wipeouts, internalizing externalities, technological changes or institutional change. It is emphasized that technology and institutions are inseparable. Technology cannot be developed or applied except within the framework of social institutions, and institutions must work through technology to make a difference in the state of the nonhuman world. Good water management, or any similar public policy goal, can be achieved only through the coordinated use of technology and social institutions. (Baker-IVI)
W85-03130

IMPROVING WETLAND POLICY THROUGH AMELIORATION OF ADVERSE EFFECTS ON LOCAL ECONOMIES,
North Dakota State Univ., Fargo. Dept. of Agricultural Economics.
J. A. Leitch, and D. F. Scott.

Water Resources Bulletin, Vol. 20, No. 5, p 687-693, October, 1984. 1 Tab, 24 Ref.

Descriptors: *Wetlands, *Economic aspects, Water resources development, Model studies, Water policy.

Public ownership of land creates several problems for state and local decision makers. Those problems are summarized and particular emphasis is placed on economic problems that may arise in local areas. Input-output analysis is used to evaluate local economic impacts of public investment. This approach takes into account direct, indirect, and induced effects of changes in expenditure and income flows within the region being examined. It explicitly takes into account the economic interdependencies that exist between sectors in a regional economy. An example is presented of converting productive agricultural land to wildlife habitat considering the payment required to compensate the landowner and the payment required to maintain personal income in the local economy. Public agencies presumably act in the public interest, which means that on balance society is better off as a result of a specific action. However, while the gains may outweight the losses in such actions, it is important to consider those losses and determine adequate compensation. Presumably, those benefiting should be willing to compensate those who are adversely affected if the gains outweigh the losses. (Baker-IVI)
W85-03134

ECONOMICS OF TIMING STORM DRAINAGE IMPROVEMENTS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Natural Resource Economics.
H. C. Cochrane, and P. C. Huszar.
Water Resources Research, Vol. 20, No. 10, p 1331-1336, October, 1984. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Economic aspects, *Storm runoff, Flood protection, Decision making, Planning, Management, Storms, Runoff.

An important component of optimizing storm drainage improvements is the timing of their implementation. A framework for considering the timing of storm drainage projects is advanced. First a relationship is specified for the net present value NPV of a project which is indicative of the issues commonly raised by city engineers, storm drainage boards, city councils, and engineering consultants. This relation is then corrected and simplified to an operational form. Finally, the calculation of the optimum time to construct a drainage project is illustrated for the cases of a new and an old community. The optimum time to construct a storm drainage project apears to depend upon the rate of growth of new structures, the rate of appreciation of structures at risk, the degree to which the area is developed, the discount rate, and the life of the project. The magnitude of the project's NPV is affected by the number of structures that can occupy the project area, the initial value per structure at risk, and the percentage of structure values expected to be lost annually due to flooding before and after protection is provided. In general, it seems that projects in urbanizing areas may be optimally delayed. The combination of the growth of new structures and the appreciation of existing structures is likely to more than offset rising construction costs for at least a time. On the other hand, projects in mature, developed areas do not appear to be likely candidates for delay. Such projects are generally either immediately feasible or never do become feasible. The reason for this relationship is that there is little new construction, and appreciation rates tend towards the growth rate in construction costs. That is, a standard cost-benefit analysis, which evaluates construction of a project in the present period only, is probably adequate for either accepting or rejecting such projects. (Baker-IVI)
W85-03159

INTERPRETATION OF DOWNHOLE DATA AND DEVELOPMENT OF A CONCEPTUAL MODEL FOR THE REDONDO CREEK AREA OF THE BACA GEOTHERMAL FIELD,
Department of Scientific and Industrial Research, Wellington (New Zealand). Applied Mathematics Div.
M. A. Grant, S. K. Garg, and T. D. Riney.
Water Resources Research, Vol. 20, No. 10, p 1401-1416, October, 1984. 26 Fig, 34 Ref. US Dept. of Energy contract DE-FC03, 78ET27163.

Descriptors: *Geothermal power, *Redondo Creek, *Wells, *Jemez River, *Baca Geothermal Field, *Paliza Canyon, Carbon dioxide, Reservoirs, Permeability, Thermodynamics.

Available drilling records, downhole surveys, and surface discharge measurements from the wells drilled in the Redondo Creek area through 1981 were examined to determine the depths at which the wells penetrate permeable zones and thereby define those locations at which the pressure/temperature measurements actually correspond to the reservoir conditions. The results of these individual well analyses are used to estimate the initial pressure and temperature distributions of the reservoir system in the Redondo Creek area. This information, together with the well stratigraphy and the zones of fracture permeability penetrated by the wells, is presented on vertical sections across the area. The extent of a two-phase region at the top of the reservoir system is also estimated using the pressure/temperature distributions and the measured carbon dioxide content of the surface discharge from the Baca wells. The conceptual model presented provides the framework needed for detailed reservoir engineering studies. (Baker-IVI)
W85-03164

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

FORECASTING RELATIVE PRICE MOVEMENTS FOR PROJECT EVALUATION,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
M. Fortin, and E. McBean.
Water Resources Research, Vol. 20, No. 10, p 1327-1330, October, 1984. 4 Fig, 1 Tab, 7 Ref.

Descriptors: *Pricing, *Water resources development, *Evaluation, *Forecasting, *Statistical analysis, Economic aspects, Inflation, Canada.

Inflationary impacts have differentially influenced the prices of various components of water resources projects. Therefore, forecasts based on statistical analyses of historical price trends are examined to determine whether the differential inflationary impacts in the future may be predicted. Forecasts of this type could be valuable in project evaluation exercises if they are reliable. Unfortunately, all of the tests conducted indicate that simple statistical estimates of anticipated rates of change in relative prices are not reliable predictors of future price movements. On average, forcasting errors associated with forecast models that allowed relative prices to vary invariably were higher than errors for a simple forecast that fixed prices to their base year values. Relative price movements should therefore be forecast only on the basis of fairly substantial analyses of market forces. Under such circumstances the value of the price forecasting information must be weighted against the cost of obtaining this information. (Baker-IVI)
W85-03158

6D. Water Demand

WATER-ENERGY LINKAGES IN NEBRASKA,
Nebraska Univ. at Omaha. Dept. of Civil Engineering.
M. W. Gilliland.
Water Resources Bulletin, Vol. 20, No. 4, p 565-572, August, 1984. 6 Fig, 2 Tab, 15 Ref.

Descriptors: *Nebraska, *Energy, *Water resources development, Groundwater, Economic aspects, Irrigation, Water conservation, Conservation, Agriculture, Electric power, Public policy.

Nebraska is well endowed with water, particularly groundwater, but has few fossil fuel reserves. However, it is located adjacent to states which have almost no water but have enormous quantities of coal and oil shale. Recent court cases facilitate the movement of water from water-rich states such as Nebraska to water-short states, such as Colorado and Wyoming. The possibility of an energy-water partnership exists and raises numerous policy questions. Within Nebraska, energy consumption patterns are similar to those of the nation's, with consumption of electricity in the agricultural secter growing fastest. Water consumption in the state is dominated by agriculture, and future development of groundwater for irrigation is expected to be intense. Although water and energy are both factors of economic production, an equivalent amount of water consumption provides more jobs in the energy industries than in agriculture. Water and energy are also interdependent. Each is required to produce the other and conservation of one will cause conservation of the other. If both agriculture and electricity are involved, such as in irrigation, the conservation effects are synergistic. Current water policy in Nebraska is biased toward agriculture relative to the energy industries and provides little incentive for water conservation. Given recent court cases and economic conditions, the advantages and disadvantages of the sale of water for export or the use of water with Wyoming coal energy development need to be compared systematically with those of using water only for agriculture. (Author's abstract)
W85-02983

RELATIONSHIP BETWEEN COMMERCIAL AND RECREATIONAL USE OF NAVIGATION LOCKS ON THE UPPER MISSISSIPPI RIVER,
Texas Agricultural Experiment Station, College Station. Dept. of Recreation and Parks.
J. H. Gramann, L. McAvoy Jr., J. D. Absher, and R. J. Burdge.
Water Resources Bulletin, Vol. 20, No. 4, p 577-582, August, 1984. 5 Tab, 14 Ref.

Descriptors: *Locks, *Mississippi River, *Boating, *Barges, Recreation, Navigation, Multiple regression analysis.

Navigation locks on the Upper Mississippi River currently receive heavy use from both commercial barge traffic and recreational craft. Multiple regression analysis of lockage statistics suggests a critical level may exist, below which barge traffic volume has little impact on recreational lock use, but above which it physically constrains recreational lockage. The capacity of the Upper Mississippi River for commercial navigation will be increased by the completion of two new lock chambers at Alton, Illinois. This may adversely impact recreational use of locks by raising commercial traffic levels above the critical level at several other locks on the river. (Author's abstract)
W85-02985

WATER SUPPLY FOR POWER IN TEXAS-GULF REGION,
Case Western Reserve Univ., Cleveland, OH. Dept. of Systems Engineering.
For primary bibliographic entry see Field 3E.
W85-03059

AVERAGE ANNUAL FULFILLMENT OF INSTREAM USES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
R. L. Smith, and W. J. Carswell, Jr.
Journal of Water Resources Planning and Management, Vol. 110, No. 4, p 497-510, October, 1984. 7 Fig, 3 Tab, 14 Ref.

Descriptors: *Instream uses, *Fulfillment, Prediction, Policy, Streams, Flow duration, Plains region, Recreation, Water use.

A significant demand for more formal recognition of instream water use has developed at national, regional, and state levels. This poses the need for a methodology to appraise the relative gains and losses which would arise from the imposition of a given instream use policy. Little prior effort has

been directed toward this goal because of the difficulties involved in quantifying instream benefits. This paper does not attempt to place a dollar value on instream benefits, but does present a procedure for determining the average annual fulfillment of instream use. Case analyses are presented for ten streams which represent a wide range of hydrologic regimes encountered in the plains environment. Predictive functions developed in this study are useful in evaluating the relative instream use potential of different streams. These relations reflect the general shape of flow duration curves experienced in the plains region during the recreational year and the hydraulic characteristics of plains streams. They would not be applicable in regions exhibiting significantly different hydrologic and hydraulic characteristics. (Author's abstract)
W85-03066

LOCAL OPPOSITION TO THE TRANSFER OF WATER SUPPLIES; AN OKLAHOMA CASE STUDY,
Oklahoma Univ., Norman. Dept. of Geography.
F. M. Shelley, and C. Wijeyawickrema.
Water Resources Bulletin, Vol. 20, No. 5, p 721-727, October, 1984. 1 Fig, 7 Tab, 15 Ref.

Descriptors: *Lake Tenkiller, *Oklahoma, *Water demand, *Public opinion, Water resources development, Water supply, Water levels, Water transfer, Water management, Decision making.

Interregional conflicts over the allocation and transfer of water supplies have occurred with increasing frequency in the contemporary United States. The results of a case study of citizen opposition to a proposal to transfer water supplies within Oklahoma are presented. A survey was administered to residents of the Lake Tenkiller region who had written letters protesting the City of Tulsa's application to obtain rights to extract water from the reservoir. Survey results indicated that expected effects on water suppy levels were by far the most important negative externality associated with the approval of the application. Effects on the local economy, property values, and recreation were ranked next in importance. The residents of the Tenkiller region appeared to value the maintenance of water levels as important in itself; they proved to be very concerned about the possibility that Tulsa would use too much water and not put the water to appropriate uses. The survey revealed important concern for community interests above and beyond individual self-interest. Effects on the individual and the community were distinguished clearly. The findings support the recently developed concept of turf politics, which suggests that regional and community based considerations tend to dominate interregional locational conflict resolution. (Baker-IVI)
W85-03138

WATER DEMAND AT WESTERN U.S. RECREATION DEVELOPMENTS,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
T. C. Hughes.
Water Resources Bulletin, Vol. 20, No. 5, p 739-746, October, 1984. 1 Fig, 5 Tab, 9 Ref.

Descriptors: *Water demand, *Recreational demand, Regional development, Water quality, Water supply, Regulations.

Regulatory agencies in western US generally do not differentiate between water supply design standards for recreation developments and municipal residential and/or hotel requirements. One notable exception is Utah, which specifies quantities for source, storage, and distribution system capacities for three different types of recreation development. While the volume of potable water used at recreation developments is minor relative to total regional water use, very high quality is required and the source is often of limited capacity such as a mountain spring or small local aquifer. Frequent confrontations between developers and regulatory agencies result from claims by developers that water demand will be very small while regulators tend to treat such developments the same as municipal residence. Almost no published data exists for resolving such conflicts. Included in this report are water use measurements of various peak period durations at several types of recreational developments in Utah and Wyoming, statistical analysis of the data and a comparison with municipal demands in the same region, and an analysis of occupancy rates at the various categories of developments. Mountain cabin developers appear to have a point, particularly in regard to seasonal and monthly water use, and to a lesser extent in regard to daily and instantaneous peaks. All of the mountain cabin system peak flows were substantially less than Utah municipal system peaks. Resort condominium developments, particularly time share types with sustained high occupany rates, however, should probably be held to the same criteria as municipal hotels and perhaps even higher criteria are needed where substantial landscaping is irrigated from the potable system. Recreation vehicle campgrounds clearly generate much lower peaks than other recreation systems and should have a separate design standard. (Baker-IVI)
W85-03140

OGALLALA AQUIFER AND CARBON DIOXIDE: COMPARISON AND CONVERGENCE,
National Center for Atmospheric Research, Boulder, CO. Environmental and Societal Impacts Group.
M. H. Glantz, and J. H. Ausubel.
Environmental Conservation, Vol. 11, No. 2, p 123-131, Summer, 1984. 1 Fig, 48 Ref.

Descriptors: *Aquifer management, *Carbon dioxide, *Global warming, *Ogallala Aquifer, Water supply, Water demand, Water resources management, Environmental impact, Great Plains.

Agricultural activities in the Great Plains today are highly dependent on water drawn from the underlying Ogallala Aquifer. Yet, there is great concern that the water is being drawn out at rates that far exceed its natural rates of recharge. While the Aquifer's thickness and rates of drawdown differ at different parts of the Great Plains, some regions are already in precarious positions due to the depletion of their portion of the Aquifer. This problem of aquifer sufficiency is examined along with the concern voiced over increasing amounts of carbon dioxide in the atmosphere, resulting in a global warming. The CO2 and the Ogallala issues share several important characteristics. First, the two have in common a long time scale - both are expected to become prominent over about the next 50 years. Both problems have features of a potential tragedy of the commons, such as occurs when a shared resource is exhausted or degraded; both will require widespread action to make most responses effective. To compare possible societal responses to depletion of the Ogallala and CO2-induced climatic changes, categories of response are defined and examples are given. Several strategies are considered including preventive strategies, compensation and adaptation modes. It is important that these two issues be considered jointly as, if present trends in exploitation of the aquifer continue and if speculation about the CO2 issues are correct, these two issues may merge in their effects on society. (Baker-IVI)
W85-03203

6E. Water Law and Institutions

OVERVIEW OF THE US-USSR JOINT AGREEMENT ON ENVIRONMENTAL PROTECTION RELATED TO PREVENTION OF WATER POLLUTION,
Amsterdam Univ. (Netherlands). Vakgroep Aquatische Oecologie.
W. R. Swain, R. A. Schoettger, N. V. Butorin, and A. M. Nikanorov.
Journal of Great Lakes Research, Vol. 10, No. 3, p 225-228, 1984.

Descriptors: *International agreements, *Ecosystems, *Water pollution prevention, *United States, *USSR, Great Lakes, Lakes, Regulation, Legislation, Standards.

A US-USSR bilateral Agreement on Environmental Protection was signed in 1972. The Prevention of Water Pollution, a part of the larger agreeme is discussed with respect to large lake proces The organization and infrastructure of this sectio of the agreement is designed to promote a glob environmental ethic. Comparisons of differences techniques and approaches in dealing with lar lake research as determined from the cooperati efforts and resultant scientific papers, has led improved understanding and has strengthened i formation bases upon which management decisio are made. Projects which fall into this area concern must provide a mutually useful outcom and concrete results of significance to aquatic re search; undertake work which is scientifically useful, methodologically sound, at the state-of-the art, and the results of which are scientifically cred ible; afford opportunities for exchange scientist and researchers which enable the transfer of tech nology, allow for personal growth, and provid scientific benefit; and function in an atmosphere o honest reciprocity. To date, as a result of th international cooperative efforts, a total of fiv international symposia have been held, and th proceedings of each have been jointly published i both English and Russian. A total of more tha one hundred contributions to new knowledge ha resulted from the associated projects. (Baker-IVI
W85-02881

SOVIET-AMERICAN COOPERATION IN THE FIELD OF PROTECTING WATER FROM POLLUTION,
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
N. V. Butorin, and R. A. Schoettger.
Journal of Great Lakes Research, Vol. 1, No. 3, p 229-234, 1984. 27 Ref.

Descriptors: *International agreements, *USSR, *United States, *Water pollution prevention, Regulations, Legislation, Standards.

Anthropogenic effects on aquatic resources in the US and USSR are briefly discussed as a background for the efforts undertaken by participants in Project 02.02-13, The Effect of Pollutants on Aquatic Organisms and Ecosystems: Development of Water Quality Criteria, under the US-USSR Joint Agreement on Environmental Protection. The objectives of this project are to jointly identify pollutants of mutual concern, to exchange information and methodologies, to assess effects of the pollutants on aquatic organisms and ecosystems, and to recommend appropriate water quality criteria. Investigations in progress have focused on toxicity of ammonia in different kinds of receiving systems, effects of organophosphate insecticides, degradation of pollutants by microorganisms, and development of behavioral methods for assessing effects of pollutants on aquatic organisms. Since 1975, the Project has sponsored five joint symposia and has produced nearly 100 scientific publications. This well established exchange of scientific information has familiarized the specialists in both countries with the organization, methods, technical equipment, and results of the work done. It has also enabled proposals to be made for a concept of the organizational aspect of protecting bodies of water from pollution, and of the level and evolution of theoretical treatments, and has yielded some practical results of studies that hold promise for development in the USSR and the USA. (Baker-IVI)
W85-02882

FLOOD WARNINGS AND FLOOD RESPONSES FOR THE RED RIVER OF THE NORTH,
Manitoba Univ., Winnipeg. Dept. of Civil Engineering.
I. C. Goulter, and T. C. Hannan.
Water Resources Bulletin, Vol. 20, No. 4, p 599-610, August, 1984. 5 Fig, 9 Tab, 11 Ref.

Descriptors: *Red River of the North, *Canada, *United States, *Flood forecasting, *Flood warnings, Flood damage, Flood hydrographs, Emergency response.

The valley of the Red River of the North is prone o frequent spring flooding. The relatively long ime required for the river flows caused by spring nelt to approach peak stages permits a general prediction of flood hydrographs and flood levels several weeks in advance of the actual event. The Red River crosses the boundary between the USA and Canada. While there are some differences in he flood prediction techniques across the border, he major differences in the flooding conditions lie n the actions taken by those exposed to the flood hazard and in the governmental response to the emergency situation. The accuracy of the prediction measures for the major floods in recent history s reviewed, and the differences between the way in which the American and Canadian authorities approach the flood emergencies are outlined. The accuracy of the forecasts are plotted against a number of parameters which reflect the efficiency of the flood fighting measures initiated by those flood forecasts. Due to the centrally co-ordinated reactive nature of the response to the flood forecast in Canada, flood damage reduction measures undertaken the the Canadian portion of the Red River valley may be more effective in reducing overall damages across the whole of the flooded region. The differences in the response to flood warnings also carries over to the post-flood activities, but the differences are not as significant at this stage. No definite relationship between damages averted and accuracy of flood forecast was observed. (Moore-IVI)
W85-02988

6F. Nonstructural Alternatives

STATE WATER CONSERVATION STRATEGIES AND ACTIVITIES,
Maryland Univ., College Park. Dept. of Geography.
S. W. Sawyer.
Water Resources Bulletin, Vol. 20, No. 5, p 679-685, October, 1984. 1 Fig, 1 Tab, 20 Ref.

Descriptors: *Water conservation, *Water management, *Water resources development, Water policy, State jurisdiction.

Strategies used by states to promote water conservation are identified, the status of state conservation activities is reported and the issues and distributions identified are discussed. It is possible to categorize most state efforts into one of four generic approaches or conservation strategies. The agricultural advice network strategy relies on the existing network of agricultural advisory services. In several states water conservation is advanced in public supply systems by requiring them to have formal conservation programs to qualify for state water supply funding programs. This leverage technique is used in Pennsylvania, Massachusetts, Oklahoma, North Carolina and other states. The performance standards strategy is more forceful than leverage incentives in that it sets specific performance requirements for withdrawal and/or consumption reductions. Conservation mandates are the final, most direct strategy identified. Fifteen states currently maintain some form of ongoing water conservation effort. State adoption of specific conservation programs and related variables are displayed to better observe their frequency of use and regional distribution. Specific needs are identified to further advance the cause of water conservation. (Baker-IVI)
W85-03133

6G. Ecologic Impact Of Water Development

FLUCTUATION IN THE ABUNDANCE OF COMMERCIAL FISHES INFLUENCED BY REGULATED RIVER DISCHARGE (AS EXEMPLIFIED BY KUYBYSHEV RESERVOIR),
Kazan State Univ. (USSR). Dept. of Vertebrate Zoology.
V. A. Kuznetsov.
Journal of Ichthyology, Vol. 20, No. 5, p 32-38, 1980. 3 Fig, 1 Tab, 27 Ref. Translated from Voprossy Ikhtiologii, Vol. 20, No. 5.

Descriptors: *Kuybyshev Reservoir, *Reservoir operation, *Water level, *Fish population, *Population dynamics, Reproduction, Spawning, Fluctuations, Reservoir filling, Environmental effects.

Patterns of fluctuations in abundance during the filling of a reservoir, as exemplified by common fish species in Kuybyshev Resrvoir, are examined. Conditions in reservoirs frequently undergo radical changes as compared with rivers. Pike, blue bream, bream, roach, sichel, white bream, and pike-perch were studied in Kuybyshev Reservoir. The rhythm and range of abundance fluctuations proved to be different in different species of fish during the process of formation of the reservoir. These differences are associated both with the changed environmental conditions, compared with the river, and with the ecological characteristics of these species. The changes in the abundance of fish within the range 30-80% should be considered as showing that a population is capable of adapting to changes in environmental conditions. Higher fluctuation levels, as noted for blue bream and pike, indicate extremely unfavorable conditions for reproduction and to slow adaptation. The food supply, and reproductive conditions are the main factors determining the abundance of populations in a reservoir. Improvement of the conditions of natural reproduction by regulation of the water level regime, improvement of spawning grounds, the creation of regulated spawning grounds and the introduction of protective measures, as well as an increase in natural reproduction, will allow the abundance of species to be regulated and the fish stocks of reservoirs to be used more rationally. (Baker-IVI)
W85-02847

EFFECT OF DREDGING OPERATIONS IN THE VOLGA RIVER ON MIGRATION OF STURGEON LARVAE,
All-Union Sturgeon Farming Research Inst., Astrakhan (USSR).
P. V. Veshchev.
Journal of Ichthyology, Vol. 21, No. 5, p 108-112, 1981. 7 Tab, 6 Ref. Translated from Voprossy Ikhtiologii, Vol. 21, No. 5, 1981.

Descriptors: *Dredging, *Volga River, *USSR, *Sturgeon, *Larvae, *Fish migration, Fish management, Fisheries, Fish populations, Environmental effects, Entrainment.

As a result of regulation of the flow of the Volga, the configuration of the stream is changing and shallow water areas are developing creating the need for intensive dredging in the lower course of the river. Sturgeon fry at the first stage of development migrate primarily along the bottom and middle levels of the river. Since most prolarvae migrate along the bottom, the probability of its being trapped in the sucking unit of the dredger undoubtedly increases. In the 8 regions of the Volga studied, the highest larval catches of sturgeons were recorded in the 17 km segment from the Solodikovskiy to Saralevskiy shoals. Over 4 years of study it was determined that 68 to 76.8% of the total larvae caught upstream of the sucking unit are destroyed by the dredging operation. At the first two stations prolarvae of age groups I-II were found in the catches of roe nets. A study of the size and weight parameters of prolarvae in the 8 sections shows that the prolarvae with a length from 4 to 16 mm and weight from 3 to 21 mg and more are trapped in the dredging equipment. This encompasses all the length and weight groups. Considering the brief duration of migration of the sturgeon fry of early age, it was recommended that dredging operations cease for a short period during the spring floods. (Baker-IVI)
W85-02850

EFFECT OF REGULATION OF THE NILE RIVER ON THE BIOPRODUCTIVITY OF SOUTHEASTERN MEDITERRANEAN SEA,
Colorado Univ., Boulder.
W. Wadia.
Journal of Ichthyology, Vol. 22, No. 5, p 164-167, 1982. 3 Tab, 11 Ref. Translated from Voprossy Ikhtiologii, Vol, 22, No. 5, 1982.

Descriptors: *Nile River, *Fish, *Mediterranean Sea, *Water resources development, *Aquatic productivity, Phytoplankton, Algae, Phosphates, Nutrients, Environmental effects, River regulation.

The Nile River previously brought a large quantity of dissolved nutrients and organic matter into the Southeastern Mediterranean Sea. Since completion of the Aswan hydrocomplex, reduction in the river flow has caused significant change in the distribution of the physico-chemical indices of the sea water as well as in the formation and distribution of the water masses in the region located north of the Nile delta. In recent years changes have been recorded in the dynamics and distribution of water temperature. From 1966 the sediment runoff of the Nile began dropping sharply due not only to reduction in the volume of river water reaching the sea, but also due to a significant reduction in the suspended particles in the flow. This has had a harmful effect on the formation and dynamics of grounds and banks near the delta and north of it. The reproduction of the shrimp in the area has changed significantly in timing and the food supplies for the young shrimp have deteriorated. Shrimp catches in 1966 were half what they had been in 1963. Commercial fishes have also decreased in numbers. Thus all links of the trophic chain have been affected from the phytoplankton to the pelagic and benthic fishes. (Baker-IVI)
W85-02852

POTENTIAL IMPACTS OF WATER DIVERSIONS ON FISHERY RESOURCES IN THE GREAT LAKES,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
B. A. Manny.
Fisheries, Vol. 9, No. 5, p 19-23, October, 1984. 1 Fig, 2 Tab, 39 Ref.

Descriptors: *Environmental impact, *Diversion losses, *Lake fisheries, *Great Lakes, Lake Michigan, Lake Erie, Welland Canal, St. Clair River, Lake Huron, Lakes, Economic impact, Fisheries, Littoral zone, Wetlands, Alewives, Smelt, Perch.

Uses of Great Lakes water within the Great Lakes basin are steadily increasing, and critical water shortages elsewhere may add to the demands for diversions of water out of the basin in the near future. The impacts of such diversions on fish in the Great Lakes must be considered in the context of in-basin uses of the water, because in-basin uses already adversely affect the fishery resources. Temporary in-basin water withdrawals from Lake Michigan by industry in 1980 equaled 260% of the total volume of water between the shoreline and the 10-meter depth - the littoral waters most heavily used by fish as spawning and nursery grounds. Nearly 100% of the fish removed by these water withdrawals were killed. Enough young alewives (Alosa pseudoharengus) and rainbow smelt (Osmerus mordax) in Lake Michigan and young yellow perch (Perca flavescens) in western Lake Erie have been removed at water intakes in recent years to reduce the productivity and biomass of adult fish stocks. Out-of-basin diversions of water at Chicago and at the Welland Canal, channel modifications in the St. Clair River, and in-basin consumptive water withdrawals have lowered the annual mean water level of Lakes Michigan and Huron by about 27 cm and that of Lake Erie by about 10 cm, dewatering wetlands that historically served as spawning and nursery habitat for many valuable fish species. The dollar value of fish lost to water diversions and withdrawals has not yet been estimated, but water withdrawals alone have already reduced the annual economic impact of the Great Lakes fisheries, which has been estimated to be 1.16 billion dollars. (Author's abstract)
W85-02899

WATER SUPPLY AND FORESTRY - A CONFLICT OF INTERESTS: CRAY RESERVOIR, A CASE STUDY,
C. Stretton.
Journal of the Institution of Water Engineers and Scientists, Vol. 38, No. 4, p 323-330, August, 1984. 2 Fig, 3 Tab.

Descriptors: *Land use, *Forestry, *Cray Reservoir, *Wales, *Water pollution sources, Reservoirs, Water quality control, Watersheds, Color, Reservoir operation.

The Cray Reservoir is situated in a glaciated valley in the Brecon Beacons at the head of the river Cray and the dam is 28 m high impounding 4850000 cu m of water at a TWL of 331 m asl. The catchment area of 10.9 sq km and the average annual rainfall of 2146 mm provide a reliable yield of 25 Ml/d, but when the reservoir is full, up to 40 Ml/d are used. Afforestation was begun in March of 1981 with the 36.6 ha Cnewr site which was ploughed and planted. The first indicating of adverse effects of water quality were reported by the reservoir keeper in May of 1981. Discoloration of the Nant Cnewr was evident after heavy rain and contamination of the reservoir was also apparent. The consequences of the developments are all the more serious because much of the distribution area cannot be supplied from an alternative source. The Authority has suffered a significant loss, particularly since management of the reservoir has now slowed the rate of storage recovery and therefore reduced availability of the relatively cheap Cray water. All water systems should list those vulnerable catchments where treatment would be inadequate to cope with significant raw water quality deterioration following land disturbance. This information should be circulated to all parties responsible for the development and control of agricultural land and also to all potential developers. The only solution to the present problems is the provision of a full treatment works. The experience at Cray demonstrates the sensitivity of such direct supply reservoirs to the type of land disturbance that accompanies afforestation. In such circumstances, water supply and forestry cannot coexist, and in future all measures must be applied to divert forestry to those many areas which do not endanger the quality of the public water supply. (Baker-IVI)
W85-03020

MATHEMATICAL MODEL STUDY OF THE FLUSHING CHARACTERISTICS OF A SHALLOW TIDAL BAY,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W85-03052

EFFECTS OF DIKE CONSTRUCTION ON THE WETLAND ECOSYSTEM ALONG THE FRESHWATER SECTION OF THE ELBE ESTUARY,
Hamburg Univ. (Germany, F.R.). Inst. fuer Hydrobiologie und Fischereiwissenschaft.
C. W. Heckman.
Archiv fur Hydrobiologie, Suppl. 61, No. 4, p 397-508, October, 1984. 23 Fig, 12 Tab, 146 Ref.

Descriptors: *Estuaries, *Haseldorder Marsch, *Wetlands, *Elbe Estuary, *Ecosystems, *Dikes, *Environmental effects, Construction, Tidewater, Aquatic biota, Macroflora, Plankton, Zooplankton, Metals.

Since the completion of a new dike in 1978, a large portion of the Haseldorfer Marsch, an alluvial wetland region along the freshwater section of the Elbe Estuary, has been cut off from tidal influence. The lower lying areas no longer undergo rhythmic periods of exposure and inundation, while the lands at slightly higher elevations are freed from the chance of occasional flooding during storm tides. A total of 348 aquatic and littoral species were observed and identified in the former tidal channels and adjacent water bodies behind the dike, compared with 119 and 286 in habitats that had been exposed to little or no tidal influence before the dike was built and 330 in the estuary and supralittoral marshes that were inundated by seasonal storm tides. Most species adapted to the tidal zone seemed to be at a disadvantage in the competition for the habitat, and some had already been eliminated, while others were relatively rare behind the dike except in the vicinity of the sluice gate, which allowed water from the estuary to pass through the dike at times. Several biotic communities were fully displaced behind the dike. A statistical analysis of benthos samples demonstrated that very heterogeneous distribution patterns prevail. Many terrestrial invertebrate species interact with the marsh community by consuming semiaquatic plants or wetland fungi. A comparison of the water chemistry in each aquatic habitat showed that significant differences already exist between the tidal estuary and the marshes cut off from it by the dike. Dense plant masses exert a strong influence on the diurnal oxygen concentration and pH fluctuations, and this is evident in the curves for the water bodies behind the new dike. Although the number of species inhabiting the waters behind the dike can be expected to increase, the situation is of concern to conservationists because many species specialized to freshwater intertidal habitats have become very rare during the past decades, and the loss of a large part of their remaining range will certainly increase their chances of extinction. (Baker-IVI)
W85-03120

OXYGEN PRODUCTION IN A BAY WITHIN THE FRESHWATER SECTION OF THE ELBE ESTUARY. AN INVESTIGATION OF THE MUHLENBERGER LOCH IN HAMBURG (DIE SAUERSTOFFPRODUKTION EINER BUCHT IM SUSSWASSERBEREICH DES ELBE-AESTUARS UNTERSUCHUNGEN IM 'MUHLENBERGER LOCH' IN HAMBURG),
Hamburg Univ. (Germany, F.R.). Inst. fuer Hydrobiologie und Fischereiwissenschaft.
H. Caspers.
Archiv fur Hydrobiologie, Suppl. 61, No. 4, p 509-542, October, 1984. 17 Fig, 11 Tab, 12 Ref.

Descriptors: *Water resources development, *Muhlenberger Loch, *Environmental effects, *Oxygen, *Elbe Estuary, Bays, Estuaries.

During periods of extreme oxygen shortages in the Elbe, the temporary supersaturation of oxygen was recorded in a shallow bay with an area of 540 ha called Muehlenberger Loch. Analyses along section lines demonstrated that within distances of less than 1 km, the oxygen concentration can increase from 1 mg/l in the channel to 13 mg/l in the inner region of the bay. The isolines for oxygen concentration approximate the zones of current flow as they move with the tides. The oxygen-poor water reaches only the outer part of the bay with the flood tide. Through mixing with the water there, its oxygen content is increased to about 3 to 4 mg/l. Vertical light measurements showed that the photic zone is limited to the upper 50 to 100 cm. Twenty-four hour exposure periods permitted the calculation of the daily production of oxygen in the photic zone and the oxygen consumption in the aphotic regions. The BOD values decrease in the deeper water layers. The data were used to calculate the oxygen cycle in the bay which shows the bay to be an oxygen donor to the Elbe during the periods in which the oxygen supply is most precarious. Thus the biological value of shallow bays along the estuary to the whole ecosystem is demonstrated. While there had been plans to fill in part of the Muhlenberger Loch to provide land for industry, these plans have been abandoned. An alternate proposal has been made calling for the deepening of Muhlenberger Loch to develop the area for sailing. (Baker-IVI)
W85-03121

7. RESOURCES DATA

7A. Network Design

CONSOLIDATION OF A STREAM QUALITY MONITORING NETWORK,
Washington Univ., Seattle. Dept. of Civil Engineering.
D. P. Lettenmaier, D. E. Anderson, and R. N. Brenner.
Water Resources Bulletin, Vol. 20, Vol. 4, p 473-481, August, 1984. 5 Fig, 3 Tab, 13 Ref.

Descriptors: *Water quality, *Monitoring networks, *Streams, *Rivers, *Seattle, *Washington, Monitoring, Network design, Cost analysis.

A method was devised for the consolidation of stream quality monitoring network, based on th stream network characteristics and a set of stati attributes. The approach utilizes a heirarchic structure; stations are allocated to what are terme primary basins on the basis of a weighted attribu score, and specific station locations within eac primary basin are specified using a criterion base on stream order numbers. Application of th method to the Municipality of Metropolitan Sea tle's routine streams and rivers monitoring networ aided in reduction of the network from 81 baselin stations to 47 stations, at a savings of approximate ly $33,000/yr, exclusive of equipment depreciatio and indirect costs. The dynamic program result were used to specify the initial network reduction which was modified slightly by inclusion of addi tional, nonquantifiable information such as fiel personnel judgement, political consideration, an the potential for inclusion of monitoring station maintained by other agencies. (Moore-IVI)
W85-02973

SOME PRINCIPLES OF THE STRUCTURE AND ORGANIZATION OF THE HYDROBIOLOGICAL MONITORING OF RIVERS (O NEKOTORYX PRINTSIPAX STRUKTURY I ORGANIZATSII GIDROBIOLOGICHESKOGO MONITORINGA REK),
J. I. Uzunov, and S. G. Kovachev.
Hydrobiology (Bulgarian Academy of Science), Vol. 21, p 34-41, May, 1984. 2 Fig, 24 Ref.

Descriptors: *Monitoring, *Rivers, *Biological properties, Ecosystems, Environmental effects, Water quality, Networks, Standards.

The biological monitoring should include both background as well as direct impact observations with the former being used as an indicator of the extent of the impact. Otherwise the background monitoring is useless. The two trends of observations should be carried out by comparable methods. Many such methods are available right now but others should be developed as well. The hydrobiological monitoring of rivers in particular should be done on biocenotic level with the implementation of the ecosystems approach. A large network of monitoring stations should be organized which would provide the needed samples annd initial information that would be fed into information-processing device of the administrative and managing unit. This should be scientifically guided by the developing of new criteria, methods and standards. (Author's abstract)
W85-03102

INTEGRATED GROUND WATER MONITORING PROGRAM USING MULTILEVEL GAS-DRIVEN SAMPLERS AND CONVENTIONAL MONITORING WELLS,
NUS Corp., Pittsburgh, PA.
For primary bibliographic entry see Field 5A.
W85-03173

UTILIZATION OF SHALLOW GEOPHYSICAL SENSING AT TWO ABANDONED MUNICIPAL/INDUSTRIAL WASTE LANDFILL ON THE MISSOURI RIVER FLOODPLAIN,
Ecology and Environment, Inc., Shawnee Mission, KS.
For primary bibliographic entry see Field 5A.
W85-03175

LONG-TERM CONFIDENCE IN GROUND WATER MONITORING SYSTEMS,
Hart (Fred C.) Associates, Inc., New York.
For primary bibliographic entry see Field 7B.
W85-03183

7B. Data Acquisition

DETERMINATION OF ALKALINITY AND ACIDITY OF WATER BY CONDUCTOMETRIC ACID-BASE TITRATION,
National Water Research Inst., Burlington (Ontario).

'or primary bibliographic entry see Field 5A.
V85-02734

MEASUREMENT OF SOIL WATER CONTENT USING A PORTABLE TDR HAND PROBE,
Department of Agriculture, Ottawa (Ontario). and Resource Research Inst.
For primary bibliographic entry see Field 2G.
W85-02801

EFFECTS OF VISITATION FREQUENCY AND NSTRUMENT RELIABILITY ON THE ACCU-RACY OF ESTIMATION OF RIVER DIS-CHARGES,
owa Inst. of Hydraulic Research, Iowa City.
For primary bibliographic entry see Field 2E.
W85-02825

DETERMINATION OF INORGANIC TELLURI-UM SPECIES IN NATURAL WATERS,
Florida State Univ., Tallahassee. Dept. of Ocean-ography.
For primary bibliographic entry see Field 2K.
W85-02831

ION CHROMATOGRAPHIC DETERMINA-TION OF NITRATE AND SULFATE IN NATU-RAL WATERS CONTAINING HUMIC SUB-STANCES,
Lund Univ. (Sweden). Dept. of Analytical Chem-istry.
For primary bibliographic entry see Field 2K.
W85-02832

ELECTRICAL METHODS OF DETECTING CONTAMINATED GROUNDWATER AT THE STRINGFELLOW WASTE DISPOSAL SITE, RIVERSIDE COUNTY, CALIFORNIA,
California Univ., Riverside. Dept. of Earth Sci-ences.
For primary bibliographic entry see Field 5B.
W85-02858

ELECTRICAL RESISTIVITY INVESTIGATION OF POTENTIAL CAVITIES UNDERLYING A PROPOSED ASH DISPOSAL AREA,
Environmental Science and Engineering, Inc., Gainesville, FL.
For primary bibliographic entry see Field 5G.
W85-02861

EVALUATION OF SOME NEW TRACERS FOR SOIL WATER STUDIES,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 2G.
W85-02869

PREDICTOR-CORRECTOR METHOD FOR MEASUREMENT OF HYDRAULIC CONDUC-TIVITY AND MEMBRANE CONDUCTANCE,
Hebrew Univ., Rehovoth (Israel). Faculty of Agri-culture.
For primary bibliographic entry see Field 2G.
W85-02870

WEIGHING LYSIMETERS FOR LONG-TERM WATER BALANCE INVESTIGATIONS AT REMOTE SITES,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 2G.
W85-02879

APPLICATION OF MATHEMATICAL MODELS TO LARGE AQUATIC ECOSYS-TEMS,
Hydrochemical Inst., Rostov-na-Donu (USSR).
For primary bibliographic entry see Field 2A.
W85-02883

SIMULATION MODELING AS A MEANS OF STUDYING LARGE AQUATIC ECOSYSTEMS,
Rostovskii-na-Donu Gosudarstvennyi Univ. (USSR). Nauchno-Issledovatel'skii Inst. Mekhaniki i Prikladnoi Matematiki.
For primary bibliographic entry see Field 2A.
W85-02884

INTERCOMPARISONS OF ANALYTICAL METHODOLOGY AND LABORATORY CAPA-BILITIES BETWEEN SOVIET AND AMERI-CAN LABORATORIES - 1973 AND 1977,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
For primary bibliographic entry see Field 5A.
W85-02887

USING HEAT CAPACITY MAPPING MISSION (HCMM) DATA TO ASSESS LAKE WATER QUALITY,
Brigham Young Univ., Provo, UT. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W85-02975

DEVELOPMENT OF EARTH SATELLITE TECHNOLOGY FOR THE TELEMETRY OF HYDROLOGIC DATA,
Geological Survey, Reston, VA.
R. W. Paulson, and W. G. Shope, Jr.
Water Resources Bulletin, Vol. 20, No. 4, p 611-618, August, 1984. 2 Fig, 11 Ref.

Descriptors: *Satellite technology, *Hydrologic data, Remote sensing, Automation, Telemetry.

The use of satellite telemetry is playing a major role in the collection of hydrologic data. Advancing technology and availability of government satellites have permitted many agencies to take advantage of new procedures for acquiring data from automated remote data collection stations. Experiments with Earth satellite technology started in the 1960's and 1970's, with the polar-orbiting National Aeronautics and Space Administration Nimbus and Landsat satellites. Subsequent advancements took place through the development phase to operational systems using the Geostationary Operational Environmental Satellite (GOES) of the National Oceanic and Atmospheric Administration. This satellite system supports more than 2,500 active telemetry sites, of which approximately 1,200 are Geological Survey stream-gaging stations for the collection of hydrologic data. A satellite data collection system is made up of three primary components; a small battery-operated radio, an Earth-orbiting satellite, and an Earth receive and data processing station. The data relay satellites' vast aerial view of the Earth's surface gives satellite telemetry a large advantage over ground-based systems for the collection of real-time hydrologic data for flood warning, reservoir management, irrigation water control, hydropower generation, and the operation of hydrologic stations. (Author's abstract)
W85-02989

INEXPENSIVE WEIR AND PROPORTIONAL SAMPLER FOR MINIATURE WATERSHED ECOSYSTEMS,
Environmental Protection Agency, Washington, DC. Office of Pesticides and Toxic Substances.
J. V. Nabholz, D. A. Crossley, Jr., and G. R. Best.
Water Resources Bulletin, Vol. 20, No. 4, p 619-625, August, 1984. 3 Fig, 2 Tab, 19 Ref. DOE contract DE-AS09-76EV00641.

Descriptors: *Weirs, *Samplers, *Small watersheds, Soil-island ecosystems, Water sampling, Rainfall runoff.

Small ecosystems, called soil-island communities, occur in depressions on granitic outcrops. These ecosystems are typically irregularly circular, and only several meters in width. A weir system with a proportional sampler for use on such miniature watershed ecosystems is described. Eight weir collection systems were evaluated for their ability to measure and sample inputs and outputs of soil-island ecosystems. The proportional water samples collected by the weir collection systems were adequate for elemental analysis and provided sufficient data for calculating elemental budgets. Although some of the proportional samples were less than the weir systems were designed to collect, a composite, proportional sample was obtained throughout an entire precipitation event. The greatest danger to sample accuracy is exceeding the capacity of the system. The weir systems were not able to account to 25 to 50% of the variation in total water passing over the cutoff wall. Optimal performance of a proportional sampler occurs when volume of water flow is near maximum rather than near minimum. (Moore-IVI)
W85-02990

EVALUATION OF TRACER DILUTION TECH-NIQUES FOR GAUGING OF RIVERS IN FLOOD,
Australian Atomic Energy Commission Research Establishment, Sutherland.
For primary bibliographic entry see Field 2E.
W85-03085

CALIBRATION OF SOIL SURFACE NEUTRON MOISTURE METER,
For primary bibliographic entry see Field 2G.
W85-03096

INTERVENTION ANALYSIS OF WATER QUALITY RECORDS,
Inland Waters Directorate, Vancouver (British Columbia). Water Quality Branch.
P. H. Whitfield, and P. F. Woods.
Water Resources Bulletin, Vol. 20, No. 5, p 657-668, October, 1984. 9 Fig, 4 Tab, 20 Ref.

Descriptors: *Water quality, *Water management, *Kootenai River, *Model studies, Stochastic hydrology, Water resources development.

The use of intervention analysis for statistically describing and modeling streamflow and water quality variables and the effects of impoundment on these variables are discussed. The intervention models were developed with data collected from June 1967 through February 1981 at the two stations on the Kootenai River immediately downstream from Libby Dam. In March 1972 the Kootenai River was impounded by Libby Dam in northwestern Montana to form Lake Koocanusa, a large reservoir operated to provide flood storage, hydroelectric power, and recreation benefits. The water quality of the Kootenai River downstream of the damsite was altered. The alterations are attributable to limnological processes which took place within the reservoir that was created. The application of time series methods, in particular intervention models, allowed the monthly changes in water chemistry to be quantified, and tested for significance. The changes downstream were largely attributable to the depth of withdrawal from the reservoir and the reservoir's ability to store and mix various influent water masses. The preimpoundment and postimpoundment time series of discharge and six water quality variables were autocorrelated and exhibited strong seasonality. (Baker-IVI)
W85-03131

REMOTE SENSING APPROACH FOR MOD-ELING WATER RESOURCE USE,
Kansas State Univ., Manhattan. Dept. of Geography.
M. D. Nellis.
Water Resources Bulletin, Vol. 20, No. 5, p 789-793, October, 1984. 3 Fig, 1 Tab, 11 Ref.

Descriptors: *Water resources development, *Remote sensing, *Irrigation, Water use, Leakage, Seepage, Reservoirs, Canals, Comsumptive use.

Remote sensing data combined with other spatially referenced data were used to predict water resource use in an irrigated area of Central Oregon. Crop type and irrigation method were determined using color infrared aerial photography and thermal infrared imagery, respectively. These data were combined with crop consumptive use and

irrigation method application efficiency values to determine total water applied to a transect sample through the heart of the study area. This information, when integrated with data on canal leakage and storage reservoir seepage, allowed the researcher to predict total water use for the entire management unit. The model developed was accurate at a level of 92.0%. The approach outlined can be repeatable, practical and cost-effective throughout irrigated areas of the Western United States. With projected increase in irrigated areas throughout the arid Western United States and the frequent lack of water resource use information, remote sensing data, when combined with other data inputs, can provide water managers with critical statistics on total water use. Such information, when combined with institutional and economic variables can increase the resource manager's ability to make wise management decisions. (Baker-IVI)
W85-03145

FLOW-THROUGH MICROCUVETTE FOR FLUOROMETRIC DETERMINATION OF CHLOROPHYLL,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
M. F. Knowlton.
Water Resources Bulletin, Vol. 20, No. 5, p 795-799, October, 1984. 4 Fig, 3 Tab, 13 Ref.

Descriptors: *Measuring instruments, *Chlorophyll, *Fluorometers, *Microcuvettes, Water analysis, Water quality control, Cuvettes.

A flow-through microcuvette is described for determination of chlorophyll with the Turner Designs model 10 fluorometer. The device approximately doubles the speed of repetitive chlorophyll determinations. With a single- standard calibration procedure, chlorophyll concentrations in the approximate range of 0.01-2.0 microg/mL can be determined with a relative error of less than 3%. Coupled with the use of extraction techniques which remove the need for grinding sample filters, use of an FTM-equipped fluorometer and the procedures outlined here can minimize the time and effort required for precise determination of chlorophyll. Adoption of these techniques can be of great advantage to those engaged in routine analysis of large numbers of chlorophyll samples. (Baker-IVI)
W85-03146

COMPUTING DRAWDOWN DISTRIBUTION USING MICROCOMPUTERS,
GAI Consultants, Inc., Monroeville, PA.
For primary bibliographic entry see Field 2F.
W85-03157

INNOVATIVE SAMPLING TECHNIQUES FOR GROUND WATER MONITORING AT HAZARDOUS WASTE SITES,
CH2M Hill, Inc., Gainesville, FL.
T. C. Emenhiser, and U. P. Singh.
Ground Water Monitoring Review, Vol. 4, No. 4, p 35-37, Fall, 1984. 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Monitoring, *Groundwater, *Sampling, Measuring instruments, Water pollution control.

Several innovative techniques have been employed for sampling ground water quality at hazardous waste sites. One sampling technique involved the use of the new ISCO Model 2600 submersible portable well sampling pump. A compressed air source forces water from the well into the pump casing and then delivers it to the surface through a pulsating action. This pump was used in wells that could not be sampled with surface lift devices. Another sampling technique involved the use of a Teflon manifold sampling device. The manifold is inserted into the top of the sampling bottle and a peristaltic pump creates a vacuum to draw the water sample from the well into the bottle. The major advantage of this technique for these conditions is the direct delivery of the water sample into the collection container, reducing the potential for contamination. These sampling techniques are successful in reducing cross-contamination between monitoring wells. Analysis of field blanks using organic-free water in contact with these sampling devices did not show any concentration at or above the method detection limit for each priority pollutant. (Baker-IVI)
W85-03171

PORTABLE WELL POINT SAMPLER FOR PLUME TRACKING,
W. B. Kerfoot.
Ground Water Monitoring Review, Vol. 4, No. 4, p 38-42, Fall, 1984. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Sampling, *Water analysis, *Groundwater, Cost analysis, Economic aspects, Plumes.

A shallow well point sampler can provide cost-effective sampling of contaminant plumes for regions of shallow groundwater. A miniature well point sampler allows rapid sampling of groundwater down to a maximum depth of 12 ft below grade. A high ratio of striking force to cross-sectional area of the shaft enables the well point to penetrate soils grading from silt through sand to fine gravel. Three slot sizes have proved satisfactory for the slotted well point. For fine gravel through silty sand, a receiver flask serving as a silt trap with a hand pump can withdraw water samples. For silt or clay, a special shielded point is used to expose a porous screen upon withdrawal of the shaft. The points can be left imbedded in the strata and a vacuum drawn to recover a sample under saturated or unsaturated conditions. The probe has been used in dye studies with conductivity meters and fluorometers for profiling subsurface plumes. A cost comparison is shown between monitoring well installation and the portable well point for varying sample frequency and depth. The cost of investigation is usually one-fourth to one-fifth that of small diameter well installation. The low purge volume and degree of isolation of the points during sampling avoid dilution interferences commonly encountered in monitoring wells. (Baker-IVI)
W85-03172

SUCTION SIDE SAMPLE CATCHER IN GROUND WATER QUALITY SAMPLING,
McLaren Environmental Engineering, Inc., Sacramento, CA.
For primary bibliographic entry see Field 5A.
W85-03174

SPATIAL MAPPING OF CONDUCTIVE GROUND WATER CONTAMINATION WITH ELECTROMAGNETIC INDUCTION,
Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV.
For primary bibliographic entry see Field 5A.
W85-03177

APPLICATION OF COMBINED SEISMIC AND ELECTRICAL MEASUREMENTS TO THE DETERMINATION OF THE HYDRAULIC CONDUCTIVITY OF A LAKE BED,
Wisconsin Univ.-Milwaukee. Dept. of Geological Sciences.
R. W. Taylor, and D. S. Cherkauer.
Ground Water Monitoring Review, Vol. 4, No.4, p 78-85, Fall, 1984. 12 Fig, 22 Ref.

Descriptors: *Groundwater, *Monitoring, *lake beds, *Hydraulic properties, Groundwater flow, Permeability.

The hydraulic properties of lake beds control the interactions between lakes and ground water systems, but these properties are normally difficult to measure directly. The method presented combines seismic reflection and electrical measurements to map the relative hydraulic conductivity of lake bed sediments. A shipboard seismic profiling system provides sediment thickness, while a towed electrical array yields longitudinal conductance and electrical chargeability. The procedure and systems have been used to map the bed of Lake Michigan offshore from an area of heavy pumpage. Mapping these plumes onshore permits the inference of the spatial distribution of offshore hydraulic conductivities. Offshore seepage measurements and numerical, chemical transport modeling of this site have confirmed the reliability of the geophysically derived hydraulic conductivities and have also demonstrated the improvement in numerical results achieved through the availability of spatially determined hydraulic conductivities. (Baker-IVI)
W85-03178

MONITORING HYDROGEOLOGICAL CONDITIONS IN FRACTURED ROCK AT THE SITE OF CANADA'S UNDERGROUND RESEARCH LABORATORY,
Atomic Energy of Canada Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
For primary bibliographic entry see Field 8E.
W85-03180

GROUND WATER INSTRUMENTATION PROGRAM OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey, NSTL Station, MS. Hydrologic Instrumentation Facility.
E. H. Cordes.
Ground Water Monitoring Review, Vol. 4, No. 4, p 103-114, Fall, 1984. 15 Fig, 3 Ref.

Descriptors: *Measuring instruments, *Groundwater, *Monitoring, Flowmeters, Pumps, Groundwater flow, Water sampling.

A variety of ground water data collection and sampling programs have been carried out over the years by the US Geological Survey. The use of commercial and industrial equipment in these studies is often precluded due to constraints imposed by logistics and the environment. In house design and development of selected instruments has been commonplace as well as modifying already existing equipment to fit the specific need involved. Groundwater instrumentation currently being designed and developed includes running time totalizer, cross-correlation pipe flowmeter, ground water monitoring system, and a small diameter deep well pump. Each of these developments is described and their principles of operation are presented. (Baker-IVI)
W85-03181

TECHNIQUES AND EQUIPMENT USED IN CONTAMINANT DETECTION AT HOE CREEK UNDERGROUND COAL GASIFICATION EXPERIMENTAL SITE,
University of Wyoming Research Corp., Laramie. Western Research Inst.
S. C. Davidson, E. M. McTernan, and R. G. Kunzel.
Ground Water Monitoring Review, Vol. 4, No. 4, p 115-118, Fall, 1984. 4 Fig, 5 Ref.

Descriptors: *Groundwater, *Monitoring, *Wells, *Hoe Creek Coal Gasification Plant, *Wyoming, *Powder River Basin, Coal gasification, Plumes, Groundwater pollution.

Twenty new monitoring wells were drilled at the Hoe Creek Underground Coal Gasification site. The final locations of the wells were determined by taking a water sample for the hole after it was drilled and field analyzing the sample for total phenol. Three aquifers were monitored in each well by using multiple well completion techniques with gas-drive sampler/piezometers. The location for each sampler piezometer was determined using electric logs. These logs were also used to obtain a more accurate picture of the site geology. The techniques and equipment used in this project have successfully delineated the contamination plume on the east, south and west sides of the three UCG burns. The limit of contamination to the north has not been defined because offsite drilling was required and permission from the landowner had not been obtained. It is anticipated that further work will be conducted to estimate the northern limit of the contaminant plume. (Baker-IVI)
W85-03182

LONG-TERM CONFIDENCE IN GROUND WATER MONITORING SYSTEMS,

rt (Fred C.) Associates, Inc., New York.
A. Perazzo, R. C. Dorrler, and J. P. Mack.
ound Water Monitoring Review, Vol. 4, No. 4, 19-123, Fall, 1984. 3 Fig, 1 Tab, 5 Ref.

escriptors: *Groundwater, *Monitoring, *Equipnt, Measuring instruments, Water quality con-l, Wells.

e degree of confidence placed in the analytical a from a ground water monitoring system nesitates that the system is carefully designed and nstructed. A thorough understanding of the geoic and hydrogeologic settings and the geoemical properties of the natural and/or contamited ground water are essential elements to be nsidered in the design of a monitoring system. ace installed, a monitoring system should be perically maintained and inspected to ensure that e wells are in hydraulic connection with the onitored zone and no obvious physical defects in e grout seal or well casing have occurred. When e integrity of the monitoring system beomes susct, a more detailed inspection using downhole evision cameras may confirm specific problems th the well casing. If certain problems are identid, abandonment of the monitoring system may the most viable option. The common goal of all andonment techniques is to place a competent out seal throughout the borehole. Several alterative abandonment methodologies have been entified. The most suitable abandonment techque depends primarily on the type of well conuction. An inspection and investigation of an isting monitoring system at a hazardous waste sposal facility was undertaken. The findings of is inspection and investigation indicate that the onitoring wells were providing pathways for ntaminant migration as a result of construction chniques, installation techniques and physical dects in the well casing materials. Subsequently, an opropriate abandonment program was designed d implemented. This program involved the in ace destruction of the monitoring wells while eventing contaminants from migrating during e abandonment process and after the well was moved by ensuring the re-drilled borehole was mpletely sealed. (Baker-IVI)
785-03183

PPLICATION OF TELEMETRY TO LARGE-CALE HORIZONTAL ANISOTROPIC PERIEABILITY DETERMINATIONS BY SURACE TILTMETER SURVEY,
ermeability, Inc., Orinda, CA.
. W. Loo, K. Franz, and G. R. Holzhausen.
round Water Monitoring Review, Vol. 4, No. 4, 124-130, Fall, 1984. 10 Fig, 12 Ref.

escriptors: *Groundwater, *Monitoring, *Measring instruments, *Tiltmeters, *Telemetry, Perieability, Groundwater movement, Anisotropy.

he application of telemetry to large-scale horiontal anisotropic permeability by surface tiltmeter uveys can provide the following improvements on onventional pump test analysis. Only one pumpg well and one observation well are needed with n array of 8 to 10 tiltmeter monitoring stations. eal-time analysis is provided of horizontal anisoropic permeability or heterogeneity of the aquifer ystem as the pressure decline cone expands. Hyraulic test depth range may effectively extend to ,000 feet in a cost effective manner. Improved ersatility and flexibility of data acquisition by two vay radio links will result. A thorough understanding of the geology overlying the aquifer ystem must be made in order to assess the applicaility of the surface tiltmeter survey to large-scale orizontal anisotropic permeability. (Baker-IVI)
W85-03184

NEW SYSTEM FOR GROUND WATER MONITORING,
BAT Envitech A.B., Stockholm (Sweden).
B.-A. Torstensson.
Ground Water Monitoring Review, Vol. 4, No. 4, p 131-138, Fall, 1984. 13 Fig, 1 Tab, 6 Ref.

Descriptors: *Groundwater, *Monitoring, *Measuring instruments, Pore water, Water pressure, Permeability, Groundwater flow, Groundwater movement.

A new system is described for ground water monitoring, called the BAT system, which includes the following functions: sampling of ground water in most types of soils, measurement of pore water pressure, and in situ measurement of hydraulic conductivity. The system can also be used for tracer tests. A permanently installed filter tip is used attached to a steel or PVC pipe. In most cases installation is performed by pushing the tip down to the desired depth. The filter tip can also be buried beneath a landfill. The primary feature of the new system is that the filter tip contains a self-sealing quick coupling unit, which makes it possible to temporarily connect the filter tip to adapters for various functions. Water sampling and measurements of pore pressure and hydraulic conductivity are some of these functions. Sampling of both pressurized water and gas is possible with the new technique. Samples are obtained directly in hermetically sealed, pre-sterilized sample cylinders. Sampling of ground water and measurement of pore pressure can be repeated over a long period of time with undiminished accuracy. Water samples can also be taken from different strata in a soil profile, in both the saturated and unsaturated zones. Actual installations range from 0.5 to 60 m depth. (Baker-IVI)
W85-03185

SIMPLE PNEUMATIC DEVICE AND TECHNIQUE FOR PERFORMING RISING WATER LEVEL SLUG TESTS,
Purdue Univ., Lafayette, IN.
D. I. Leap.
Ground Water Monitoring Review, Vol. 4, No. 4, p 141-146, Fall, 1984. 4 Fig, 8 Ref.

Descriptors: *Groundwater, *Monitoring, *Transmissivity, Wells, Aquifer characteristics, Groundwater level.

A pneumatic water level depressor can be built quite inexpensively for about $500 from off-the-shelf items. It provides a method of making water level recovery tests for transmissivity in wells without having to inject water or bail it out or to displace it with a dead weight. More sophistication can be obtained by use of a pressure transducer and strip chart recorder or data logger to detect and record water level changes, but the device described is much less expensive and does not require calibration before each test as does the transducer. In addition, there is the advantage of rugged durability. The simplicity of the device is advantageous in rugged field conditions because it has few sophisticated parts to break down. Field repairs are quite easy and replacement parts can usually be obtained from a local hardware store or machine shop. Plots of head recovery in the well as a function of time can be used to estimate transmissivity by three well-established methods. (Baker-IVI)
W85-03186

DESIGN AND IMPLEMENTATION OF EVAPOTRANSPIRATION MEASURING EQUIPMENT FOR OWENS VALLEY, CALIFORNIA,
For primary bibliographic entry see Field 2D.
W85-03188

SURFACE AND BOREHOLE GEOPHYSICAL METHODS IN GROUND WATER INVESTIGATIONS,
O'Brien and Gere Engineers, Inc., Syracuse, NY.
For primary bibliographic entry see Field 2F.
W85-03189

APPLICATION OF TELEVISION BOREHOLE LOGGING TO GROUND WATER MONITORING PROGRAMS,
Hart (Fred C.) Associates, Inc., New York.
For primary bibliographic entry see Field 2F.
W85-03190

STATE-OF-THE-ART APPROACH TO HYDROLOGIC DATA MANAGEMENT,
Insitu Consulting, Laramie, WY.
S. C. Way, H. K. Wainwright, and W. P. Ward.
Ground Water Monitoring Review, Vol. 4, No. 4, p 179-182, Fall, 1984. 5 Fig, 2 Tab.

Descriptors: *Measuring instruments, *Water level, *Hydrologic data, *Automation, Data management, Groundwater, Monitoring, Pump testing, Slug tests, Computers.

High-accuracy electronic data acquisition equipment, a solid-state memory, computer interface and software have been developed to provide a complete system for measuring and recording water level changes. A small, stand alone hydrologic instrument, the SE1000, provides the automation and accuracy of solid-state electronics in pump tests, slug tests, and long and short term groundwater monitoring. The unit is powered by a high performance battery pack with a minimum life of four years. This instrument can be buried at the monitoring site for protection from vandals, animals and temperature extremes. Ten pre-programmed 949-point data schedules are standard. One schedule is logarithmic with an initial data interval of 0.2 seconds. Nine linear schedules provide data intervals ranging from 15 minutes to 1.5 days and corresponding test durations ranging from 10 days to 46 months. The stored data can be recovered directly via the LCD display or transferred to a computer. Software provides automatic data reduction with hard copy tables and plots. The SE1000 has been used successfully for data collection in a number of capacities. One example of its use involved the measuring and recording of water levels in a Parshal flume at a remote site in Utah, approximately 10,000 feet above sea level. The instrument was installed in the fall of 1982, as field conditions permitted, and left there to collect data, unattended, during the following spring. At another site, in Wyoming, slug tests were performed on a number of existing stock wells to determine the range of transmissivity values over a large area. (Baker-IVI)
W85-03191

MONITORING IN THE VADOSE AND SATURATED ZONES UTILIZING FLUOROPLASTIC,
Timco Mfg., Inc., Prairie du Sac, WI.
T. Fishbaugh.
Ground Water Monitoring Review, Vol. 4, No. 4, p 183-187, Fall, 1984. 4 Fig, 3 Tab, 7 Ref.

Descriptors: *Lysimeters, *Groundwater, *Monitoring, *Fluoroplastic, Vadose zone, Saturated zone, Filter materials.

The development of the sleeve lysimeter has alleviated many of the problems involved in monitoring the saturated/unsaturated zone. With the sleeve lysimeter attached directly to the casing string, correlation problems between the zones are eliminated. Installation time is reduced because the entire system is installed at the same time and because the number of seals and conductor pipes is at a minimum. The sleeve lysimeter's threaded design enables the other components of the monitoring well to be variable in design and construction. This affords a monitoring well suited for the soil characteristics and contamination present and also allows the design to have more flexibility with costs. It should be emphasized that savings in initial installation costs can be misleading in the overall long-term monitoring program. The development of the Teflon lysimeter and monitoring well has made it possible to install a totally inert monitoring system; a system in which the materials used in construction do not interfere with the integrity of the well or the samples withdrawn. (Baker-IVI)
W85-03192

7C. Evaluation, Processing and Publication

STANDARD HYDROLOGIC EXCHANGE FORMAT (SHEF),

National Weather Service, Portland, OR. Northwest River Forecast Center.
V. C. Bissel, P. A. Pasteris, and D. G. Bennett.
Journal of Water Resources Planning and Management, Vol. 110, No. 4, p 392-401, October, 1984. 4 Fig, 2 Tab, 8 Ref.

Descriptors: *Standard Hydrologic Exchange Format, *Data processing, *Hydrologic data, *Meteorological data, Data transmission, Automation.

The Standard Hydrologic Exchange Format (SHEF) has been developed jointly by the National Weather Service (NWS) and by the Corps of Engineers North Pacific Division for use in the interagency Columbia River Operational Hydromet Management System (CROHMS). SHEF features include: (1) Readability by both man and machine; (2) two characters to describe most hydrometeorological parameters; (3) internal data base identification of observational data, processed products, and forecasts; (4) time identification in either local or Greenwich meridian time systems; (5) identification of data from non-standard locations; (6) optional special data descriptors to individual data values; (7) three different format structures to allow coding one-station-per-line, several lines with common data elements indicated by a header line, and lines of evenly time spaced data strings; (8) flexibility in use of spaces and comments within code text to enhance readability; and (9) ease of use in either English or SI units. The SHEF code holds great potential for easing automated exchanges of operational hydrometeorological data among a wide variety of agencies and reducing the multiplicity of data-receiving software typical of many broad-scale operations. (Author's abstract)
W85-03060

8. ENGINEERING WORKS

8A. Structures

GROUTING REHABS EARTH DAM,
GKN Hayward Baker Co., Odenton, MD.
W. H. Baker, H. N. Gazaway, and G. Kautzmann.
Civil Engineering, Vol. 54, No. 9, p 49-52, September, 1984. 4 Fig, 1 Tab.

Descriptors: *Earth dams, *Rehabilitation, *Grouting, Dam construction, Powerplants, Storage basins, Acrylate, Cement, Fly ash.

The following crucial steps were required for the cutoff grout curtain rehab: careful, detailed subsurface investigation and work planning; cased-hole drilling to protect the embankment materials from hydraulic fracturing due to drilling fluid pressures; low-pressure, short duration water testing to assist in type selection of grout; field selection of grout types, on a hole-by-hole basis, between stable cement-based grouts for high water-take zones and rapid-setting, low-viscosity acrylate groups for the lower water-take zones; high-speed shear mixing of low water:cement or water:solids ratio grouts to produce a stable grout mix with excellent groutability; continuous mixing injection of controlling gel time, acrylate grout for pumping times longer than gel times; injection under low pressures of selected grout type in split-spaced borehole pattern, with at least secondary holes and tertiary holes in high take areas; careful monitoring of injection pressures and flow rates to detect embankment fracturing; and piezometer monitoring of before- and after-grouting water levels within the dam embankment and foundation. These were the steps used in rehabing an earthfill dam for a storage basin at a Pennsylvania powerplant. The implementation of the cement/fly ash and acrylate chemical grouting program is described. (Baker-IVI)
W85-02728

YANGTZE ENGINEERS AIM HIGH.
For primary bibliographic entry see Field 6B.
W85-02753

WHY NOT HERE - AN ENGINEER LOOKS AT INLAND WATERWAY TRANSPORT,
Imperial Coll. of Science and Technology, London (England).
M. Baldwin.
Proceedings of the Institution of Civil Engineers, Vol. 76, Part 1, p 601-613, August, 1984. 10 Tab, 31 Ref.

Descriptors: *Transportation, *Canals, *Great Britain, *Inland waterways, Planning, Waterways, Civil engineering.

It is often popularly supposed that the development of waterway engineering in Britain came to an end with the onset of the railway age. The careers of L. F. Vernon-Harcourt, Sir Edward Leader Williams, William Bartholomew and John Saner, all of whom started work in the period 1840-1880, show that this is not the case, although it remains true that there has been little important development this century. In contrast, in may other industrialized countries innovative engineering has been essential to allow waterways to remain competitive in the freight transport market. Why do so many other nations make far greater use of this mode than the UK does. Before answering this, the important features of inland waterway transport must be identified. These include the absence of monopolistic operation, and the large capacity and low operating costs of the craft. No intrinsic technical factor explains the low level of use of waterways in Britain, nor does the topography. Instead, the answer lies in our system of planning and financing transport. The removal of existing anomalies would not only give industry access to cheap transport, with minimum environmental disturbance, but also provide the associated benefits of water distribution, and leisure use. (Author's abstract)
W85-02947

NEW PORT OF SAPELE, NIGERIA,
P. W. Ediale, J. G. Logie, and J. W. Alexander.
Proceedings of the Institution of Civil Engineers, Part 1, Vol. 76, p 615-634, 1984. 11 Fig, 3 Ref, 4 Append.

Descriptors: *Construction, *Design criteria, *Port facilities, *Sapele, *Nigeria, Planning, Management, Decision making, Contracts.

The program of development of the ports in Nigeria during the past 25 years is reviewed. Particular attention is given to the role of the Port of Sapele. Sapele is situated on the Benin River and is approached from the sea by entering the Escravos River and through the Nana Creek to join the Benin River. The contract negotiations for the port are described leading to the start of construction in July 1980. The port has a quay length of 1150 m, the quay having a composite schedule of facilities including a unique combined water and control tower. Construction problems are discussed including methods adopted to create the port of Sapele out of virgin forest in a period of 18 months. Details are provided concerning soils investigation studies, dredging and reclamation works, pilings, the control/water tower, buildings and structures, concrete pavements, materials and workmanship, and staff. The port of Sapele was commissioned on 1 May 1982, from which date the port has been in operation. (Baker-IVI)
W85-02948

REINFORCEMENT CORROSION AND THE DURABILITY OF CONCRETE BRIDGES,
Transport and Road Research Lab., Crowthorne (England).
P. Vassie.
Proceedings of the Institution of Civil Engineers, Vol. 76, Part 1, p 713-723, August, 1984. 6 Fig, 1 Tab, 11 Ref.

Descriptors: *Bridges, *Concrete construction, *Corrosion control, *Reinforced concrete, Bridge design, Salts, Chloride, Cathodes, Asphalt.

Corrosion can arise in most parts of a bridge substructure or superstructure and usually results from the use of de-icing salts. Substructure corrosion is often associated with leaking joints, faulty drainage or salt spray from traffic. General corrosion is found on substructures and although this is a relatively slow process, producing only small reductions in bar cross-section, it causes substantial disruption of the concrete cover. Localized corrosion has occurred on unwaterproofed decks and is much more rapid than general corrosion; it lead to substantial local reductions in bar cross-section. This form of corrosion is not easy to detect visually because it is not always associated with concrete disruption or rust staining and, in any event, the deck is covered with asphalt surfacing. Several site investigation tests are available. When used together they can usually locate corroding reinforcement, determine its type and causes and estimate its rate, thus providing the information required to specify repairs. The threshold concentration of chlorides in concrete bridges of 0.35% has not proved a reliable basis for predicting corrosion. Likely explanations are that chloride contamination is associated with relatively high concentrations of the more-damaging free chloride ion. Localized anodes also sometimes protect the surrounding steel from effects of high chloride levels. The repair of chloride-contaminated bridges is difficult. Repair of corroding areas is generally effective, but the development of anodes in the concrete adjacent to the repair can lead to further damage. Cathodic protection appears to be the most promising method of overcoming this problem, although further development is needed before it can be applied effectively. (Author's abstract)
W85-02950

HYDROECOLOGY OF THE GRASS-ASSOCIATIONS FOUND AT THE DAMS ALONG THE UPPER-TISZA,
Jozsef Attila Univ., Szeged (Hungary). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W85-03118

DESIGN FOR A STABLE CHANNEL IN COARSE ALLUVIUM FOR RIPARIAN ZONE RESTORATION,
Bureau of Land Management, Denver, CO.
For primary bibliographic entry see Field 2E.
W85-03135

8B. Hydraulics

BOUNDARY EFFECTS ON A SUBMERGED JET GROUP,
Hong Kong Univ. Dept. of Civil Engineering.
J. H. W. Lee.
Journal of Hydraulic Research, Vol. 22, No. 4, p 199-216. 9 Fig, 2 Tab, 10 Ref.

Descriptors: *Boundary effects, *Jets, *Model studies, *Boundary conditions, Hydraulics, Mixing, Hydraulic models.

A vortex model was employed to calculate the flow induced by a line group of submerged high velocity shallow water jets discharging in proximity to a shoreline boundary. Based on an inviscid flow model, kinematic and dynamic boundary conditions were formulated along the unknown lines of velocity discontinuity downstream of the multiple jets. This resulted in two governing nonlinear integral equations in terms of the unknown circulation strength along the unknown slipstream lines. The numerically computed two dimensional momentum-induced flow showed that, as the jet group is placed closer to the boundary, the contraction of the slipstream becomes stronger, resulting in a decrease of the induced flow. All of the features predicted by the theory are in good agreement with experimental results of this and previous investigations. (Author's abstract)
W85-02952

SCOUR DUE TO RIPRAP AND IMPROPER FILTERS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
H. J. Koloseus.

al of Hydraulic Engineering, Vol. 110, No. 1315-1324, October, 1984. 5 Fig, 4 Ref, 1 nd.

riptors: *Scour, *Riprap, *Filters, Piezome-gradients, Hydraulic structures, Water level, ure, Ponding, Rainfall runoff, Irrigation ef-

uently, an alluvial channel immediately down-m of a hydraulic structure shows signs of even though the channel appears to be other-in equilibrium and even though the channel is ily riprapped just downstream from the struc- Differences in water level between various of a hydraulic structure could give rise to tive piezometric gradients which might result cessive scour in the vicinity of the structure. ap can have a tendency to magnify piezome-gradients at the bed of a channel thereby ncing the leaching potential of the gradients. ap might also bring about elevated pressures h have a tendency to dislodge the riprap. ap will not give rise to magnified gradients or ted pressures if proper use is made of filters high permeability drainage layers. Erratic nel scour may be due to temporal changes in metric gradients which are brought about by natural occurrences as ponding of water, rain-nd irrigation. (Moore-IVI)
-03005

MPUTATION OF DYNAMIC WAVES IN NNEL NETWORKS,
Joliffe.
nal of Hydraulic Engineering, Vol. 110, No. 1358-1370, October, 1984. 3 Fig, 1 Tab, 13 1 Append.

criptors: *Channel networks, *Dynamic es, Mathematical models, Computers, Simula- Sparse matrix technique.

umerical model was developed for simulating s in either looped or dendritic channel net-ks. Analytic differentiation is used to evaluate partial derivative terms in the linear equations are used to calculate the flow corrections. A se matrix technique is used to store and solve partial derivative terms. The model has the e convergence and stability characteristics as n numerical differentiation is applied to a le channel propagation problem. Simulations of s in channel networks showed the proposed el to require a much smaller quantity of com-r memory than an alternate model formulated out using the sparse matrix solution technique. same numerical experiments showed the el to be computationally efficient, requiring ll amounts of computational time for network ulations. (Moore-IVI)
5-03007

TIAL TRANSIENTS IN LONG WAVE COM-TATIONS,
es Cook Univ. of North Queensland, Towns-e (Australia). Dept. of Civil and Systems Engi-ring.
Bode, and R. J. Sobey.
rnal of Hydraulic Engineering, Vol. 110, No. p 1371-1397, October, 1984. 11 Fig, 15 Ref, 2 pend.

criptors: *Long wave, *Mathematical equa-s, *Initial transients, Hydrodynamics, Coastal s, Forcing, Channels, Estuaries, Friction, ndary conditions.

e shallow water or long wave equations provide uccessful predictive capability for a number of portant flow problems in coastal hydrodyna-s. The generation of initial transients in long ve computations has been traced to the incom-ibility between the initial conditions and the ced response at zero time. Their origin is physi- not numerical. They are free mode responses; y are unwanted and cannot be avoided, but they be accomodated. The character of the initial nsients is described in the context of numerical utions to a typical estuary and a typical channel blem and in the context of an analytical solu-tion to the linearized equations for a prismatic channel. Strategies to avoid initial transients are investigated in detail, in particular, initially-enhanced friction, the gradual introduction of forcing and various radiation boundary conditions. A modified Reid radiation boundary condition provides a gradual transition back to the correct one point boundary conditions and to the correct forced response, but taking advantage initially of the efficiency of the Reid condition in eliminating the free modes. This approach is quite successful and suitable for general aplication, supplemented where necessary by the gradual introduction of the forcing over part or all of the transition period. (Moore-IVI)
W85-03008

REGULAR MEANDER PATH MODEL,
San Diego State Univ., CA. Dept. of Civil Engineering.
H. H. Chang.
Journal of Hydraulic Engineering, Vol. 110, No. 10, p 1398-1411, October, 1984. 6 Fig, 23 Ref, 1 Append. NSF grant CEE-8209029.

Descriptors: *Meanders, *River flow, *Transverse circulation, Wave length, Channel roughness, Curvature, Channel morphology.

River flow in a meandering channel is characterized by the growth and decay of the transverse circulation which reaches a maximum near the apex and reverses its direction near the crossover. Based upon the mechanics of flow governing the spatial variation of transverse circulation, a mathematical model for regular meander paths is developed. For a specified arc angle or channel curvature at the apex, this model provides the shape as well as the scale of the meander path, from which other planimetric parameters such as arc length, wave length, and amplitude can be directly obtained. The arc length-depth ratio is found to be an inverse function of channel roughness. A meander bend is constrained by a maximum curvature that it may develop under the state of equilibrium. Under such a curvature, the wave length-depth ratio is directly related to channel width-depth ratio and inversely related to channel roughness. (Author's abstract)
W85-03009

BOUNDARY SHEAR IN SYMMETRICAL COMPOUND CHANNELS,
Birmingham Univ. (England). Dept. of Civil Engineering.
D. W. Knight, and M. E. Hamed.
Journal of Hydraulic Engineering, Vol. 110, No. 10, p 1412-1430, October, 1984. 12 Fig, 5 Tab, 39 Ref, 1 Append.

Descriptors: *Shear stress, *Shear force, *Boundary shear, *Channel morphology, Flood plains, Roughness, Mathematical equations, Model studies, Momentum, Velocity, Flow discharge.

Experimental results are presented concerning the boundary shear stress and boundary shear force distributions in a compound section comprising of one rectangular main channel and two symmetrically disposed flood plains. The flood plains were roughened progressively in six steps so that the influence of differential roughness between the flood plains and the main channel on the lateral momentum transfer process could be studied. For the maximum applied roughness, the widths of the flood plains were then reduced. Equations are presented giving the shear force on the flood as a percentage of the total shear force in terms of four dimensionless parameters. Supplementary equations are also presented giving the apparent shear forces on vertical, inclined and horizontal interfaces within the cross section. The influence of momentum transfer between sub areas on the vertical and lateral distribution of longitudinal velocity is also assessed. The discharge and apparent shear force results reveal certain weaknesses in four commonly adopted methods used to predict the discharge capacity of compound channels. (Author's abstract)
W85-03010

UNIFIED CULVERT SCOUR DETERMINATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
S. R. Abt, R. L. Kloberdanz, and C. Mendoza.
Journal of Hydraulic Engineering, Vol. 110, No. 10, p 1475-1479, October, 1984. 1 Fig, 3 Tab, 6 Ref.

Descriptors: *Culverts, *Scour, *Erosion, Jets, Noncohesive materials, Particle size, Flow discharge.

The ability to predict the magnitude and geometry of scour is useful in the control and management of localized erosion. Experiments were conducted to evaluate how an impinging jet affects the geometry of localized scour in 5 noncohesive bed materials. The resulting data from all tests were dimensionlessly consolidated and the scour dimensions at depth, width, length and volume were correlated to the discharge intensity. A single expression was derived which estimates the dimensions of scour for a variety of noncohesive materials based upon the discharge, culvert diameter, material mean grain diameter and material standard deviation. (Moore-IVI)
W85-03013

SECONDARY CURRENT AND RIVER-MEANDER FORMATION,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 2E.
W85-03035

LINE MOMENTUM SOURCE IN SHALLOW INVISCID FLUID,
Hong Kong Univ. Dept. of Civil Engineering.
J. H. W. Lee, and M. D. Greenberg.
Journal of Fluid Mechanics, Vol. 145, p. 287-304, August, 1984. 9 Fig, 3 Tab, 19 Ref.

Descriptors: *Water currents, *Jets, *Line momentum, Turbulent flow, Streamflow, Slipstreamlines, Mathematical equations,.

An array of closely spaced, aligned, turbulent, incompressible jets is effectively stimulated by a line momentum source. In a shallow inviscid fluid, such a source induces a predominantly two-dimensional non-diffusive flow which is irrotational except along lines of velocity discontinuity downstream of the source. The flow can be generated by a distribution of line vortices of unknown strength along the unknown slipstreamlines. Based on this vortex model, kinematic and dynamic conditions along the slipstreamlines are formulated and the two resulting nonlinear singular integral equations are solved numerically using a Newton-Raphson-type iterative collocation method. The present results are applicable for multiple weakly buoyant jets into restricted depths, such as cooling water discharges into shallow receiving waters. The success of this theoretical approach suggests extension to the case in which the ambient current is misaligned with the source momentum. The approach suggested avoids the need for an artificial boundary. The flow field demonstrated a marked resemblance to that induced by a nonlinear actuator disk. In the case of no ambient current, experimental results indicate that the slipstreamlines emanate from points which are close to, but not at the ends of, the source. As the ambient current strength increases, a dividing streamline appears in the induced sink flow upstream of the source, and the points from which the slipstreamlines emanate move closer to the ends of the source. Further increases in the current strength result in the smooth blending of this dividing streamline with the slipstreamline. (Baker-IVI)
W85-03038

PLOTTING POSITIONS FOR PEARSON TYPE-III DISTRIBUTION,
Yangtze Valley Planning Office, Wuhan (China).
For primary bibliographic entry see Field 2E.
W85-03079

8C. Hydraulic Machinery

PRESSURE AND SOURCE SIZE EFFECTS ON CAVITATION DAMAGE,
Concordia Univ., Sir George Williams Campus, Montreal (Quebec). Dept. of Civil Engineering.
A. S. Ramamurthy, Y. S. L. Ranganath, and L. B. Carballada.
Journal of Hydraulic Engineering, Vol. 110, No. 10, p 1490-1494, October, 1984. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Hydraulic equipment, *Design criteria, *Cavitation, Pressure, Velocity, Cavitation sources.

In hydraulic machinery, cavitation damage can be caused by flow past components such as streamlined guiding surfaces, which act as obstacles to flow. The determination of the velocity exponent, n1, for maximum cavitation damage and the effect of cavitation number on cavitation damage when the source sizes and velocities are fixed are discussed. Studies were conducted in a rotating disk facility which consisted of a circular disk 61 cm in diameter attached to a rotating horizontal shaft (1,800 RPM). To study the effect of source size on damage, equilateral triangular prisms were mounted on the disk to form the cavitating source. The triangular source reduced the large influence of the Reynolds number on the results of damage tests. Maximum caviation erosion appears to be associated with a critical source size when the cavitation number and flow velocity are held constant. Maximum erosion occurs in a narrow band of cavitation numbers. The velocity exponent, n1, had a value of 5.95 and was within the range reported by other investigators. The information presented should be helpful to design engineers of hydraulic machinery. (Baker-IVI)
W85-03014

ELECTRIC DRIVES - TYPES AND CHOICES,
C. L. Pattison.
Journal of Institution of Water Engineers and Scientists, Vol. 38, No. 4, p 316-322, August, 1984.

Descriptors: *Pumping plants, *Electric drive systems, Motors, Drive systems, Efficiency, Cost analysis, Maintenance.

In a pumping installation the electrical drive system(s) is usually the largest single plant investment; this is particularly true of variable speed systems when the drive can represent 60% of the total plant costs. Furthermore, the drive system efficiency is one of the major determinants of plant running costs, which when aggregated over the lifetime of the installation, can amount to 90% of the total life cycle costs. Drive systems selection therefore requires careful consideration during project planning and specification, and a decision whether to opt for fixed or variable speed operation is often dominant in the early design stages. The principal requirements of a pump drive system in a modern installation are to minimize energy and manpower costs by optimizing efficiency and creating a reliable maintenance-free operation. Most of the recent significant developments take advantage of modern solid-state devices. (Moore-IVI)
W85-03019

8D. Soil Mechanics

INFLUENCE OF DRAINAGE TRENCHES ON SLOPE STABILITY,
Zagreb Univ. (Yugoslavia). Faculty of Civil Engineering.
B. Stanic.
Journal of Geotechnical Engineering, Vol. 110, No. 1, p 1624-1636, November, 1984. 9 Fig, 6 Ref, 1 Append.

Descriptors: *Slope stability, *Drainage ditches, *Pore pressure, Groundwater, Earthworks, Shear stress, Landslides, Erosion.

Any slope sliding is a consequence of the equilibrium disturbance between the active and the resisting forces on the critical slip line withing the slope section. An unfavorable groundwater condition is a frequent cause of slope sliding. Pore pressure decreases the effective stress level and consequently the shear stability of the soil on the slip surface is decreased. A change in the groundwater condition is achieved by drainage systems. Drainage trenches are suitable for stabilizing shallow translational slides. The best effect of the drains is achieved when the pore pressures in the failure zone are maximally reduced. A parametric study was undertaken of the spatial influence of drainage trenches on the potential field change in the slope. Using the model developed, the spacing of drainage trenches for slope stability can be determined. The factor of safety obtained represents the long-term value for the steady state condition. The method could be extended to include the time required to consolidate the pore pressure after the drains have been installed. (Moore-IVI)
W85-03098

8E. Rock Mechanics and Geology

DYNAMIC RESPONSE OF DAMS AND OTHER STRUCTURES TO DIFFERENTIAL GROUND MOTIONS,
A. A. Dumanoglu, and R. L. Severn.
Proceedings of the Institute of Civil Engineers, Part 2, Vol. 77, p 333-352, September, 1984. 13 Fig, 9 Ref.

Descriptors: *Dams, *Design criteria, *Earthquakes, Stress, Dam design, Construction, Hydraulic engineering, Foundations, Bridges.

The effect of an earthquake on a structure depends on its speed of propagation relative to the size of the structure. If the speed is low, as in soft clays, or the structure is large, as with a dam or large bridge, a satisfactory analysis must take into account the finite travel time of the earthquake across the foundation of the structure. The effect of the finite travel time is shown to produce what is called a pseudo-static displacement, in addition to the normal dynamic displacement. Whereas the latter is caused by inertia, the former is caused by the differential movement of the structure-foundation interface, and its determination requires the deformed shape of the structure to be calculated for a given unit displacement of each point, or region, of the interface connection. Differential base accelerations of a structure caused by earthquakes may be categorized as either asynchronous or multiple-support, but in numerical form the same approach relates to both. The basic difference between common and differential base acceleration is that the latter requires the calculation of vectors of displacement which describe the shape which the structure takes up due to unit movement of each of the degrees of freedom which connect the structure to the ground. The distortions are additional to the distortions produced by inertia, and cause additional stresses. These pseudo-static stresses are significant in magnitude for portal frames and three types of dam, and should certainly be taken into account in the design stage. (Baker-IVI)
W85-03053

MONITORING HYDROGEOLOGICAL CONDITIONS IN FRACTURED ROCK AT THE SITE OF CANADA'S UNDERGROUND RESEARCH LABORATORY,
Atomic Energy of Canada Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
C. C. Davison.
Ground Water Monitoring Review, Vol. 4, N
p 95-102, Fall, 1984. 13 Fig, 1 Tab, 9 Ref

Descriptors: *Powerplants, *Construction, *
logic fractures, *Nuclear power, *Mani
*Canada, Groundwater, Monitoring.

The physical and chemical hydrogeological c
tions have been determined for a 2.0 x 10 to th
power cubic m volume of fractured plutonic
surrounding the excavation site of Canada's U
ground Research Lab. This information has
used by computer modeling groups to predict
drawdown conditions that will develop at
study area when shaft and underground facil
are excavated. Piezometric and ground w
chemistry conditions are being monitored in
rock mass by means of a variety of instrum
installed in an extensive borehole array. Con
tional water table wells and multiple piezome
have been installed in shallow boreholes to m
tor the near-surface hydrogeologic conditi
Deep boreholes have been completed with eith
multiple-interval casing system or a multi
packer/multiple-standpipe piezometer system
pending on their diameter. Polyvinyl chloride p
tic versions of a mutiple-interval casing sys
have been installed in 76 mm diameter boreh
shallower than 200 m and stainless-steel vers
have been installed in 76 mm diameter boreh
deeper than 200 m. Multiple-packer/multi
standpipe piezometers have been installed in al
the 152 mm diameter percussion-drilled boreh
at the study area. The data obtained will be c
pared to computer model predictions to evalu
how well the models, based on pre-excavat
data, were able to represent the actual hydroge
gical conditions that exist in the large volume
fractured granitic rock surrounding the excavat
site. (Baker-IVI)
W85-03180

8F. Concrete

GROUTING REHABS EARTH DAM,
GKN Hayward Baker Co., Odenton, MD.
For primary bibliographic entry see Field 8A.
W85-02728

8I. Fisheries Engineering

**ASSESSING ENVIRONMENTAL IMPACT
MASS BALANCE, CARRYING CAPACITY A
GROWTH OF EXPLOITED POPULATIONS,**
Michigan Univ., Ann Arbor. School of Natu
Resources.
A. L. Jensen.
Environmental Pollution (Series A), Vol. 36, N
2, p 133-145, 1984. 3 Fig, 5 Tab, 17 Ref.

Descriptors: *Environmental impact stateme
*Population dynamics, *Model studies, *Fish ma
agement, Fish populations.

Population models that have been applied for
sessment of exploited populations are also use
for assessment of environmental impact. Surpl
production models have been applied for bo
fishery and environmental impact assessme
There are three ways that an impact can be intr
duced into the logistic equation. An impact c
affect the mass balance, it can change the coef
cient of increase, or it can change the environme
tal carrying capacity. The properties of logist
surplus production models in which these differe
impacts are introduced are examined and the r
sults are compared. For each of these possib
modes of action the equilibrium relations amo
biomass, yield, level of fishing and level of env
ronmental stress are developed. The resultin
equations are applied to describe the results of la
experiments in which exploited populations we
manipulated to alter the growth coefficient, carr
ing capacity, or mass balance. (Baker-IVI)
W85-03044

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